

# Analytical Procedures Appendices

Spectroquant® Prove  
Spectrophotometer 100 plus  
1.73026



# Analytical Procedures and Appendices

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# Analytical Procedures and Appendices

## I Available photometric test kits and methods

The following methods with the corresponding method numbers are programmed into the photometer and measurements can be made without any further adjustments. Method selection is achieved through a barcode on the cell (for cell tests) or through a barcode on the AutoSelector (for reagent tests).

The method number listed in column 1 is for manual selection. The total range relates to the cited test in column 2 and, in the reagent tests, covers all possible path length (cells from 10 to 50 mm).

At the end of this chapter there are the tables for the pre-programmed AQA1 and PipeCheck methods.

Method number	Determination		Total range	Method
208	Acid Capacity Cell Test to pH 4.3 (total alkalinity)	1.01758	0.40 – 8.00 mmol/l	Indicator reaction
2518	ADMI Color Measurement <sup>6)</sup>		2.0 – 100.0	Inherent color
2517	ADMI Color Measurement <sup>6)</sup>		10 – 500	Inherent color
2516	ADMI Color Measurement <sup>6)</sup>		10 – 1000	Transmittances from 400 - 700 nm
2612	$\alpha$ Acids <sup>2)</sup>		0 – 80 mg/l	Inherent color
196	Aluminium Cell Test <sup>1)</sup>	1.00594	0.02 – 0.50 mg/l Al	Chromazurole S
43	Aluminium Test <sup>1)</sup>	1.14825	0.020 – 1.20 mg/l Al	Chromazurole S
	Amino nitrogen, free - see Free Amino Nitrogen			
2520	Ammonia, free		0.00 – 3.65 mg/l NH <sub>3</sub>	as ammonium
104	Ammonium Cell Test	1.14739	0.010 – 2.000 mg/l NH <sub>4</sub> -N	Indophenol blue
51	Ammonium Cell Test	1.14558	0.20 – 8.00 mg/l NH <sub>4</sub> -N	Indophenol blue
52	Ammonium Cell Test	1.14544	0.5 – 16.0 mg/l NH <sub>4</sub> -N	Indophenol blue
53	Ammonium Cell Test	1.14559	4.0 – 80.0 mg/l NH <sub>4</sub> -N	Indophenol blue
54	Ammonium Test	1.14752	0.010 – 3.00 mg/l NH <sub>4</sub> -N	Indophenol blue
155	Ammonium Test	1.00683	2.0 – 75.0 mg/l NH <sub>4</sub> -N	Indophenol blue
163	Ammonium Test	1.00683	5 – 150 mg/l NH <sub>4</sub> -N	Indophenol blue
2587	Anisidine value <sup>5)</sup>		0.0 – 200.0 AV	Measurement at 350 nm
2601	Anthocyanogenes <sup>2)</sup>		0 – 100 mg/l	Acidic hydrolysis
130	Antimony in water and wastewater		0.10 – 8.00 mg/l Sb	Brilliant green
2540	Annatto Cheese §64 LFGB 03.00-37		0.0 – 10.0 mg/kg	Bixin / Norbixin
156	AOX Cell Test <sup>1)</sup>	1.00675	0.05 – 2.50 mg/l AOX	Oxidation to chloride
132	Arsenic Test <sup>1)</sup>	1.01747	0.001 – 0.100 mg/l As	Ag-DDTC
2562	ASTM Color Measurement		0.5 - 8.0	Inherent color

<sup>1)</sup> turbidity correction possible

<sup>2)</sup> the analytical procedure for this method is given in the manual of the "Brewery Methods Prove plus"

<sup>5)</sup> the analytical procedure for this method is given in the manual of the "Methods for color measurement"

<sup>6)</sup> the analytical procedure for this method is also given in the manual of the "Methods for color measurement"

Method number	Determination		Total range	Method
157	BOD Cell Test <sup>1)</sup>	1.00687	0.5 – 3000 mg/l BOD	Modification of Winkler method
164	Boron Cell Test <sup>1)</sup>	1.00826	0.05 – 2.00 mg/l B	Azomethine H
46	Boron Test <sup>1)</sup>	1.14839	0.050 – 0.800 mg/l B	Rosocyanine
307	Bromate in water and drinking water - Ultra Low Range		1.0 – 40.0 µg/l BrO <sub>3</sub>	3,3'-Dimethylnaphthidine
308	Bromate in water and drinking water - Low Range		5.0 – 200.0 µg/l BrO <sub>3</sub>	3,3'-Dimethylnaphthidine
146	Bromine <sup>4)</sup> Test <sup>1)</sup>	1.00605	0.020 – 10.00 mg/l Br <sub>2</sub>	S-DPD
67	Cadmium Cell Test	1.14834	0.025 – 1.000 mg/l Cd	Cadion derivate
183	Cadmium Test	1.01745	0.0020 – 0.500 mg/l Cd	Cadion derivate
165	Calcium Cell Test <sup>1)</sup>	1.00858	10 – 250 mg/l Ca	Phthalein purple
42	Calcium Test <sup>1)</sup>	1.14815	5 – 160 mg/l Ca	Glyoxal-bis-hydroxyanil
125	Calcium Test sensitive <sup>1)</sup>	1.14815	1.0 – 15.0 mg/l Ca	Glyoxal-bis-hydroxyanil
304	Calcium Test <sup>3)</sup>	1.00049	0.20 – 4.00 mg/l Ca	Phthalein derivate
	Carbohydrates, total - see Total Carbohydrates			
2523	Carotene (palm oil)		10 – 7500 mg/kg	Inherent color
313	Cell Density (OD600)		-0.020 – 1.200	Measurement at 600 nm
	Cell Density - see McFarland or Cell Density (OD600)			
95	Chloride Cell Test <sup>1)</sup>	1.14730	5 – 125 mg/l Cl	Iron(III)-thiocyanat
110	Chloride Test <sup>1)</sup>	1.14897	2.5 – 25.0 mg/l Cl	Iron(III)-thiocyanat
63	Chloride Test <sup>1)</sup>	1.14897	10 – 250 mg/l Cl	Iron(III)-thiocyanat
218	Chloride Cell Test <sup>1)</sup>	1.01804	0.5 – 15.0 mg/l Cl	Iron(III)-thiocyanat
219	Chloride Test <sup>1)</sup>	1.01807	0.10 – 5.00 mg/l Cl	Iron(III)-thiocyanat
141	Chlorine Cell Test <sup>1)</sup> (free chlorine)	1.00595	0.03 – 6.00 mg/l Cl <sub>2</sub>	S-DPD
142	Chlorine Cell Test <sup>1)</sup> (free chlorine + total chlorine)	1.00597	0.03 – 6.00 mg/l Cl <sub>2</sub>	S-DPD
143	Chlorine Test <sup>1)</sup> (free chlorine)	1.00598	0.010 – 6.00 mg/l Cl <sub>2</sub>	S-DPD
145	Chlorine Test <sup>1)</sup> (total chlorine)	1.00602	0.010 – 6.00 mg/l Cl <sub>2</sub>	S-DPD
144	Chlorine Test <sup>1)</sup> (free chlorine + total chlorine)	1.00599	0.010 – 6.00 mg/l Cl <sub>2</sub>	S-DPD
194	Chlorine Cell Test <sup>1)</sup> (free chlorine + total chlorine)	1.00086/1.00087/ 1.00088/1.00089	0.03 – 6.00 mg/l Cl <sub>2</sub>	DPD

<sup>1)</sup> turbidity correction possible

<sup>3)</sup> individual calibration necessary

<sup>4)</sup> can also be determined with Spectroquant® Chlorine Test, Cat. No. 1.00598 (see corresponding application notes on [www.sigmaaldrich.com](http://www.sigmaaldrich.com))

## Analytical Procedures and Appendice – I Available photometric test kits and methods

Method number	Determination	Total range	Method	
306	Chlorine Test <sup>1)</sup> (free chlorine + total chlorine)	1.00086/1.00087/ 1.00088	0.010 – 1.000 mg/l Cl <sub>2</sub>	DPD
149	Chlorine Dioxide Test <sup>1)</sup>	1.00608	0.020 – 10.00 mg/l ClO <sub>2</sub>	S-DPD
2509	Chlorophyll-a (DIN/ISO)		result in µg/l Chl-a or Phaeo	Inherent color
2504	Chlorophyll-a (APHA/ASTM)		result in mg/m <sup>3</sup> Chl-a or Phaeo	Inherent color
2507	Chlorophyll-a, -b, -c (APHA/ASTM)		result in mg/m <sup>3</sup> Chl-a, -b, -c	Inherent color
39	Chromate Cell Test <sup>1)</sup>	1.14552	0.05 – 2.00 mg/l Cr	Diphenylcarbazide
39	Chromate Cell Test <sup>1)</sup> (total chromium)	1.14552	0.05 – 2.00 mg/l Cr	Peroxodisulfate oxidation / Diphenylcarbazide
40	Chromate Test <sup>1)</sup>	1.14758	0.010 – 3.00 mg/l Cr	Diphenylcarbazide
20	Chromium Baths		4.0 – 400 g/l CrO <sub>3</sub>	Inherent color
2584	CIE color distance <sup>5)</sup>		ΔE*ab 0.00 – 200.00 ΔL* -200.00 – 200.00 Δa* -200.00 – 200.00 Δb* -200.00 – 200.00 ΔC*ab -200.00 – 200.00	Comparative measure- ment of transmittances from 360 - 780 nm
2580	CIELAB color space (brightness, chroma) <sup>5)</sup>		ΔE*ab 0.00 – 200.00 ΔL* -200.00 – 200.00 Δa* -200.00 – 200.00 Δb* -200.00 – 200.00 ΔC*ab -200.00 – 200.00	Comparative measure- ment of transmittances from 360 - 780 nm
2581	CIELUV color space <sup>5)</sup>		L* 0.00 – 105.00 u* -180.0 – 180.0 v* -180.0 – 180.0 C*uv 0.00 – 300.00 S*uv 0.000 – 200.000	Transmittances from 360 – 780 nm
2582	CIExyY color space <sup>5)</sup>		x 0.0000 – 0.8000 y 0.0000 – 0.8000 Y 0.000 – 200.000	Transmittances from 360 – 780 nm
232	Cobalt Cell Test <sup>1)</sup>	1.17244	0.05 – 2.00 mg/l Co	Nitroso-R salt
305	Cobalt in water		0.5 – 10.0 mg/l Co	Nitroso-R salt
31	COD Cell Test <sup>1)</sup>	1.14560	4.0 – 40.0 mg/l COD	Chromosulfuric acid oxidation / chromate determination
211	COD Cell Test <sup>1)</sup>	1.01796	5.0 – 80.0 mg/l COD	Chromosulfuric acid oxidation / chromate determination

<sup>1)</sup> turbidity correction possible

<sup>5)</sup> the analytical procedure for this method is given in the manual of the "Methods for color measurement"

Method number	Determination		Total range	Method
14	COD Cell Test <sup>1)</sup>	1.14540	10 – 150 mg/l COD	Chromosulfuric acid oxidation / chromate determination
105	COD Cell Test <sup>1)</sup>	1.14895	15 – 300 mg/l COD	Chromosulfuric acid oxidation / chromate determination
93	COD Cell Test <sup>1)</sup>	1.14690	50 – 500 mg/l COD	Chromosulfuric acid oxidation / chromate determination
23	COD Cell Test <sup>1)</sup>	1.14541	25 – 1500 mg/l COD	Chromosulfuric acid oxidation / chromium(III) determination
94	COD Cell Test <sup>1)</sup>	1.14691	300 – 3500 mg/l COD	Chromosulfuric acid oxidation / chromium(III) determination
24	COD Cell Test <sup>1)</sup>	1.14555	500 – 10000 mg/l COD	Chromosulfuric acid oxidation / chromium(III) determination
209	COD Cell Test <sup>1)</sup>	1.01797	5000 – 90000 mg/l COD	Chromosulfuric acid oxidation / chromium(III) determination
137	COD Cell Test (Hg free) <sup>1)</sup>	1.09772	10 – 150 mg/l COD	Chromosulfuric acid oxidation / chromate determination
138	COD Cell Test (Hg free) <sup>1)</sup>	1.09773	100 – 1500 mg/l COD	Chromosulfuric acid oxidation / chromium(III) determination
220	COD Cell Test for seawater <sup>1)</sup>	1.17058	5.0 – 60.0 mg/l COD	Chloride depletion / chromosulfuric acid oxidation / chromate determination
221	COD Cell Test for seawater <sup>1)</sup>	1.17059	50 – 3000 mg/l COD	Chloride depletion / chromosulfuric acid oxidation / chromium(III) determination
15	Color $\alpha$ (436) (spectral absorptions coefficient) <sup>6)</sup>		0.1 – 250 m <sup>-1</sup>	Measurement at 436 nm
61	Color $\alpha$ (525) (spectral absorptions coefficient) <sup>6)</sup>		0.1 – 250 m <sup>-1</sup>	Measurement at 525 nm
78	Color $\alpha$ (620) (spectral absorptions coefficient) <sup>6)</sup>		0.1 – 250 m <sup>-1</sup>	Measurement at 620 nm

<sup>1)</sup> turbidity correction possible

<sup>6)</sup> the analytical procedure for this method is also given in the manual of the "Methods for color measurement"

## Analytical Procedures and Appendice – I Available photometric test kits and methods

Method number	Determination	Total range	Method
303	Color (410) (EN 7887) <sup>6)</sup>	2 – 2500 mg/l Pt	Measurement at 410 nm
2633	Color - ASBC <sup>2), 5)</sup>	0.0 – 50.0 °SRM 0.0 – 100.0 EBC Units	Absorption at 430 nm
2602	Color - EBC <sup>2), 5)</sup>	0.0 – 60.0 EBC Units	Absorption at 430 nm
32	Color Hazen <sup>1), 6)</sup>	0.2 – 500 mg/l Pt/Co (Hazen)	Platinum-cobalt-Standard Method, measurement at 340 nm
179	Color Hazen <sup>1), 6)</sup>	0 – 1000 mg/l Pt/Co (Hazen)	Platinum-cobalt-Standard Method, measurement at 445 nm
180	Color Hazen <sup>1), 6)</sup>	0 – 1000 mg/l Pt/Co (Hazen)	Platinum-cobalt-Standard Method, measurement at 455 nm
181	Color Hazen <sup>1), 6)</sup>	0 – 1000 mg/l Pt/Co (Hazen)	Platinum-cobalt-Standard Method, measurement at 465 nm
2588	Color α(436), α(525), and α(620) <sup>5)</sup>	0.0 – 250.0 m <sup>-1</sup>	Absorption at 436, 525, and 620 nm
	Color of sugar solutions - see ICUMSA Color		
2613	Copper - EBC <sup>2)</sup>	0.10 – 5.00 mg/l Cu	Cuprethol
26	Copper Cell Test <sup>1)</sup>	1.14553	Cuprizone
27	Copper Test <sup>1)</sup>	1.14767	Cuprizone
83	Copper Baths	2.0 – 80.0 g/l Cu	Inherent color
228	Cyanide Cell Test <sup>1)</sup> (free cyanide)	1.02531	Barbituric acid + pyridinecarboxylic acid
75	Cyanide Cell Test <sup>1)</sup> (free cyanide)	1.14561	Barbituric acid + pyridinecarboxylic acid
75	Cyanide Cell Test <sup>1)</sup> (readily liberated cyanide)	1.14561	Citric acid / barbituric acid + pyridinecarboxylic acid
109	Cyanide Test <sup>1)</sup> (free cyanide)	1.09701	Barbituric acid + pyridinecarboxylic acid
109	Cyanide Test <sup>1)</sup> (readily liberated cyanide)	1.09701	Citric acid / barbituric acid + pyridinecarboxylic acid
210	Cyanuric Acid Test	1.19253	Triazine derivative
2631	Diacyl (ASBC) <sup>2)</sup>	0.00 – 4.00 mg/l Diacyl	a-Naphthol
	Diacyl (EBC) - see Vicinal Diketones		
2626	Flavanoids <sup>2)</sup>	3 – 200 mg/l	4-Dimethylaminocinnamaldehyde

<sup>1)</sup> turbidity correction possible

<sup>2)</sup> the analytical procedure for this method is given in the manual of the "Brewery Methods Prove plus"

<sup>5)</sup> the analytical procedure for this method is given in the manual of the "Methods for color measurement"

<sup>6)</sup> the analytical procedure for this method is also given in the manual of the "Methods for color measurement"

Method number	Determination		Total range	Method
2635	Flocculation (ASBC) <sup>2)</sup>		0.0 - 100.0%	Turbidity
215	Fluoride Cell Test <sup>1)</sup>	1.00809	0.10 – 1.80 mg/l F	Alizarin complexone
216	Fluoride Cell Test sensitive	1.00809	0.025 – 0.500 mg/l F	Alizarin complexone
234	Fluoride Cell Test	1.17243	0.10 – 2.50 mg/l F	SPADNS (As free)
166	Fluoride Test <sup>1)</sup>	1.14598	0.10 – 2.00 mg/l F	Alizarin complexone
167	Fluoride Test <sup>1)</sup>	1.14598	1.0 – 20.0 mg/l F	Alizarin complexone
217	Fluoride Test	1.00822	0.02 – 2.00 mg/l F	SPADNS
233	Fluoride Test	1.17236	0.02 – 2.00 mg/l F	SPADNS (As free)
28	Formaldehyde Cell Test <sup>1)</sup>	1.14500	0.10 – 8.00 mg/l HCHO	Chromotropic acid
91	Formaldehyde Test <sup>1)</sup>	1.14678	0.02 – 8.00 mg/l HCHO	Chromotropic acid
2606	Free Amino Nitrogen beer / wort <sup>2)</sup>		0 – 400 mg/l	Ninhydrin
2561	Gardner Color Measurement <sup>6)</sup>		1.0 - 18.0 Gardner	Transmittances from 360 – 780 nm
45	Gold Test	1.14821	0.5 – 12.0 mg/l Au	Rhodamine B
	Hardness - see Total Hardness or Residual Hardness			
	Hazen - see Color Hazen			
2586	Hess-Ives color scale <sup>5)</sup>		0.0 – 400 H-I	Absorption at 460, 470, 560, and 640 nm
2585	Hunter color distance <sup>5)</sup>		$\Delta E^*H$ 0.00 – 200.00 $\Delta L^*$ -200.00 – 200.00 $\Delta a^*$ -200.00 – 200.00 $\Delta b^*$ -200.00 – 200.00	Transmittances from 360 – 780 nm
2583	HunterLab color space <sup>5)</sup>		$L^*$ 0.00 – 105.00 $a^*$ -180.0 – 180.0 $b^*$ -180.0 – 180.0	Transmittances from 360 – 780 nm
44	Hydrazine Test <sup>1)</sup>	1.09711	0.005 – 2.00 mg/l N <sub>2</sub> H <sub>4</sub>	4-Dimethylaminobenzaldehyde
99	Hydrogen Peroxide Cell Test <sup>1)</sup>	1.14731	2.0 – 20.0 mg/l H <sub>2</sub> O <sub>2</sub>	Titanyl sulfate
128	Hydrogen Peroxide Cell Test sensitive <sup>1)</sup>	1.14731	0.25 – 5.00 mg/l H <sub>2</sub> O <sub>2</sub>	Titanyl sulfate
198	Hydrogen Peroxide Test	1.18789	0.015 – 6.00 mg/l H <sub>2</sub> O <sub>2</sub>	Phenanthroline derivative
2538	Hydroxyproline Meat §64 LFGB 06.00-8		0.000 – 1.000 g/100 g	4-Dimethylaminobenzaldehyde
2548	ICUMSA Color GS1/3-7 (2011) <sup>6)</sup>		0 – 50 000 IU <sub>7,0</sub>	Absorption at 420 nm
2549	ICUMSA Color GS2/3-9 (2005) <sup>6)</sup>		0 – 600 IU <sub>7,0</sub>	Absorption at 420 nm
2550	ICUMSA Color GS2/3-10 (2011) <sup>6)</sup>		0 – 50 IU <sub>7,0</sub>	Absorption at 420 nm

<sup>1)</sup> turbidity correction possible

<sup>2)</sup> the analytical procedure for this method is given in the manual of the "Brewery Methods Prove plus"

<sup>5)</sup> the analytical procedure for this method is given in the manual of the "Methods for color measurement"

<sup>6)</sup> the analytical procedure for this method is also given in the manual of the "Methods for color measurement"



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Method number	Determination	Total range	Method
2551	ICUMSA Color GS9/1/2/3-8 (2011) <sup>6)</sup>	0 – 20 000 IU <sub>7,0</sub>	Absorption at 420 nm
147	Iodine <sup>4)</sup> Test <sup>1)</sup>	1.00606	0.050 – 10.00 mg/l I <sub>2</sub>
2615	Iodine Value, photometric <sup>2)</sup>	0.00 – 0.80	S-DPD
2616	Iodine Value, photometric <sup>2)</sup>	0.00 – 0.80	Iodine
33	Iodine Color Number <sup>6)</sup>	0.010 – 3.00	Iodine
21	Iodine Color Number <sup>6)</sup>	0.2 – 50.0	Measurement at 340 nm
2642	Iron - ASBC <sup>2)</sup>	0.00 – 3.00 mg/l Fe	Measurement at 445 nm
2643	Iron - ASBC <sup>2)</sup>	0.00 – 3.00 mg/l Fe	1,10-Phenanthroline
2644	Iron - ASBC <sup>2)</sup>	0.00 – 0.40 mg/l Fe	2,2'-Bipyridine
2623	Iron - EBC <sup>2)</sup>	0.000 – 1.000 mg/l Fe	Triazine (ferrozine)
2624	Iron - EBC <sup>2)</sup>	0.000 – 0.800 mg/l Fe	Triazine
37	Iron Cell Test	1.14549	0.05 – 4.00 mg/l Fe
106	Iron Cell Test <sup>1)</sup>	1.14896	1.0 – 50.0 mg/l Fe (Fe(II) and Fe(III))
38	Iron Test	1.14761	0.005 – 5.00 mg/l Fe
161	Iron Test <sup>1)</sup>	1.00796	0.010 – 5.00 mg/l Fe (Fe(II) and Fe(III))
311	Klett color index <sup>5)</sup>	0 – 1000 Klett417	Absorption at 417 nm
66	Lead Cell Test <sup>1)</sup>	1.14833	0.10 – 5.00 mg/l Pb
160	Lead Test <sup>1)</sup>	1.09717	0.010 – 5.00 mg/l Pb
158	Magnesium Cell Test <sup>1)</sup>	1.00815	5.0 – 75.0 mg/l Mg
159	Manganese Cell Test <sup>1)</sup>	1.00816	0.10 – 5.00 mg/l Mn
19	Manganese Test <sup>1)</sup>	1.14770	0.010 – 10.00 mg/l Mn
226	Manganese Test <sup>1)</sup>	1.01846	0.005 – 2.00 mg/l Mn
2513	McFarland	0.0 – 10.0	Formaloxime
135	Mercury in water and wastewater	0.025 – 1.000 mg/l Hg	Formaloxime
175	Molybdenum Cell Test	1.00860	0.0 – 10.0
206	Molybdenum Test	1.19252	0.02 – 1.00 mg/l Mo
185	Monochloramine Test	1.01632	0.5 – 45.00 mg/l Mo
2614	Nickel - EBC <sup>2)</sup>	0.00 – 5.00 mg/l Ni	Mercaptoacetic acid
17	Nickel Cell Test <sup>1)</sup>	1.14554	0.050 – 10.00 mg/l Cl <sub>2</sub>
			Indophenol blue
			Dimethylglyoxime
			Dimethylglyoxime

<sup>1)</sup> turbidity correction possible

<sup>2)</sup> the analytical procedure for this method is given in the manual of the "Brewery Methods Prove plus"

<sup>4)</sup> can also be determined with Spectroquant® Chlorine Test, Cat. No. 1.00598 (see corresponding application notes on [www.sigmaaldrich.com](http://www.sigmaaldrich.com))

<sup>5)</sup> the analytical procedure for this method is given in the manual of the "Methods for color measurement"

<sup>6)</sup> the analytical procedure for this method is also given in the manual of the "Methods for color measurement"

Method number	Determination		Total range	Method
18	Nickel Test <sup>1)</sup>	1.14785	0.02 – 5.00 mg/l Ni	Dimethylglyoxime
57	Nickel Bath		2.0 – 120 g/l Ni	Inherent color
59	Nitrate Cell Test <sup>1)</sup>	1.14542	0.5 – 18.0 mg/l NO <sub>3</sub> -N	Nitrospectral
30	Nitrate Cell Test <sup>1)</sup>	1.14563	0.5 – 25.0 mg/l NO <sub>3</sub> -N	2,6-Dimethylphenol
107	Nitrate Cell Test <sup>1)</sup>	1.14764	1.0 – 50.0 mg/l NO <sub>3</sub> -N	2,6-Dimethylphenol
151	Nitrate Cell Test <sup>1)</sup>	1.00614	23 – 225 mg/l NO <sub>3</sub> -N	2,6-Dimethylphenol
60	Nitrate Test <sup>1)</sup>	1.14773	0.20 – 20.0 mg/l NO <sub>3</sub> -N	Nitrospectral
139	Nitrate Test <sup>1)</sup>	1.09713	0.10 – 25.0 mg/l NO <sub>3</sub> -N	2,6-Dimethylphenol
72	Nitrate Cell Test in seawater <sup>1)</sup>	1.14556	0.10 – 3.00 mg/l NO <sub>3</sub> -N	Resorcine
140	Nitrate Test in seawater <sup>1)</sup>	1.14942	0.2 – 17.0 mg/l NO <sub>3</sub> -N	Resorcine
227	Nitrate Test	1.01842	0.3 – 30.0 mg/l NO <sub>3</sub> -N	Reduction / Benzoic acid derivative
35	Nitrite Cell Test <sup>1)</sup>	1.14547	0.010 – 0.700 mg/l NO <sub>2</sub> -N	Griess reaction
197	Nitrite Cell Test <sup>1)</sup>	1.00609	1.0 – 90.0 mg/l NO <sub>2</sub> -N	Iron(II)-ethylenediammonium sulfate
36	Nitrite Test <sup>1)</sup>	1.14776	0.002 – 1.00 mg/l NO <sub>2</sub> -N	Griess reaction
68	Nitrogen (total) Cell Test	1.14537	0.5 – 15.0 mg/l N	Peroxodisulfate oxidation / Nitrospectral
153	Nitrogen (total) Cell Test	1.00613	0.5 – 15.0 mg/l N	Peroxodisulfate oxidation / 2,6-Dimethylphenol
108	Nitrogen (total) Cell Test	1.14763	10 – 150 mg/l N	Peroxodisulfate oxidation / 2,6-Dimethylphenol
	OD600 - see Cell Density (OD600)			
	Oils - see K (olive oil), delta K (olive oil), Carotene (palm oil) or DOBI (palm oil)			
92	Oxygen Cell Test <sup>1)</sup>	1.14694	0.5 – 12.0 mg/l O <sub>2</sub>	Modification of Winkler method
207	Oxygen Scavengers Test	1.19251	0.020 – 0.500 mg/l DEHA	FerroZine®
148	Ozone Test <sup>1)</sup>	1.00607	0.010 – 4.00 mg/l O <sub>3</sub>	S-DPD
133	Palladium in water and wastewater		0.05 – 1.25 mg/l Pd	Thio-Michler's ketone
	2,3-Pentandion - see Vicinal Diketones			
186	pH Cell Test	1.01744	6.4 – 8.8	Phenol red
	Phaeophytin (DIN/ISO) / (APHA/ASTM) - see Chlorophyll-a (DIN/ISO) or (APHA/ASTM)			
73	Phenol Cell Test <sup>1)</sup>	1.14551	0.10 – 2.50 mg/l C <sub>6</sub> H <sub>5</sub> OH	MBTH
176	Phenol Test <sup>1)</sup>	1.00856	0.025 – 5.00 mg/l C <sub>6</sub> H <sub>5</sub> OH	Aminoantipyrine
177	Phenol Test <sup>1)</sup>	1.00856	0.002 – 0.100 mg/l C <sub>6</sub> H <sub>5</sub> OH	Aminoantipyrine by extraction

<sup>1)</sup> turbidity correction possible

## Analytical Procedures and Appendice – I Available photometric test kits and methods

Method number	Determination		Total range	Method
	Phenols, steam-volatile - see steam-volatile Phenols			
212	Phosphate Cell Test	1.00474	0.05 – 5.00 mg/l PO <sub>4</sub> -P	Phosphormolybdenum blue
55	Phosphate Cell Test	1.14543	0.05 – 5.00 mg/l PO <sub>4</sub> -P	Phosphormolybdenum blue
55	Phosphate Cell Test (total phosphorus)	1.14543	0.05 – 5.00 mg/l P	Peroxodisulfate oxidation / phosphormolybdenum blue
213	Phosphate Cell Test	1.00475	0.5 – 25.0 mg/l PO <sub>4</sub> -P	Phosphormolybdenum blue
86	Phosphate Cell Test	1.14729	0.5 – 25.0 mg/l PO <sub>4</sub> -P	Phosphormolybdenum blue
86	Phosphate Cell Test (total phosphorus)	1.14729	0.5 – 25.0 mg/l P	Peroxodisulfate oxidation / phosphormolybdenum blue
152	Phosphate Cell Test	1.00616	3.0 – 100.0 mg/l PO <sub>4</sub> -P	Phosphormolybdenum blue
214	Phosphate Cell Test	1.00673	3.0 – 100.0 mg/l PO <sub>4</sub> -P	Phosphormolybdenum blue
214	Phosphate Cell Test (total phosphorus)	1.00673	3.0 – 100.0 mg/l P	Peroxodisulfate oxidation / phosphormolybdenum blue
56	Phosphate Test	1.14848	0.005 – 5.00 mg/l PO <sub>4</sub> -P	Phosphormolybdenum blue
162	Phosphate Test	1.00798	1.0 – 100.0 mg/l PO <sub>4</sub> -P	Phosphormolybdenum blue
69	Phosphate Cell Test <sup>1)</sup>	1.14546	0.5 – 25.0 mg/l PO <sub>4</sub> -P	Vanadatomoxybdate
70	Phosphate Test <sup>1)</sup>	1.14842	0.5 – 30.0 mg/l PO <sub>4</sub> -P	Vanadatomoxybdate
2535	Phosphatide Milk §64 LFGB 01.00-41		0 – 750 mg/100 g P	Ashing / phosphormolybdenum blue
2534	Phosphorus Juice EN 1136		0.0 – 300.0 mg/l P	Phosphormolybdenum blue
2533	Phosphorus Meat §64 LFGB 06.00-9		0.000 – 2.500 g/100 g P <sub>2</sub> O <sub>5</sub>	Ashing / vanadatomoxybdate
2532	Phosphorus Milk §64 LFGB 01.00-92		0 – 2000 mg/100 g P	Ashing / phosphormolybdenum blue
	Photometric iodine test - see Iodine Test, photometric			
	Pigment, yellow - see Yellow Pigment			
134	Platinum in water and wastewater		0.10 – 1.25 mg/l Pt	o-Phenylendiamine
103	Potassium Cell Test	1.14562	5.0 – 50.0 mg/l K	Kalignost®, turbidimetric
150	Potassium Cell Test	1.00615	30 – 300 mg/l K	Kalignost®, turbidimetric
2539	Proline Juice EN 1141		0 – 1200 mg/l	Ninhydrin
319	Protein BCA <sup>3)</sup>		200 – 1000 µg/l BSA	Bicinchoninic acid (BCA)
315	Protein Biuret Low Range <sup>3)</sup>		0.5 – 5.0 g/l BSA	Biuret reaction
316	Protein Biuret High Range <sup>3)</sup>		1 – 10 g/l BSA	Biuret reaction

<sup>1)</sup> turbidity correction possible

<sup>3)</sup> individual calibration necessary

Method number	Determination		Total range	Method
2617	Reducing Power <sup>2)</sup>		0 – 100%	DPI
2632	Reducing Sugars <sup>2)</sup>		0.00 – 1.00 g/l Dextrose	PAHBAH
98	Residual Hardness Cell Test <sup>1)</sup>	1.14683	0.50 – 5.00 mg/l Ca	Phthalein purple
2563	Saybolt Color Measurement <sup>6)</sup>		-15 - 30 Saybolt	Transmittances from 380 – 780 nm
79	Silicate (Silicic acid) Test	1.14794	0.11 – 10.70 mg/l SiO <sub>2</sub>	Silicomolybdenum blue
81	Silicate (Silicic acid) Test	1.14794	0.011 – 1.600 mg/l SiO <sub>2</sub>	Silicomolybdenum blue
169	Silicate (Silicic acid) Test <sup>1)</sup>	1.00857	1.1 – 107.0 mg/l SiO <sub>2</sub>	Molybdatosilicate
171	Silicate (Silicic acid) Test <sup>1)</sup>	1.00857	11 – 1070 mg/l SiO <sub>2</sub>	Molybdatosilicate
225	Silicate (Silicic acid) Test	1.01813	0.5 – 500.0 µg/l SiO <sub>2</sub>	Silicomolybdenum blue
47	Silver Test <sup>1)</sup>	1.14831	0.25 – 3.00 mg/l Ag	Eosine / 1,10-Phenanthroline
168	Sodium Cell Test in nutrient solutions <sup>1)</sup>	1.00885	10 – 300 mg/l Na	indirectly as chloride
302	Spectral Absorption Coefficient $\alpha(436)$ <sup>6)</sup>		0.1 – 250 m <sup>-1</sup>	Measurement at 436 nm
2621	Steam-volatile Phenols - malt <sup>2)</sup>		0.00 – 3.00 mg/kg	Aminoantipyrine by extraction
2621	Steam-volatile Phenols - beer <sup>2)</sup>		0.00 – 0.30 mg/kg	Aminoantipyrine by extraction
2622	Steam-volatile Phenols - malt <sup>2)</sup>		0.00 – 3.00 mg/kg	Aminoantipyrine by extraction
2622	Steam-volatile Phenols - beer <sup>2)</sup>		0.00 – 0.30 mg/kg	Aminoantipyrine by extraction
314	Sugars <sup>3)</sup>		0 – 200 g/l	3,5-Dinitrosalicylic acid (DNSA)
	Sugar solutions, Color of - see ICUMSA Color			
229	Sulfate Cell Test	1.02532	1.0 – 50.0 mg/l SO <sub>4</sub>	Bariumsulfate, turbidimetric
64	Sulfate Cell Test	1.14548	5 – 250 mg/l SO <sub>4</sub>	Bariumsulfate, turbidimetric
154	Sulfate Cell Test	1.00617	50 – 500 mg/l SO <sub>4</sub>	Bariumsulfate, turbidimetric
82	Sulfate Cell Test	1.14564	100 – 1000 mg/l SO <sub>4</sub>	Bariumsulfate, turbidimetric
65	Sulfate Test <sup>1)</sup>	1.14791	25 – 300 mg/l SO <sub>4</sub>	Tannin

<sup>1)</sup> turbidity correction possible

<sup>2)</sup> the analytical procedure for this method is given in the manual of the "Brewery Methods Prove plus"

<sup>3)</sup> individual calibration necessary

<sup>6)</sup> the analytical procedure for this method is also given in the manual of the "Methods for color measurement"

## Analytical Procedures and Appendice – I Available photometric test kits and methods

Method number	Determination		Total range	Method
224	Sulfate Test	1.01812	0.50 – 50.0 mg/l SO <sub>4</sub>	Bariumsulfate, turbidimetric
230	Sulfate Test <sup>7)</sup>	1.02537	5 – 300 mg/l SO <sub>4</sub>	Bariumsulfate, turbidimetric
236	Sulfate Test <sup>7)</sup>	1.02537	5 – 300 mg/l SO <sub>4</sub>	Bariumsulfate, turbidimetric
80	Sulfide Test <sup>1)</sup>	1.14779	0.020 – 1.50 mg/l S	Dimethyl-p-phenylendiamin
71	Sulfite Cell Test <sup>1)</sup>	1.14394	1.0 – 20.0 mg/l SO <sub>3</sub>	Ellman's reagent
127	Sulfite Cell Test sensitive <sup>1)</sup>	1.14394	0.05 – 3.00 mg/l SO <sub>3</sub>	Ellman's reagent
187	Sulfite Test <sup>1)</sup>	1.01746	1.0 – 60.0 mg/l SO <sub>3</sub>	Ellman's reagent
231	Surfactants (anionic) Cell Test	1.02552	0.05 – 2.00 mg/l SDAS	Methylene blue
192	Surfactants (cationic) Cell Test <sup>1)</sup>	1.01764	0.05 – 1.50 mg/l k-Ten	Disulfine blue
193	Surfactants (nonionic) Cell Test <sup>1)</sup>	1.01787	0.10 – 7.50 mg/l n-Ten	TBPE
182	Suspended Solids		1 – 750 mg/l SusS	
2619	Thiobarbituric Acid Number <sup>2)</sup>		0 – 250	Thiobarbituric acid
100	Tin Cell Test <sup>1)</sup>	1.14622	0.10 – 2.50 mg/l Sn	Pyrocatechol violet
235	Tin Cell Test <sup>1)</sup>	1.17265	0.10 – 2.50 mg/l Sn	Pyrocatechol violet
2577	Tint index <sup>5)</sup>		-6.00 – 3.00 TI <sub>10mm</sub>	Transmittances from 360 – 780 nm
2578	Tint index <sup>5)</sup>		-6.00 – 3.00 TI <sub>10mm</sub>	Transmittances from 360 – 780 nm
172	TOC Cell Test	1.14878	5.0 – 80.0 mg/l TOC	Peroxodisulfate oxidation / Indicator
173	TOC Cell Test	1.14879	50 – 800 mg/l TOC	Peroxodisulfate oxidation / Indicator
2625	Total Carbohydrates <sup>2)</sup>		0.000 – 6.000 g/100 ml	Anthrone
178	Total Hardness Cell Test <sup>1)</sup>	1.00961	5 – 215 mg/l Ca	Phthalein purple
2610	Total Polyphenols <sup>2)</sup>		1 – 800 mg/l	Iron(III)
2579	Transmittances T <sub>x</sub> , T <sub>y</sub> , T <sub>z</sub> <sup>5)</sup>		T <sub>x</sub> 0.0 – 150.0 T <sub>y</sub> 0.0 – 150.0 T <sub>z</sub> 0.0 – 150.0	Transmittances from 380 – 780 nm
77	Turbidity		1 – 100 FAU	Measurement at 550 nm
2620	Vicinal Diketones <sup>2)</sup>		0.000 – 2.000 mg/kg	Phenylendiamin

<sup>1)</sup> turbidity correction possible

<sup>2)</sup> the analytical procedure for this method is given in the manual of the "Brewery Methods Prove plus"

<sup>5)</sup> the analytical procedure for this method is given in the manual of the "Methods for color measurement"

<sup>7)</sup> **only when selecting the method manually:**

for batches with a minimum shelf life **till** 2021/10/31: select method number **230**

for batches with a minimum shelf life **after** 2021/10/31: select method number **236**

Method number	Determination		Total range	Method
222	Volatile Organic Acids Cell Test <sup>1)</sup>	1.01749	50 – 3000 mg/l CH <sub>3</sub> COOH	Esterification
223	Volatile Organic Acids Test <sup>1)</sup>	1.01809	50 – 3000 mg/l CH <sub>3</sub> COOH	Esterification
Water hardness - see Total Hardness or Residual Hardness				
2575	Whiteness <sup>5)</sup>		40.0 – 220.0 WI <sub>10mm</sub>	Transmittances from 380 – 780 nm
2576	Whiteness <sup>5)</sup>		40.0 – 220.0 WI <sub>50mm</sub>	Transmittances from 380 – 780 nm
2541	Yellow Pigment EN ISO 11052		0.000 – 1.250 mg/100 g	β-Carotene
2573	Yellowness <sup>5)</sup>		0.0 – 30.0 YI <sub>10mm</sub>	Transmittances from 380 – 780 nm
2574	Yellowness <sup>5)</sup>		0.0 – 90.0 YI <sub>50mm</sub>	Transmittances from 380 – 780 nm
174	Zinc Cell Test	1.00861	0.025 – 1.000 mg/l Zn	PAR
74	Zinc Cell Test	1.14566	0.20 – 5.00 mg/l Zn	PAR
41	Zinc Test <sup>1)</sup>	1.14832	0.05 – 2.50 mg/l Zn	Cl-PAN

<sup>1)</sup> turbidity correction possible

<sup>5)</sup> the analytical procedure for this method is given in the manual of the "Methods for color measurement"

I

## Pre-programmed AQA1 and PipeCheck methods

### AQA1

Method number	Name	Cat. No.	Method	Content
9002	Certipur® UV-VIS Standard 1	1.08160.0001	Photometric accuracy	Potassium dichromate solution
9003	Certipur® UV-VIS Standard 1a	1.04660.0001	Photometric accuracy	Potassium dichromate solution
9005	Certipur® UV-VIS Standard 2	1.08161.0001	Stray light	Sodium nitrite solution
9004	Certipur® UV-VIS Standard 6	1.08166.0001	Wavelength accuracy	Holmium oxide solution
9001	Spectroquant® PhotoCheck	1.14693.0001	Photometric accuracy	Color solutions

II

### PipeCheck

Method number	Name	Cat. No.	Pipette volume	Content
9012	Spectroquant® PipeCheck	1.14692.0001	2.0 ml	Check and reference solution
9013	Spectroquant® PipeCheck	1.14692.0001	3.0 ml	Check and reference solution
9014	Spectroquant® PipeCheck	1.14692.0001	5.0 ml	Check and reference solution
9015	Spectroquant® PipeCheck	1.14692.0001	10.0 ml	Check and reference solution

III

IV

# Acid Capacity to pH 4.3 (Total Alkalinity)

1.01758

Cell Test

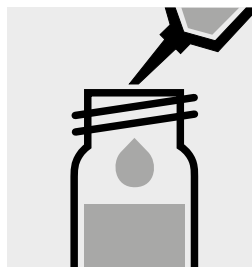
<b>Measuring</b>	0.40 – 8.00 mmol/l
<b>range:</b>	20 – 400 mg/l CaCO <sub>3</sub>



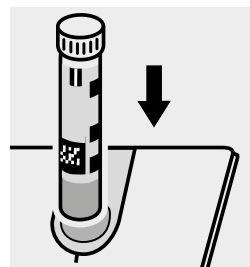
Pipette 4.0 ml of **AC-1** into a round cell.



Add 1.0 ml of the sample with pipette, close the cell with the screw cap, and mix.



Add 0.50 ml of **AC-2** with pipette, close the cell with the screw cap, and mix.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a sodium hydroxide solution 0.1 mol/l, Cat.No. 1.09141, can be used after diluting accordingly (see section "Standard solutions").



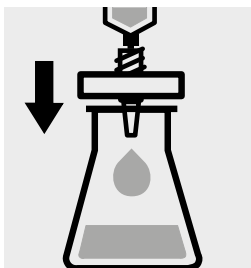
# ADMI Color Measurement

Application

corresponds to **APHA 2120F** (ADMI Weighted-Ordinate Spectrophotometric Method)

<b>Measuring range:</b>	10 – 1000	10-mm cell	Method No. 2516
	10 – 500	10-mm cell	Method No. 2517
	2.0 – 100.0	50-mm cell	Method No. 2518
<b>Attention!</b>	Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended. This zero value remains valid until the method is exited.		

## Preparation:

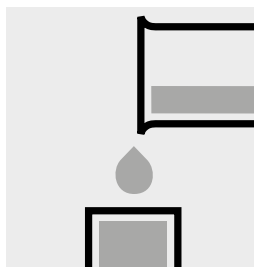


Filter turbid samples.

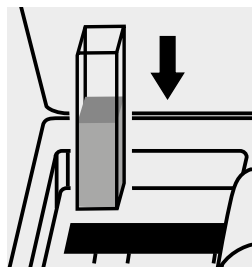
## Determination at the original pH:



Select method no. **2516**, **2517**, or **2518**. Perform the zero adjustment and confirm by pressing the <OK> button.



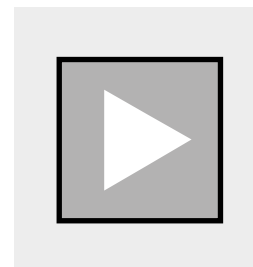
Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The ADMI is shown in the display.



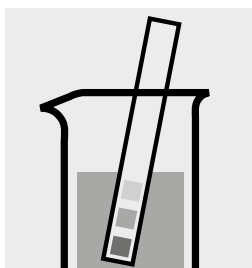
Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

# ADMI Color Measurement

Application

corresponds to **APHA 2120F** (ADMI Weighted-Ordinate Spectrophotometric Method)

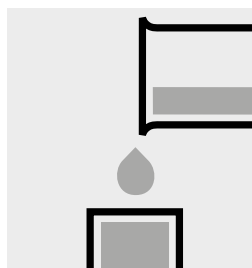
## Determination at pH 7.0:



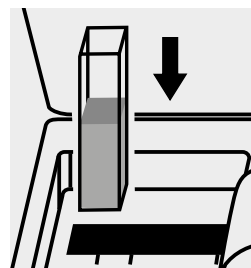
Check the pH of the sample, specified value: pH 7.0. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method no. **2516**, **2517**, or **2518**. Perform the zero adjustment and confirm by pressing the <OK> button.



Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The ADMI is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

### Note:

The ADMI factor of 1400 used for calculating the measurement result can be adjusted by the user (see the application for further details).

In the case of **serial measurements** the accuracy of the measurement can be enhanced by making a zero setting prior to **each** individual measurement.

### Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

### Quality assurance:

To check the measurement system (measurement device, and handling) ready-to-use platinum-cobalt color reference solution (Hazen 500) Certipur®, Cat.No. 1.00246, concentration 500 mg/l Pt can be used after diluting accordingly.

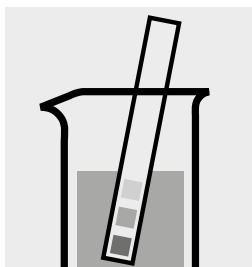
# Aluminium

1.00594

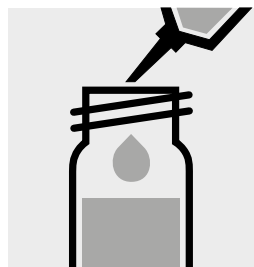
Cell Test

**Measuring** 0.02 – 0.50 mg/l Al

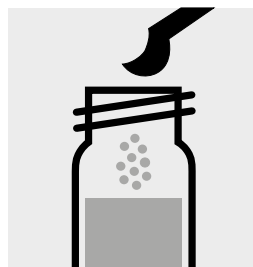
**range:** Expression of results also possible in mmol/l.



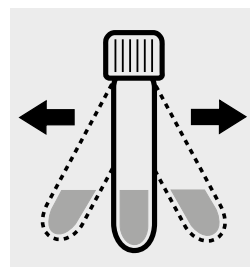
Check the pH of the sample, specified range: pH 3 – 10. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 6.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 1 level blue microspoon of **Al-1K**, close with the screw cap.



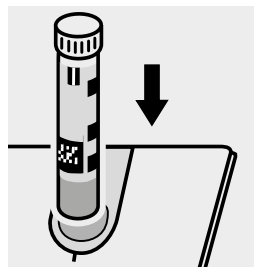
Shake the cell vigorously to dissolve the solid substance.



Add 0.25 ml of **Al-2K** with pipette, close with the screw cap, and mix.



Reaction time:  
5 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 100, Cat.No. 1.18701 or the Standard solution for photometric applications, Cat.No. 1.32225.

Ready-to-use aluminium standard solution Certipur®, Cat.No. 1.19770, concentration 1000 mg/l Al, can also be used after diluting accordingly.

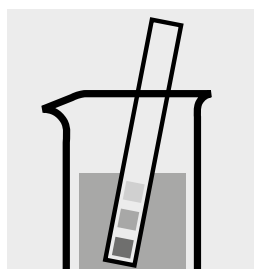
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 100) is highly recommended.

# Aluminium

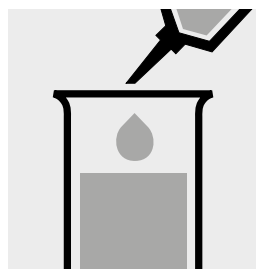
1.14825

Test

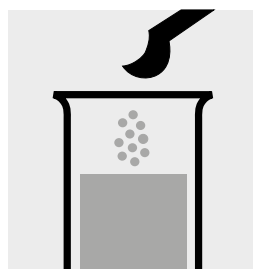
<b>Measuring range:</b>	0.10 – 1.20 mg/l Al	10-mm cell
	0.05 – 0.60 mg/l Al	20-mm cell
	0.020 – 0.200 mg/l Al	50-mm cell
	Expression of results also possible in mmol/l.	



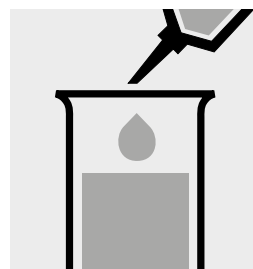
Check the pH of the sample, specified range: pH 3 – 10. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



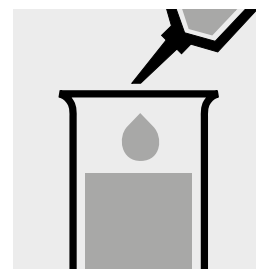
Pipette 5.0 ml of the sample into a test tube.



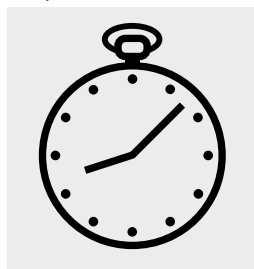
Add 1 level blue microspoon of **Al-1** to the test tube and dissolve the solid substance.



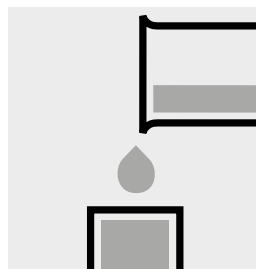
Add 1.2 ml of **Al-2** with pipette and mix.



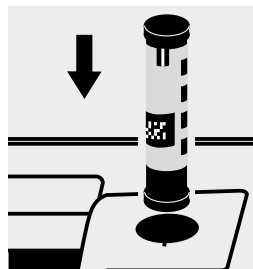
Add 0.25 ml of **Al-3** with pipette and mix.



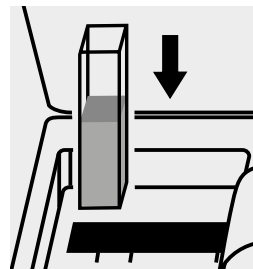
Reaction time:  
2 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

To measure in the 50-mm cell, the sample volume and the volume of the reagents have to be doubled for each. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 100, Cat.No. 1.18701 or the Standard solution for photometric applications, Cat.No. 1.32225.

Ready-to-use aluminium standard solution Certipur®, Cat.No. 1.19770, concentration 1000 mg/l Al, can also be used after diluting accordingly.

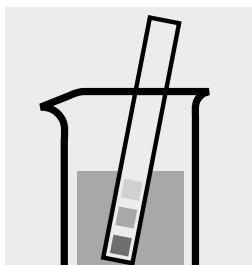
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 100) is highly recommended.

# Ammonia, free

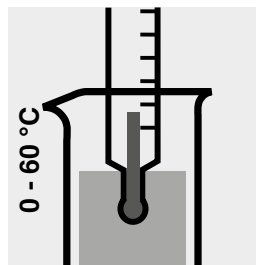
(as ammonium)

## Application

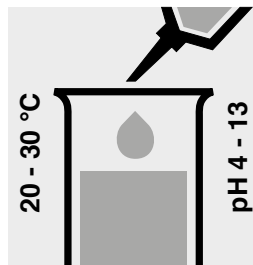
<b>Measuring range:</b>	0.00 – 3.65 mg/l NH <sub>3</sub>	0.00 – 3.00 mg/l NH <sub>3</sub> -N	10-mm cell	Method No. 2520
	0.00 – 1.83 mg/l NH <sub>3</sub>	0.00 – 1.50 mg/l NH <sub>3</sub> -N	20-mm cell	Method No. 2520
	0.000 – 0.730 mg/l NH <sub>3</sub>	0.000 – 0.600 mg/l NH <sub>3</sub> -N	50-mm cell	Method No. 2520



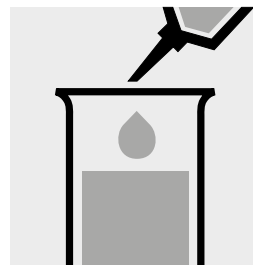
Check the pH of the sample **and note**.



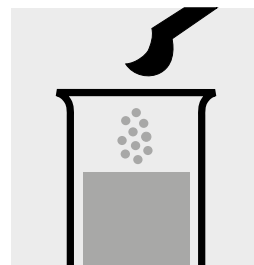
Check the temperature of the solution **and note**.



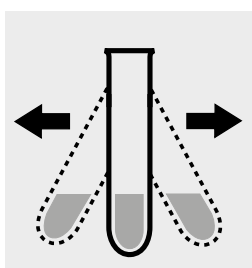
Pipette 5.0 ml of the sample into a test tube. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH and bring the sample to the appropriate temperature.



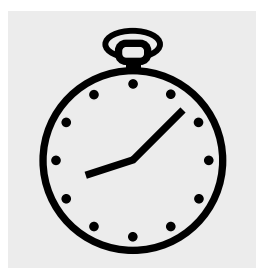
Add 0.60 ml of **NH<sub>4</sub>-1** (from Spectroquant® Ammonium Test, Cat. No. 1.14752) with pipette and mix.



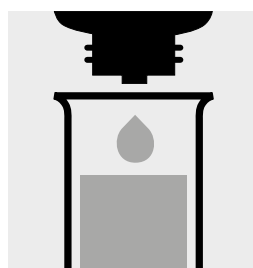
Add 1 level blue microspoon of **NH<sub>4</sub>-2** (from Spectroquant® Ammonium Test, Cat. No. 1.14752).



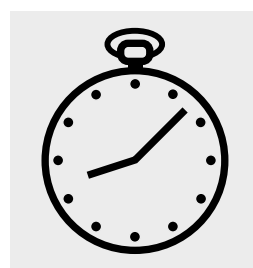
Shake vigorously to dissolve the solid substance.



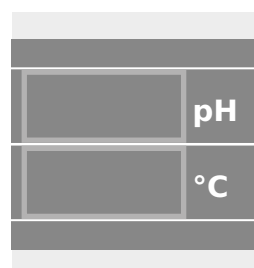
Reaction time:  
5 minutes



Add 4 drops of **NH<sub>4</sub>-3** (from Spectroquant® Ammonium Test, Cat. No. 1.14752) and mix.



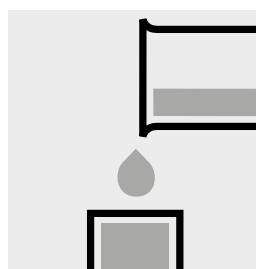
Reaction time:  
5 minutes



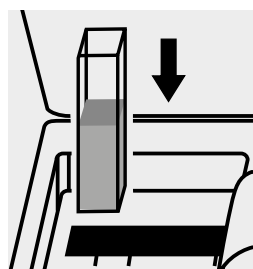
Select method no. **2520**. Enter the pH and the temperature in °C of the original sample.



Tap the <Start> button.



Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The NH<sub>3</sub> and NH<sub>3</sub>-N content is shown in the display in mg/l.

### Important:

Very high ammonium concentrations in the sample produce turquoise-colored solutions (measurement solution should be yellow-green to green) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

To measure in the 50-mm cell, the sample volume and the volume of the reagents have to be doubled for each. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

### Important:

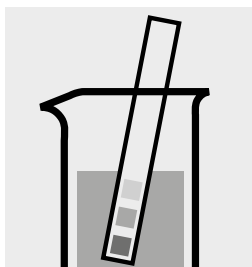
The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

# Ammonium

1.14739

Cell Test

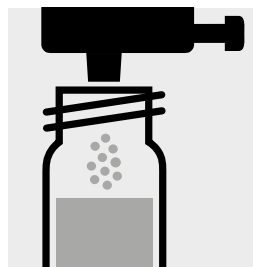
<b>Measuring</b>	0.010 – 2.000 mg/l NH <sub>4</sub> -N
<b>range:</b>	0.013 – 2.571 mg/l NH <sub>4</sub>
	0.010 – 2.000 mg/l NH <sub>3</sub> -N
	0.012 – 2.432 mg/l NH <sub>3</sub>
	Expression of results also possible in mmol/l.



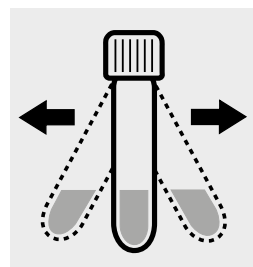
Check the pH of the sample, specified range: pH 4 – 13. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a reaction cell close with the screw cap, and mix.



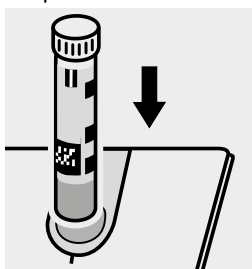
Add 1 dose of **NH<sub>4</sub>-1K** using the blue dose-metering cap, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 15 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Important:

Very high ammonium concentrations in the sample produce turquoise-colored solutions (measurement solution should be yellow-green to green) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 50, Cat.No. 1.14695, or the Standard solutions for photometric applications, Cat.Nos. 1.25022, 1.25023, and 1.32227.

Ready-to-use ammonium standard solution Certipur®, Cat.No. 1.19812, concentration 1000 mg/l NH<sub>4</sub><sup>+</sup>, can also be used after diluting accordingly.

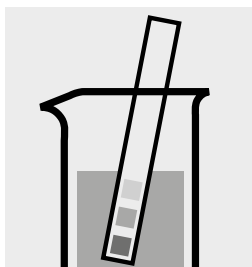
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 50) is highly recommended.

# Ammonium

1.14558

Cell Test

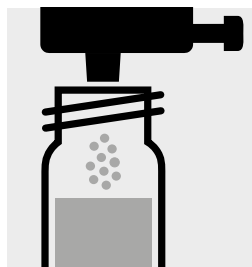
<b>Measuring</b>	0.20 – 8.00 mg/l NH <sub>4</sub> -N
<b>range:</b>	0.26 – 10.30 mg/l NH <sub>4</sub>
	0.20 – 8.00 mg/l NH <sub>3</sub> -N
	0.24 – 9.73 mg/l NH <sub>3</sub>
	Expression of results also possible in mmol/l.



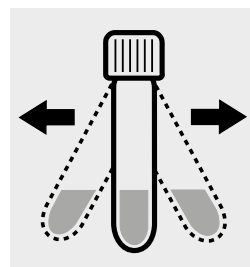
Check the pH of the sample, specified range: pH 4 – 13. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



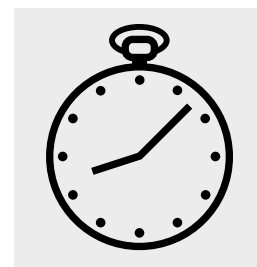
Pipette 1.0 ml of the sample into a reaction cell close with the screw cap, and mix.



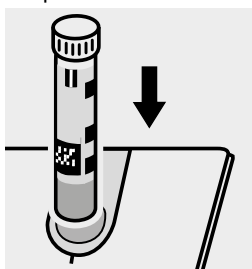
Add 1 dose of **NH<sub>4</sub>-1K** using the blue dose-metering cap, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 15 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Important:

Very high ammonium concentrations in the sample produce turquoise-colored solutions (measurement solution should be yellow-green to green) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 1.14676, or the Standard solutions for photometric applications, Cat.Nos. 1.25022, 1.25023, 1.25024, and 1.25025.

Ready-to-use ammonium standard solution Certipur®, Cat.No. 1.19812, concentration 1000 mg/l NH<sub>4</sub><sup>+</sup>, can also be used after diluting accordingly.

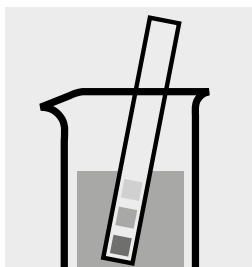
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

# Ammonium

1.14544

Cell Test

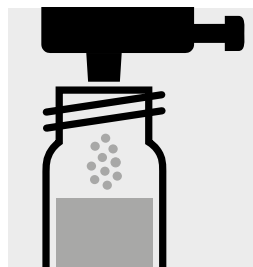
<b>Measuring</b>	0.5 – 16.0 mg/l NH <sub>4</sub> -N
<b>range:</b>	0.6 – 20.6 mg/l NH <sub>4</sub>
	0.5 – 16.0 mg/l NH <sub>3</sub> -N
	0.6 – 19.5 mg/l NH <sub>3</sub>
	Expression of results also possible in mmol/l.



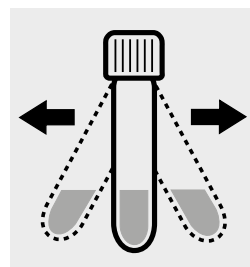
Check the pH of the sample, specified range: pH 4 – 13. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 0.50 ml of the sample into a reaction cell close with the screw cap, and mix.



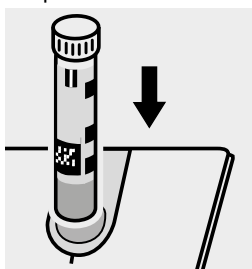
Add 1 dose of **NH<sub>4</sub>-1K** using the blue dose-metering cap, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 15 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Important:

Very high ammonium concentrations in the sample produce turquoise-colored solutions (measurement solution should be yellow-green to green) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20, Cat.No. 1.14675, or the Standard solutions for photometric applications, Cat.Nos. 1.25023, 1.25024, 1.25025, and 1.25026.

Ready-to-use ammonium standard solution Certipur®, Cat.No. 1.19812, concentration 1000 mg/l NH<sub>4</sub><sup>+</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 20) is highly recommended.

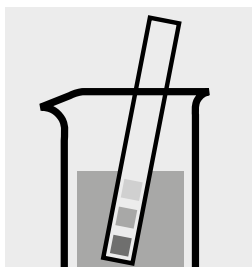


# Ammonium

1.14559

Cell Test

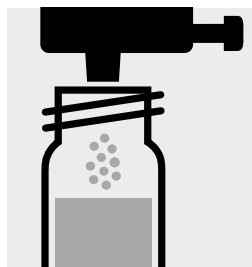
<b>Measuring</b>	4.0 – 80.0 mg/l NH <sub>4</sub> -N
<b>range:</b>	5.2 – 103.0 mg/l NH <sub>4</sub>
	4.0 – 80.0 mg/l NH <sub>3</sub> -N
	4.9 – 97.3 mg/l NH <sub>3</sub>
	Expression of results also possible in mmol/l.



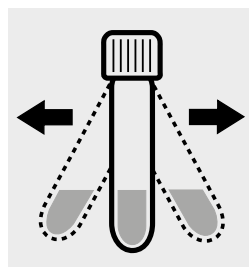
Check the pH of the sample, specified range: pH 4 – 13. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 0.10 ml of the sample into a reaction cell close with the screw cap, and mix.



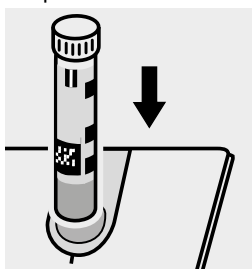
Add 1 dose of **NH<sub>4</sub>-1K** using the blue dose-metering cap, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 15 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Important:

Very high ammonium concentrations in the sample produce turquoise-colored solutions (measurement solution should be yellow-green to green) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 70, Cat.No. 1.14689, or the Standard solutions for photometric applications, Cat.Nos. 1.25025, 1.25026, and 1.25027.

Ready-to-use ammonium standard solution Certipur®, Cat.No. 1.19812, concentration 1000 mg/l NH<sub>4</sub><sup>+</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 70) is highly recommended.

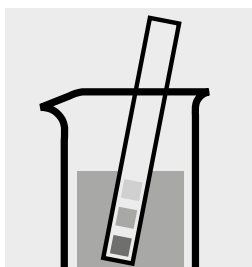
# Ammonium

1.14752

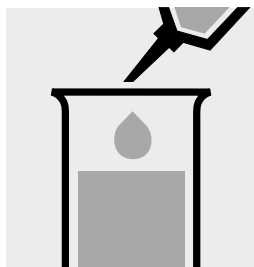
Test

<b>Measuring range:</b>	0.05 – 3.00 mg/l NH <sub>4</sub> -N	0.06 – 3.86 mg/l NH <sub>4</sub>	10-mm cell
	0.03 – 1.50 mg/l NH <sub>4</sub> -N	0.04 – 1.93 mg/l NH <sub>4</sub>	20-mm cell
	0.010 – 0.500 mg/l NH <sub>4</sub> -N	0.013 – 0.644 mg/l NH <sub>4</sub>	50-mm cell
	0.05 – 3.00 mg/l NH <sub>3</sub> -N	0.06 – 3.65 mg/l NH <sub>3</sub>	10-mm cell
	0.03 – 1.50 mg/l NH <sub>3</sub> -N	0.04 – 1.82 mg/l NH <sub>3</sub>	20-mm cell
	0.010 – 0.500 mg/l NH <sub>3</sub> -N	0.016 – 0.608 mg/l NH <sub>3</sub>	50-mm cell

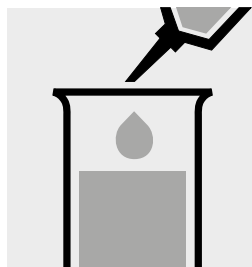
Expression of results also possible in mmol/l.



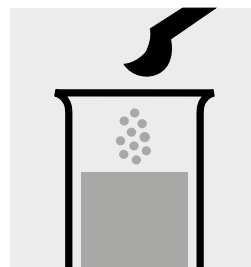
Check the pH of the sample, specified range: pH 4 – 13.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



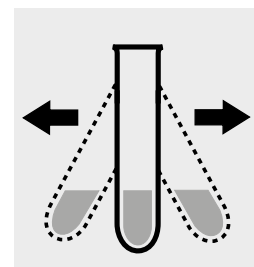
Pipette 5.0 ml of the sample into a test tube.



Add 0.60 ml of **NH<sub>4</sub>-1** with pipette and mix.



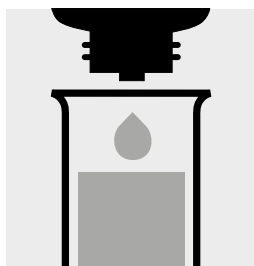
Add 1 level blue microspoon of **NH<sub>4</sub>-2**.



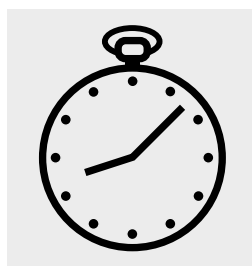
Shake vigorously to dissolve the solid substance.



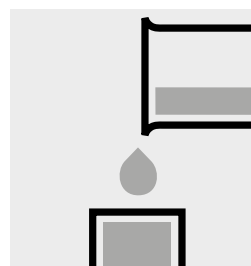
Reaction time:  
5 minutes



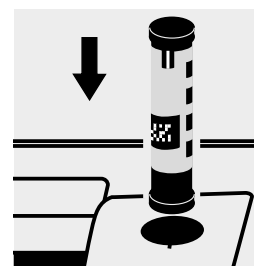
Add 4 drops of **NH<sub>4</sub>-3** and mix.



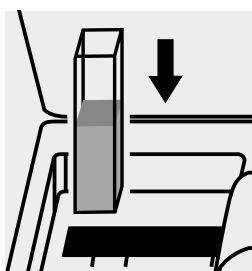
Reaction time:  
5 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

Very high ammonium concentrations in the sample produce turquoise-colored solutions (measurement solution should be yellow-green to green) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

To measure in the 50-mm cell, the sample volume and the volume of the reagents have to be doubled for each. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 50, Cat.No. 1.14695, or the Standard solutions for photometric applications, Cat.Nos. 1.25022, 1.25023, 1.25024, and 1.32227.

Ready-to-use ammonium standard solution Certipur®, Cat.No. 1.19812, concentration 1000 mg/l NH<sub>4</sub><sup>+</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 50) is highly recommended.

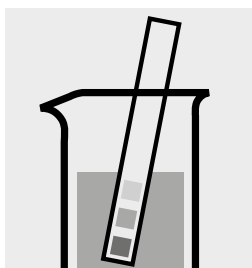
# Ammonium

1.00683

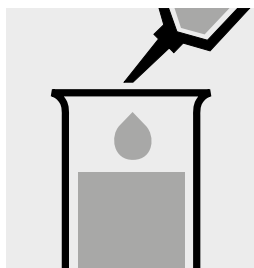
Test

<b>Measuring range:</b>	2.0 – 75.0	mg/l NH <sub>4</sub> -N	2.6 – 96.6	mg/l NH <sub>4</sub>	10-mm cell
	5 – 150	mg/l NH <sub>4</sub> -N	6 – 193	mg/l NH <sub>4</sub>	10-mm cell
	2.0 – 75.0	mg/l NH <sub>3</sub> -N	2.4 – 91.2	mg/l NH <sub>3</sub>	10-mm cell
	5 – 150	mg/l NH <sub>3</sub> -N	6 – 182	mg/l NH <sub>3</sub>	10-mm cell
Expression of results also possible in mmol/l.					

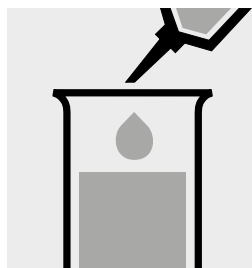
Measuring range: 2.0 – 75.0 mg/l NH<sub>4</sub>-N



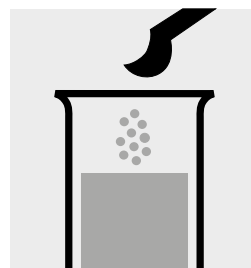
Check the pH of the sample, specified range: pH 4 – 13.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



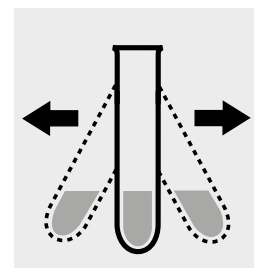
Pipette 5.0 ml of **NH<sub>4</sub>-1** into a test tube.



Add 0.20 ml of the sample with pipette.



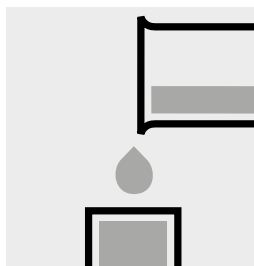
Add 1 level blue microspoon of **NH<sub>4</sub>-2**.



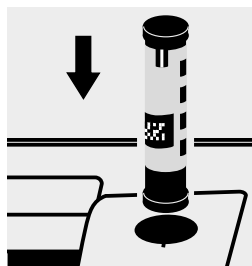
Shake vigorously to dissolve the solid substance.



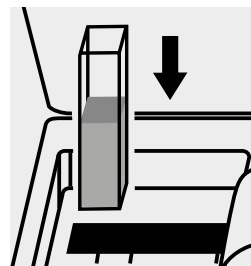
Reaction time: 15 minutes



Transfer the solution into a cell.

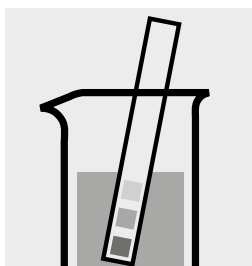


Select method with AutoSelector measuring range 2.0 – 75.0 mg/l NH<sub>4</sub>-N.

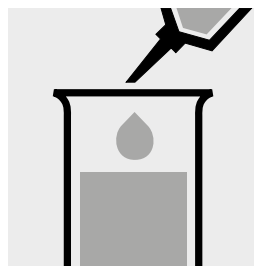


Place the cell into the cell compartment.

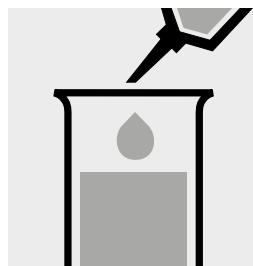
Measuring range: 5 – 150 mg/l  $\text{NH}_4\text{-N}$



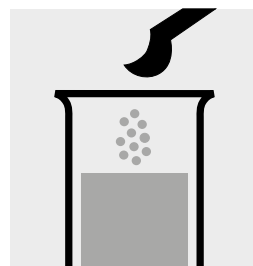
Check the pH of the sample, specified range: pH 4 – 13.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



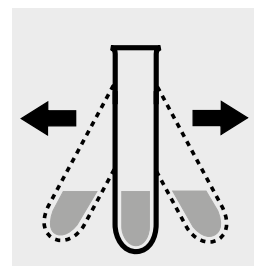
Pipette 5.0 ml of  $\text{NH}_4\text{-1}$  into a test tube.



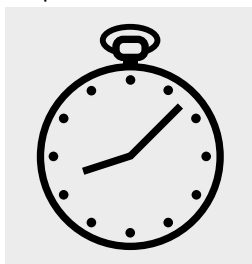
Add 0.10 ml of the sample with pipette.



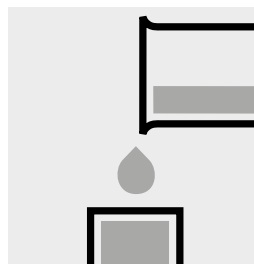
Add 1 level blue micro-spoon of  $\text{NH}_4\text{-2}$ .



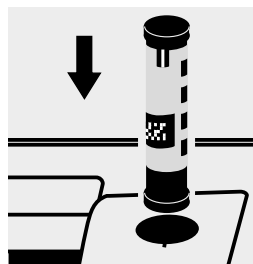
Shake vigorously to dissolve the solid substance.



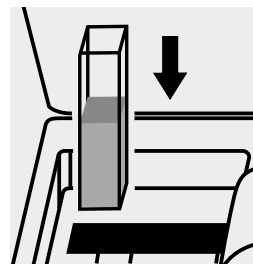
Reaction time:  
15 minutes



Transfer the solution into a cell.



Select method with AutoSelector measuring range 5 – 150 mg/l  $\text{NH}_4\text{-N}$ .



Place the cell into the cell compartment.

### Important:

Very high ammonium concentrations in the sample produce turquoise-colored solutions (measurement solution should be yellow-green to green) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 70, Cat.No. 1.14689, or the Standard solutions for photometric applications, Cat.Nos. 1.25025, 1.25026, and 1.25027.

Ready-to-use ammonium standard solution Certipur®, Cat.No. 1.19812, concentration 1000 mg/l  $\text{NH}_4^+$ , can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 70) is highly recommended.

# Annatto in cheese

corresponds to German Food and Feed Code §64 LFGB 03.00.37

Application

**Measuring range:** 0.0 – 10.0 mg/kg

10-mm cell

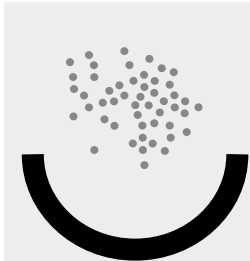
Method No. 2540

**Attention!**

Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended. This zero value remains valid until the method is exited.

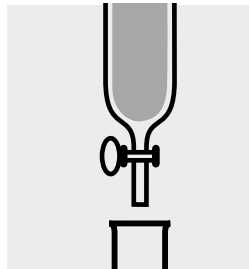
**Reagent blank:**

Extraction of annatto



Fill sea sand into a mortar and perform the extraction acc. to §64 LFGB 03.00.37, section 9.1.1 [1]:  
**blank extract.**

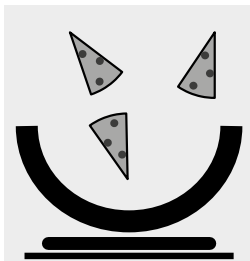
Solid-phase extraction (SPE)



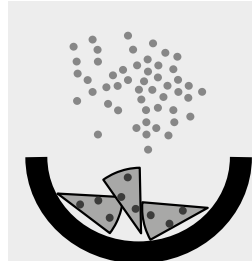
Using the blank extract perform a solid-phase extraction acc. to §64 LFGB 03.00.37, section 9.1.2 [1]:  
**reagent blank.**

**Measurement sample:**

Extraction of annatto

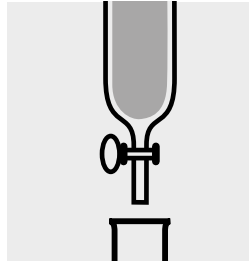


Weigh approx. 5 g of grated cheese into a mortar, accurately weighed to 1 mg.



Mix with sea sand and perform the extraction acc. to §64 LFGB 03.00.37, section 9.1.1 [1]:  
**sample extract.**

Solid-phase extraction (SPE)



Using the sample extract perform a solid-phase extraction acc. to §64 LFGB 03.00.37, section 9.1.2 [1]:  
**measurement sample.**

# Annatto in cheese

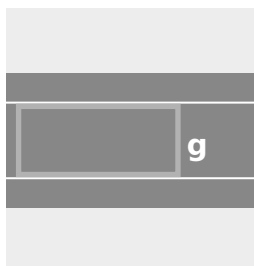
corresponds to German Food and Feed Code §64 LFGB 03.00.37

Application

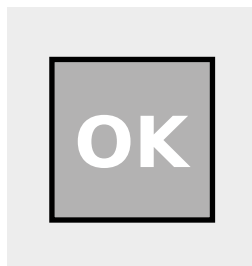
## Measurement:



Select method no. **2540**. Perform the zero adjustment and confirm by pressing the <OK> button.



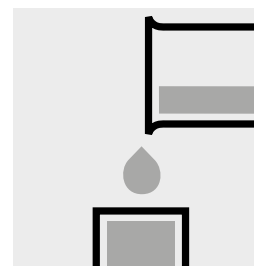
Enter the sample weight in grams.



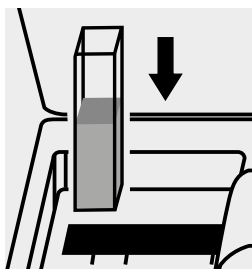
Confirm with <OK>.



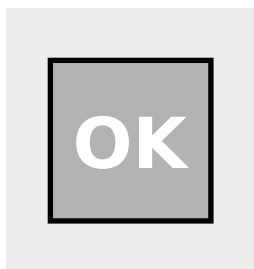
Tap the <Start> button.



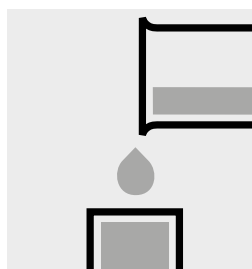
Transfer the solution "**reagent blank**" into the cell.



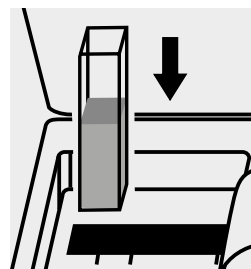
Place the cell into the cell compartment. The blank measurement is performed automatically.



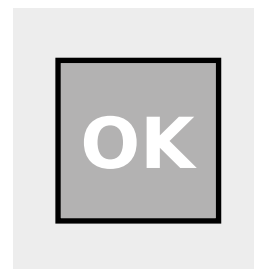
Confirm with <OK>.



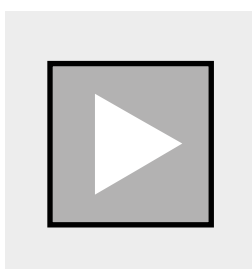
Transfer the solution "**measurement sample**" into the cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The result is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

## Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

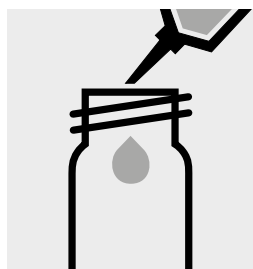
# Antimony in water and wastewater

Application

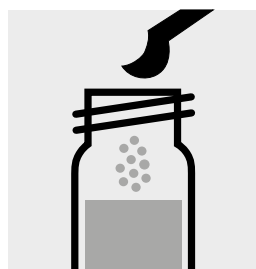
Measuring range: 0.10 – 8.00 mg/l Sb

10-mm cell

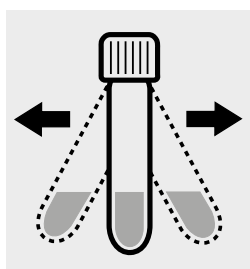
Method No. 130



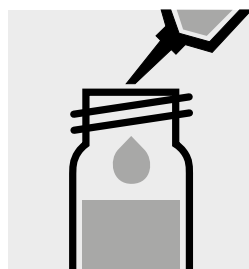
Pipette 4.0 ml of the sample into an empty round cell (Empty cells, Cat.No. 1.14724).



Add approx. 1.5 g of **aluminium chloride hexahydrate extra pure** (Cat.No. 1.01084), close the cell with the screw cap.



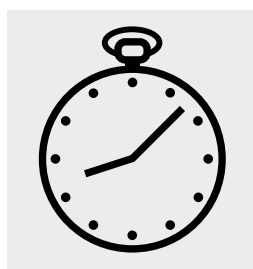
Shake the cell vigorously to dissolve the solid substance.



Add 1.0 ml **phosphoric acid 85 % GR** (Cat.No. 1.00573) with pipette, close the cell with the screw cap, and mix.



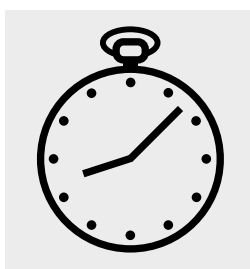
Add 2 drops of **reagent 1**, close the cell with the screw cap, and mix.



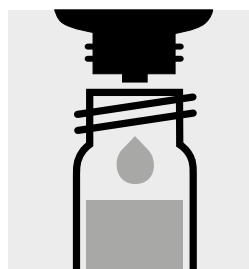
Reaction time:  
3 minutes



Add 2 drops of **reagent 2**, close the cell with the screw cap, and mix.



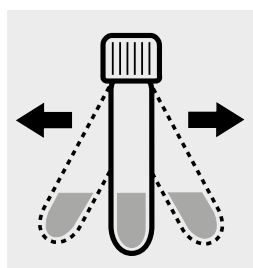
Reaction time:  
2 minutes



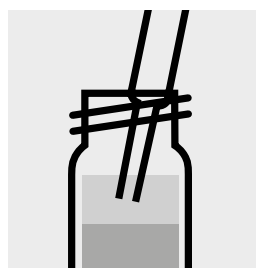
Add 2 drops of **reagent 3**, close the cell with the screw cap, and mix.



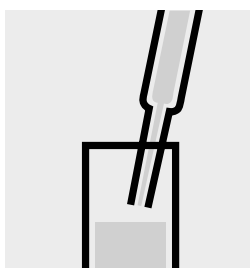
Add 5.0 ml **toluene GR** (Cat.No. 1.08325) with pipette, close the cell with the screw cap.



Shake the cell vigorously for 30 seconds. Leave to stand to allow phases to separate.



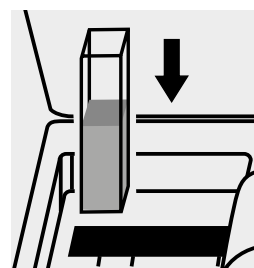
Aspirate the clear upper phase from the tube with pipette.



Transfer the solution into a cell.



Select method no. **130**.



Place the cell into the cell compartment. The measurement is performed automatically.

## Note:

Empty cells with screw caps, Cat.No. 1.14724 are recommended for the preparation. These cells can be sealed with the screw caps, thus enabling a hazard-free mixing of the sample.

## Important:

The exact composition and preparation of the reagents 1, 2, and 3 used are given in the corresponding application, which also includes further information on the method employed. This application can be downloaded from the website.

# AOX

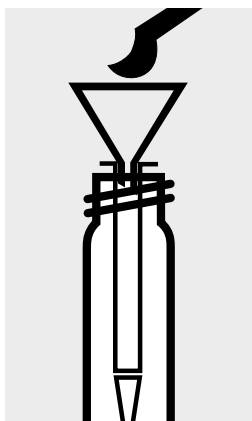
## Adsorbable Organic Halogens (x)

1.00675

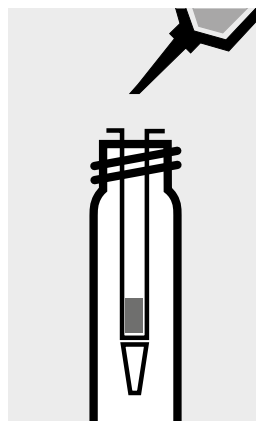
Cell Test

Measuring range: 0.05 – 2.50 mg/l AOX

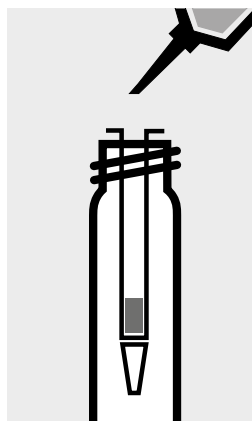
### Preparation of the adsorption column:



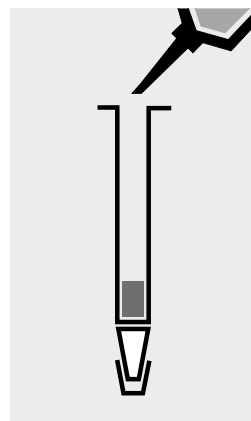
Place the column in an empty cell. Fill 1 level blue microspoon of **AOX-1** into the column using the glass funnel.



Run 3 separate 1-ml portions of **AOX-2** through the column. Discard the wash solution.

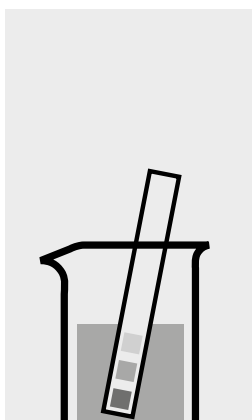


Run 3 separate 1-ml portions of **AOX-3** through the column. Discard the wash solution.

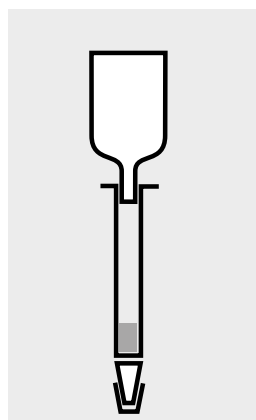


Close the bottom end of the column with the stopper. Apply to the column 1 ml of **AOX-3**. Close the top end of the column with the stopper and swirl to eliminate air bubbles. Remove the stopper on the top end and fill the column to the brim with **AOX-3**.

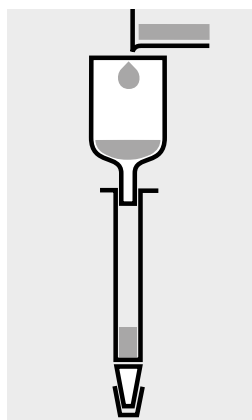
### Sample enrichment:



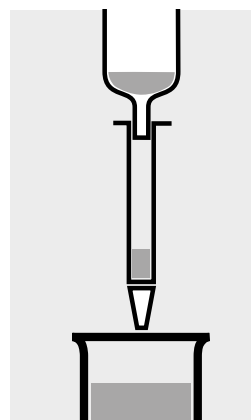
Check the pH of the sample, specified range: pH 6 – 7. If required, add dilute sodium hydroxide solution or nitric acid drop by drop to adjust the pH.



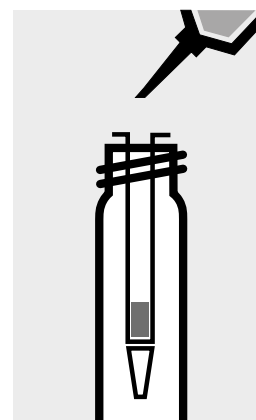
Attach the glass reservoir to the prepared column (closed at the bottom end).



Fill 100 ml of the sample and 6 drops of **AOX-4** into the reservoir.



Remove the stopper from the column outlet and run the sample through completely.



Detach the column from the reservoir. Apply 3 separate 1-ml portions of **AOX-3**. Discard the wash solution.



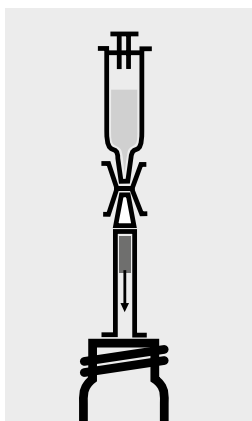
# AOX

## Adsorbable Organic Halogens (x)

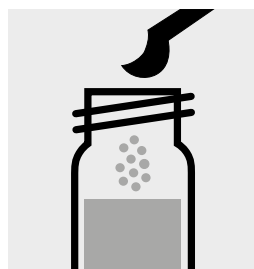
1.00675

Cell Test

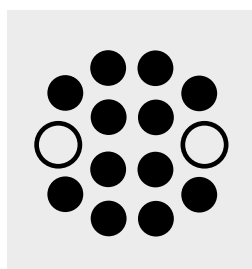
### Digestion:



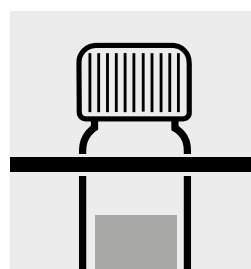
Fill the 10-ml syringe with 10 ml of reagent **AOX-5** and attach the syringe with the column outlet using the connector. Place the top end of the column on an empty cell and rinse the charcoal filling of the column into an empty 16-mm cell.



Add 2 level green microspoons of **AOX-6**, close the cell with the screw cap, and mix.



Heat the cell at 120 °C in the thermoreactor for 30 minutes.



Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature.



Add 5 drops of **AOX-4**, close the cell and mix; clear supernatant: **pretreated sample**.

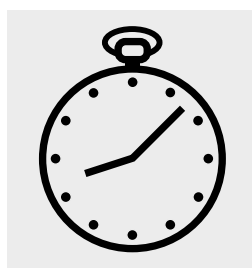
### Determination:



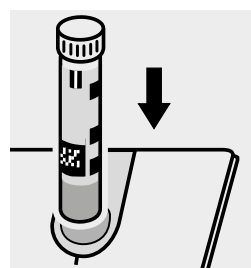
Pipette 0.20 ml of **AOX-1K** into a reaction cell, and mix.



Add 7.0 ml of **pretreated sample** with glass pipette, close the cell with the screw cap, and mix.



Reaction time: 15 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Note:

To increase the accuracy it is recommended to measure against an own prepared blank sample (reaction cell + distilled water).

### Quality assurance:

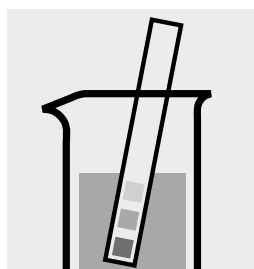
To check the measurement system (test reagents, measurement device, and handling) Spectroquant® AOX Standard, Cat.No. 1.00680, concentration 0.2 – 2.0 mg/l can be used.

# Arsenic

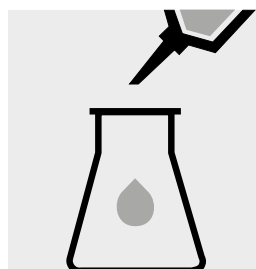
1.01747

Test

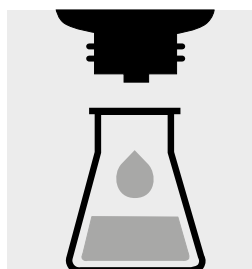
<b>Measuring</b>	0.005 – 0.100 mg/l As	10-mm cell
<b>range:</b>	0.001 – 0.020 mg/l As	20-mm cell
Expression of results also possible in mmol/l.		



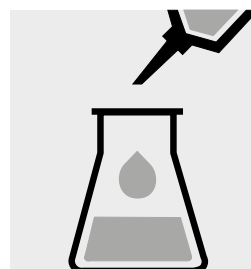
Check the pH of the sample, specified range: pH 0 – 13.



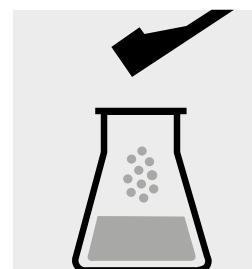
Place 350 ml of the sample into an Erlenmeyer flask with ground joint.



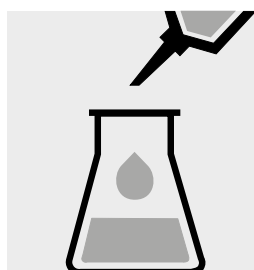
Add 5 drops of **As-1** and mix.



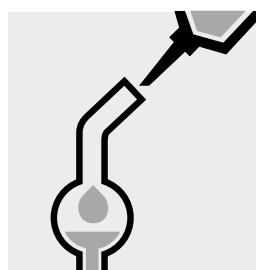
Add 20 ml of **As-2** with pipette and mix.



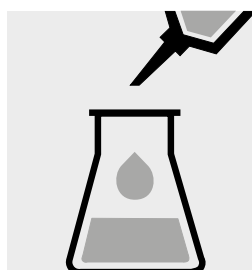
Add 1 level green dosing spoon of **As-3** and dissolve.



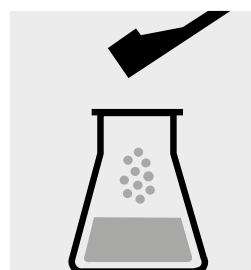
Add 1.0 ml of **As-4** with pipette and mix.



Pipette 5.0 ml of **As-5** into the absorption tube.



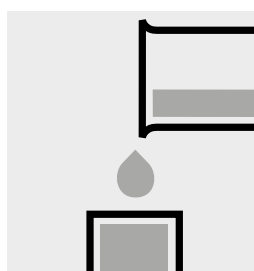
Add 1.0 ml of **As-6** with pipette to the solution in the Erlenmeyer flask and mix.



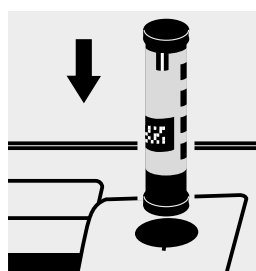
Add 3 level red dosing spoons of **As-7**. **Immediately** attach the absorption tube to the Erlenmeyer flask.



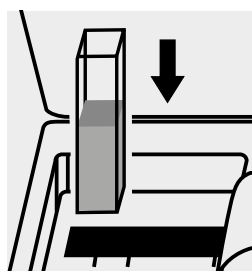
Leave to stand for 2 hours. During this time carefully swirl the flask several times or stir slowly with a magnetic stirrer.



Transfer the solution from the absorption tube into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use arsenic standard solution Certipur®, Cat.No. 1.19773, concentration 1000 mg/l As or the Standard solution for photometric applications, Cat.No. 1.33002 can be used after diluting accordingly.

# ASTM Color Measurement

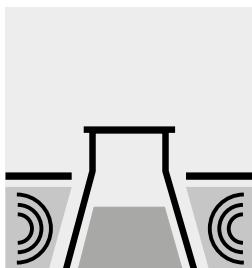
Application

analogous to **ASTM D6045**

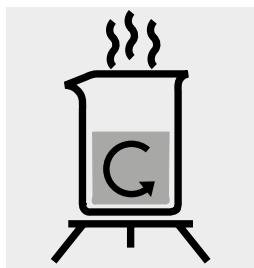
**Measuring range:** 0.5 – 8.0 ASTM Color      10-mm cell      Method No. 2562

**Attention!** Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended. This zero value remains valid until the method is exited.

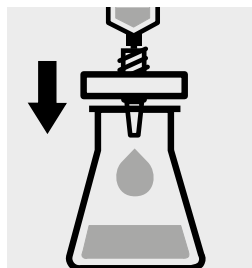
## Preparation:



Contains the sample air or gas bubbles: degassing in ultrasonic bath.



Melt solid samples and homogenize.

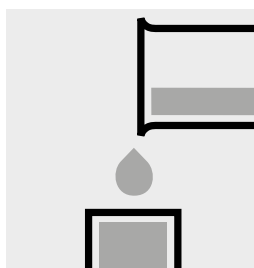


Filter or centrifuge turbid samples.

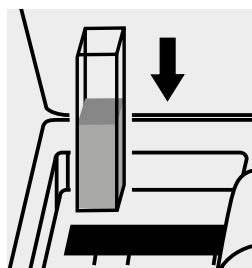
## Determination:



Select method no. **2562**. Perform the zero adjustment and confirm by pressing the <OK> button.



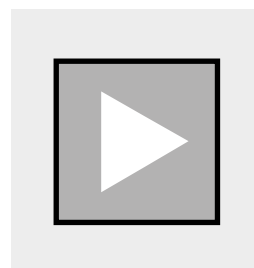
Transfer the solution into the cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. ASTM Color is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

# BOD

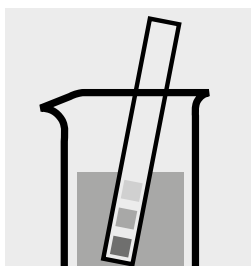
1.00687

## Biochemical Oxygen Demand

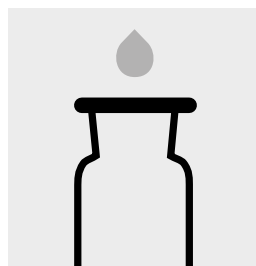
Cell Test

<b>Measuring</b>	0.5 – 3000 mg/l BOD
<b>range:</b>	0.5 – 3000 mg/l O <sub>2</sub>
	Expression of results also possible in mmol/l.

### Preparation and incubation:



Check the pH of the sample, specified range: pH 6 – 8.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Fill 2 oxygen reaction bottles each with **pretreated sample** and 2 glass beads to overflowing. Close bubble-free with the slanted ground-glass stoppers.



Fill 2 oxygen reaction bottles each with **inoculated nutrient-salt solution** and 2 glass beads to overflowing. Close bubble-free with the slanted ground-glass stoppers.

#### Measurement of initial oxygen concentration

= **Result 1**  
(measurement sample)  
= **Result 1**  
(blank)



Use one bottle of **pretreated sample** and one of **inoculated nutrient-salt solution** for the measurement of the initial oxygen concentration.

Incubate one bottle of **pretreated sample** and one of **inoculated nutrient-salt solution** closed in a thermostatic incubation cabinet at  $20 \pm 1^\circ\text{C}$  for 5 days.

### Determination:

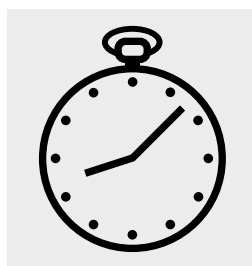
#### Measurement of final oxygen concentration

= **Result 2**  
(measurement sample)  
= **Result 2**  
(blank)

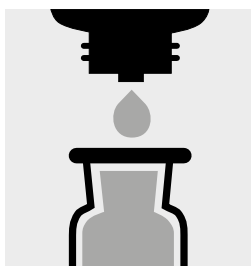


After incubation, use one bottle of **pretreated sample** and one of **inoculated nutrient-salt solution** for the measurement of the final oxygen concentration.

Add 5 drops of **BOD-1K** and then 10 drops of **BOD-2K**, close bubble-free, and mix for approx. 10 seconds.



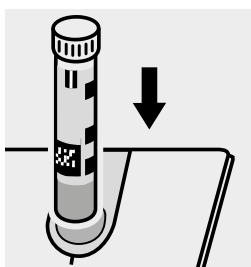
Reaction time:  
1 minute



Add 10 drops of **BOD-3K**, reclose, and mix.



Fill the solution into a round cell.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Calculation:

BOD of measurement sample:  
Result 1 – Result 2 (measurement sample) = A in mg/l  
BOD of blank:  
Result 1 – Result 2 (blank) = B in mg/l  
BOD of original sample in mg/l =  
= (A – B) x dilution factor

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) Spectroquant BOD Standard (acc. to EN 1899), Cat.No. 1.00718, can be used.

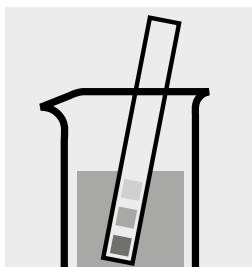
# Boron

1.00826

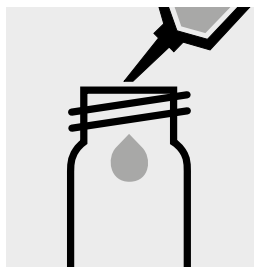
Cell Test

**Measuring** 0.05 – 2.00 mg/l B

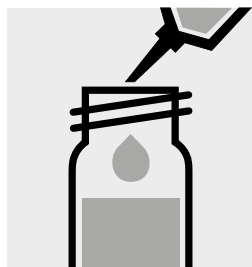
**range:** Expression of results also possible in mmol/l.



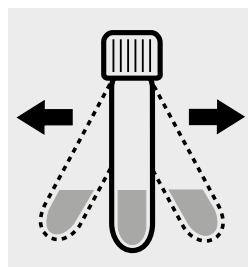
Check the pH of the sample, specified range: pH 2 – 12. If required, add dilute sodium hydroxide solution or nitric acid drop by drop to adjust the pH.



Pipette 1.0 ml of **B-1K** into a reaction cell, close with the screw cap, and mix.



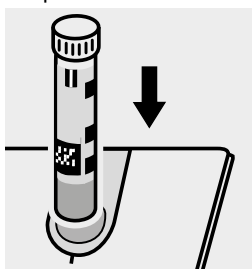
Add 4.0 ml of the sample with pipette into a reaction cell, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 60 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

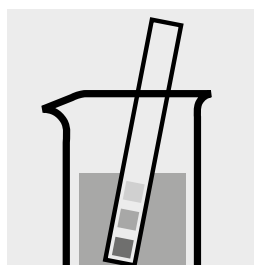
To check the measurement system (test reagents, measurement device, and handling) ready-to-use boron standard solution Certipur®, Cat.No. 1.19500, concentration 1000 mg/l B can also be used after diluting accordingly as well as the Standard solution for photometric applications, Cat.No. 1.33005.

# Boron

1.14839

Test

<b>Measuring</b>	0.050 – 0.800 mg/l B	10-mm cell
<b>range:</b>	Expression of results also possible in mmol/l.	



Check the pH of the sample, specified range: pH 1 – 13.



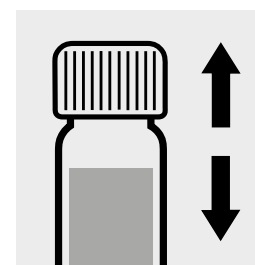
Pipette 5.0 ml of the sample into a test tube with screw cap. **(Important: Do not use test tubes made of glass containing boron!)**



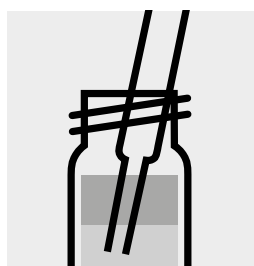
Add 1.0 ml of **B-1** with pipette, close with the screw cap, and mix.



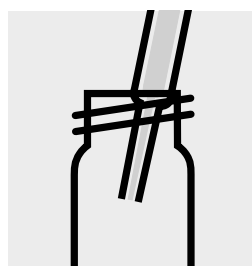
Add 1.5 ml of **B-2** with pipette and close with the screw cap.



Shake the tube vigorously for 1 minute.



Aspirate 0.5 ml of the clear lower phase from the tube with pipette.



Transfer the extract to a separate fresh tube.



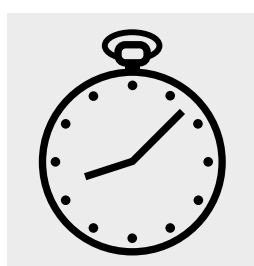
Add 0.80 ml of **B-3** with pipette, close with the screw cap, and mix.



Add 4 drops of **B-4**, close with the screw cap, and mix.



Add 18 drops of **B-5**, close with the screw cap, and mix.



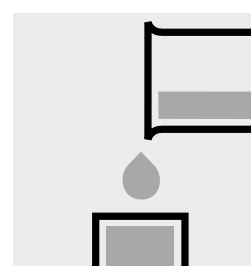
Reaction time: 12 minutes



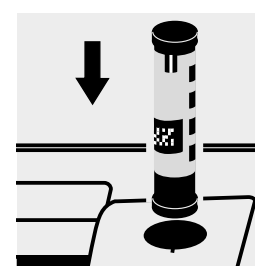
Add 6.0 ml of **B-6** with pipette, close with the screw cap, and mix.



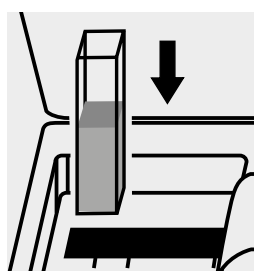
Reaction time: 2 minutes



Transfer the solution into a cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use boron standard solution Certipur®, Cat.No. 1.19500, concentration 1000 mg/l B can also be used after diluting accordingly.

# Bromate in water and drinking water Ultra Low Range

Application

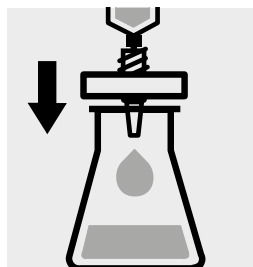
Measuring range: 1.0 – 40.0 µg/l BrO<sub>3</sub>

50-mm cell

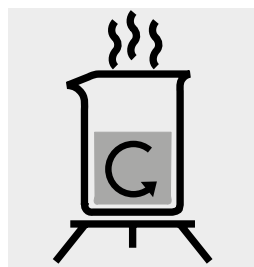
Method No. 307

**Attention!**

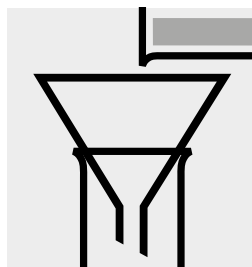
The measurement is carried out at 550 nm in a corresponding rectangular cell against a blank, prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) and the reagents in an analogous manner.



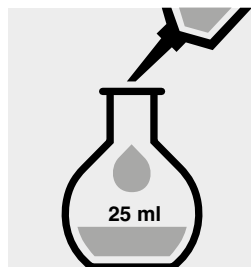
Filter turbid samples.



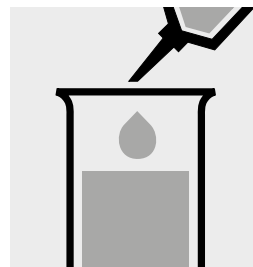
Evaporate 250 ml of sample solution in a glass beaker almost to dryness on the hob.



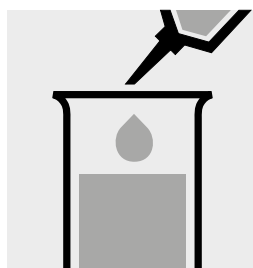
Transfer the residue to a 25-ml volumetric flask using a little distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended).



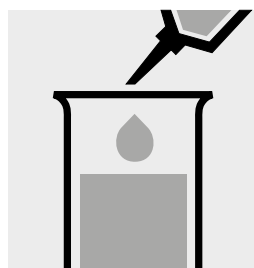
Make up the contents of the volumetric flask to the mark with distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended), mix thoroughly, and filter, if necessary: **pretreated sample**.



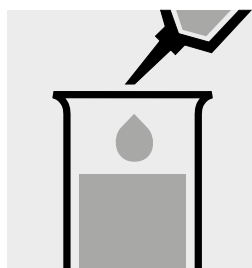
Pipette 10 ml of the pretreated sample into a test tube.



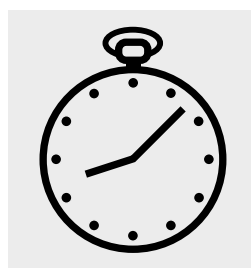
Add 0.10 ml of **reagent 1** with pipette and mix.



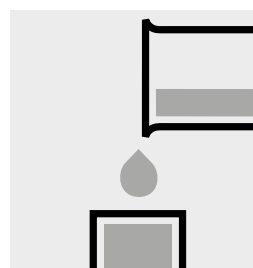
Add 0.20 ml of **reagent 2** with pipette and mix.



Add 0.20 ml **perchloric acid 70 - 72 % GR** (Cat.No. 1.00519) with pipette and mix.



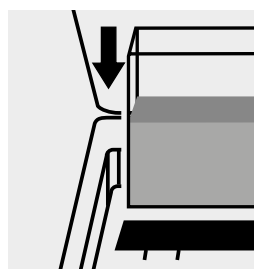
Reaction time: 30 minutes



Filter, if necessary, and transfer the solution into a corresponding cell.



Select method no. **307**.



Place the cell into the cell compartment. The measurement is performed automatically.

**Important:**

The exact composition and preparation of the reagents 1 and 2 used are given in the corresponding application, which also includes further information on the method employed. This application can be downloaded from the website.

**Quality assurance:**

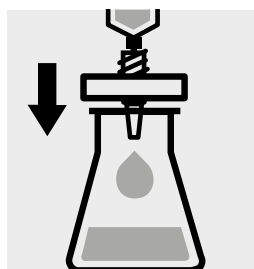
To check the measurement system (reagents, measurement device, and handling) Standard solution for photometric applications, Cat.No. 1.33006 can be used.

# Bromate in water and drinking water Low Range

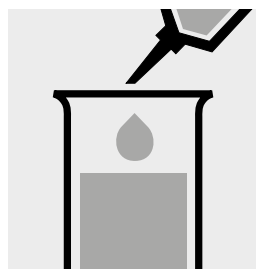
Application

**Measuring range:** 5.0 – 200.0 µg/l BrO<sub>3</sub>      50-mm cell      Method No. 308

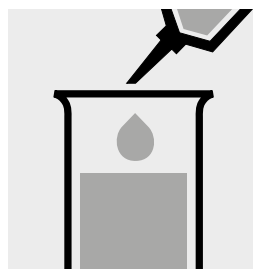
**Attention!** The measurement is carried out at 550 nm in a corresponding rectangular cell against a blank, prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) and the reagents in an analogous manner.



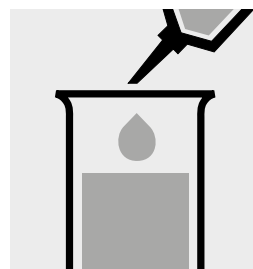
Filter turbid samples.



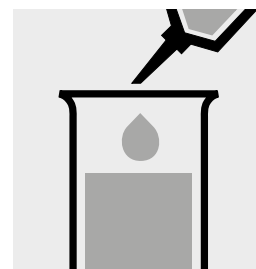
Pipette 10 ml of the pre-treated sample into a test tube.



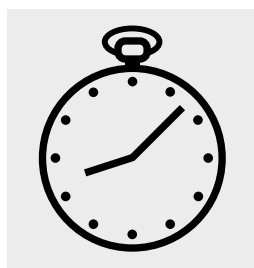
Add 0.10 ml of **reagent 1** with pipette and mix.



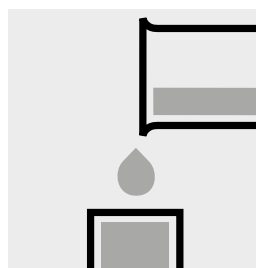
Add 0.20 ml of **reagent 2** with pipette and mix.



Add 0.20 ml **perchloric acid 70 - 72 % GR** (Cat.No. 1.00519) with pipette and mix.



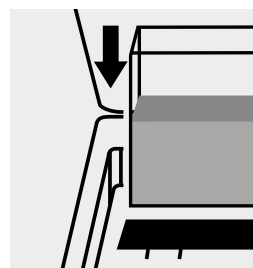
Reaction time:  
30 minutes



Filter, if necessary, and transfer the solution into a corresponding cell.



Select method no. **308**.



Place the cell into the cell compartment. The measurement is performed automatically.

## Important:

The exact composition and preparation of the reagents 1 and 2 used are given in the corresponding application, which also includes further information on the method employed. This application can be downloaded from the website.

## Quality assurance:

To check the measurement system (reagents, measurement device, and handling) Standard solutions for photometric applications, Cat.Nos. 1.33006 and 1.33007 can be used.

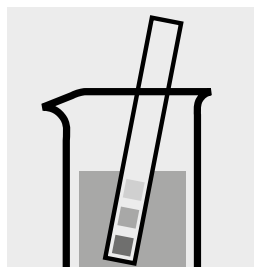


# Bromine

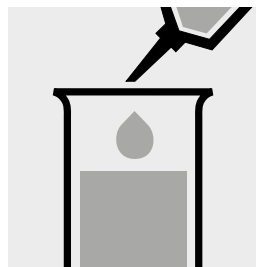
1.00605

Test

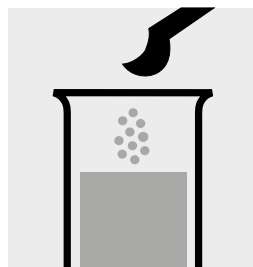
<b>Measuring</b>	0.10 – 10.00 mg/l Br <sub>2</sub>	10-mm cell
<b>range:</b>	0.05 – 5.00 mg/l Br <sub>2</sub>	20-mm cell
	0.020 – 2.000 mg/l Br <sub>2</sub>	50-mm cell
Expression of results also possible in mmol/l.		



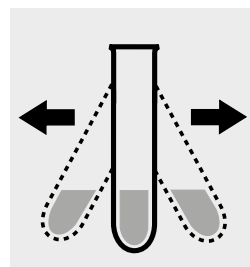
Check the pH of the sample, specified range: pH 4 – 8. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 10 ml of the sample into a test tube.



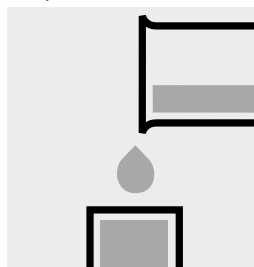
Add 1 level blue micro-spoon of Br<sub>2</sub>-1.



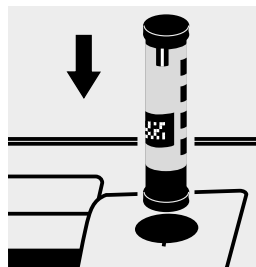
Shake vigorously to dissolve the solid substance.



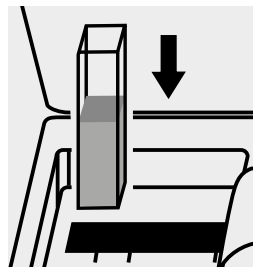
Reaction time: 1 minute



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

Very high bromine concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

## Note:

Bromine can also be determined with Spectroquant® Chlorine Test, Cat. No. 1.00598 (see corresponding application notes on [www.sigmaaldrich.com](http://www.sigmaaldrich.com)).

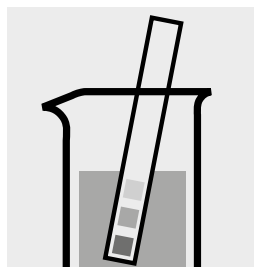
# Cadmium

1.14834

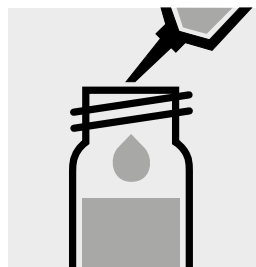
Cell Test

**Measuring** 0.025 – 1.000 mg/l Cd

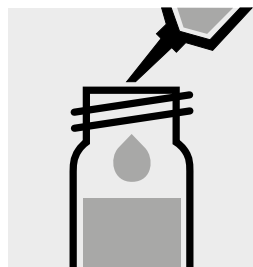
**range:** Expression of results also possible in mmol/l.



Check the pH of the sample, specified range: pH 3 – 11. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



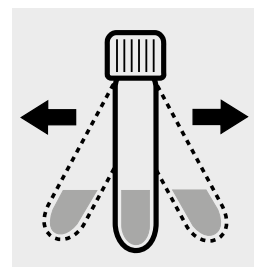
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



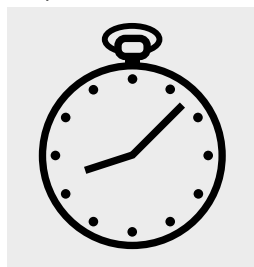
Add 0.20 ml of **Cd-1K** with pipette, close the cell with the screw cap, and mix.



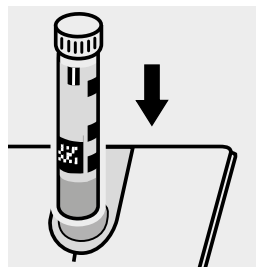
Add 1 level green microspoon of **Cd-2K**, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time:  
2 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Important:

For the determination of **total cadmium** a pretreatment with Crack Set 10C, Cat.No. 1.14688 or Crack Set 10, Cat.No. 1.14687, and thermoreactor is necessary.

Result can be expressed as sum of cadmium ( $\Sigma$  Cd).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 90, Cat.No. 1.18700.

Ready-to-use cadmium standard solution Certipur®, Cat.No. 1.19777, concentration 1000 mg/l Cd, can also be used after diluting accordingly.

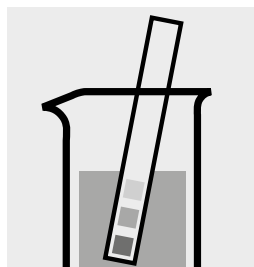
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 90) is highly recommended.

# Cadmium

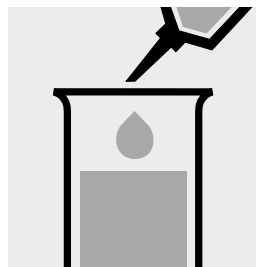
1.01745

Test

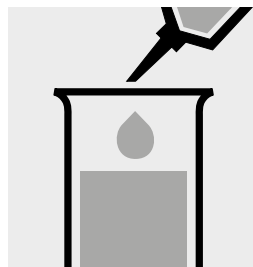
<b>Measuring range:</b>	0.01 – 0.500 mg/l Cd	10-mm cell
	0.005 – 0.250 mg/l Cd	20-mm cell
	0.0020 – 0.1000 mg/l Cd	50-mm cell
	Expression of results also possible in mmol/l.	



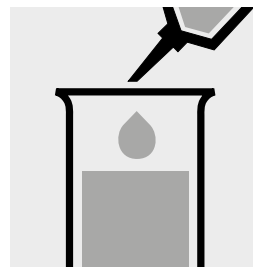
Check the pH of the sample, specified range: pH 3 – 11.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



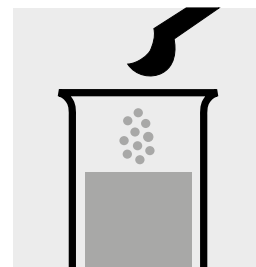
Pipette 1.0 ml of **Cd-1** into a test tube.



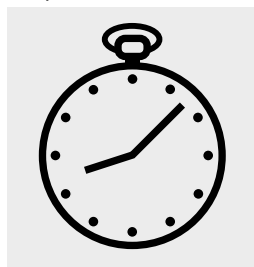
Add 10 ml of the sample with pipette and mix.



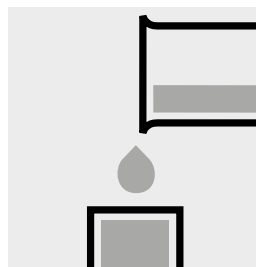
Add 0.20 ml of **Cd-2** with pipette and mix.



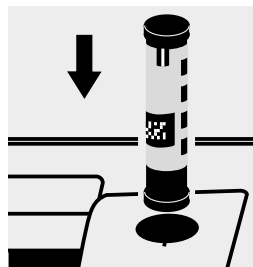
Add 1 level green microspoon of **Cd-3** and dissolve the solid substance.



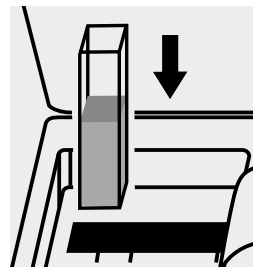
Reaction time:  
2 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

For the determination of **total cadmium** a pretreatment with Crack Set 10C, Cat.No. 1.14688 or Crack Set 10, Cat.No. 1.14687, and thermoreactor is necessary.

Result can be expressed as sum of cadmium ( $\Sigma$  Cd).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 90, Cat.No. 1.18700 or the Standard solution for photometric applications, Cat.No. 1.33008.

Ready-to-use cadmium standard solution Certipur®, Cat.No. 1.19777, concentration 1000 mg/l Cd, can also be used after diluting accordingly.

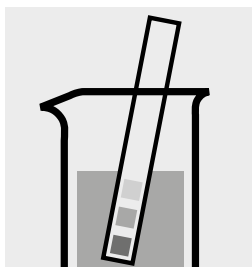
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 90) is highly recommended.

# Calcium

1.00858

Cell Test

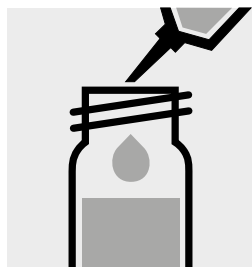
<b>Measuring</b>	10 – 250 mg/l Ca
<b>range:</b>	14 – 350 mg/l CaO
	25 – 624 mg/l CaCO <sub>3</sub>
	Expression of results also possible in mmol/l.



Check the pH of the sample, specified range: pH 3 – 9.  
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



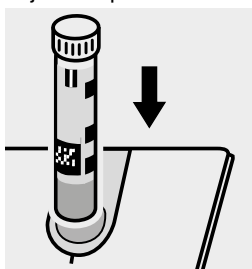
Add 1.0 ml of **Ca-1K** with pipette, close the cell with the screw cap, and mix.



Reaction time: **exactly 3 minutes**



Add 0.50 ml of **Ca-2K** with pipette, close the cell with the screw cap, and mix.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

# Calcium

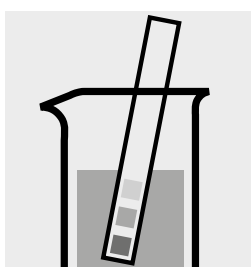
1.14815

Test

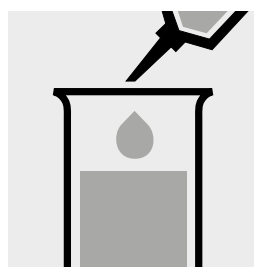
<b>Measuring range:</b>	10 – 160 mg/l Ca	14 – 224 mg/l CaO	25 – 400 mg/l CaCO <sub>3</sub>	10-mm cell
	5 – 80 mg/l Ca	7 – 112 mg/l CaO	12 – 200 mg/l CaCO <sub>3</sub>	20-mm cell
	1.0 – 15.0 mg/l Ca	1.4 – 21.0 mg/l CaO	2.5 – 37.5 mg/l CaCO <sub>3</sub>	10-mm cell

Expression of results also possible in mmol/l.

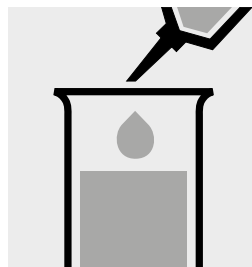
## Measuring range: 5 – 160 mg/l Ca



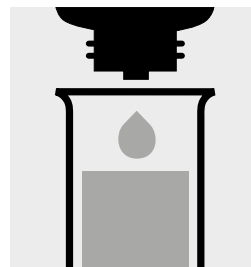
Check the pH of the sample, specified range: pH 4 – 10.  
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Pipette 0.10 ml of the sample into a test tube.



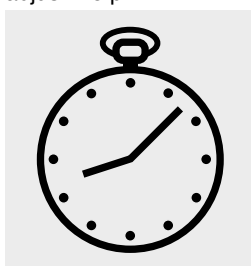
Add 5.0 ml of **Ca-1** with pipette and mix.



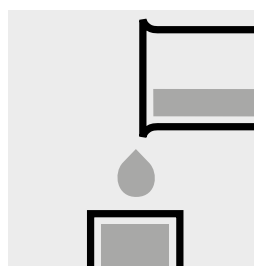
Add 4 drops of **Ca-2** and mix.



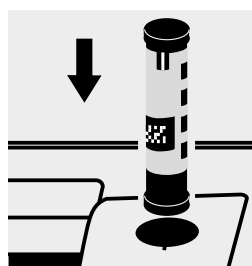
Add 4 drops of **Ca-3** and mix.



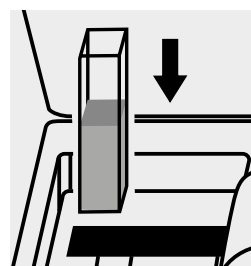
Reaction time: 8 minutes, **measure immediately**.



Transfer the solution into a corresponding cell



Select method with AutoSelector measuring range 5 - 160 mg/l Ca.



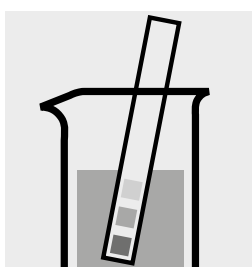
Place the cell into the cell compartment.

# Calcium

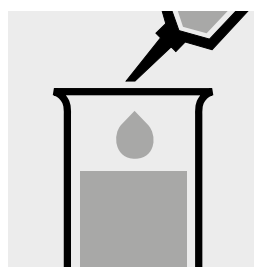
1.14815

Test

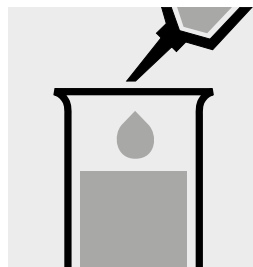
Measuring range: 1.0 – 15.0 mg/l Ca



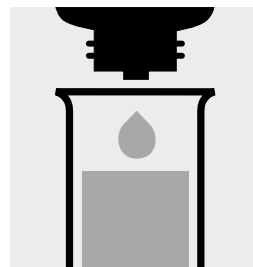
Check the pH of the sample, specified range: pH 4 – 10.  
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



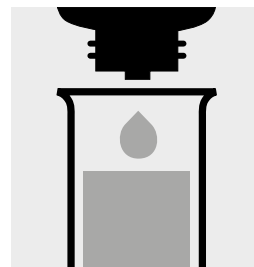
Pipette 0.50 ml of the sample into a test tube.



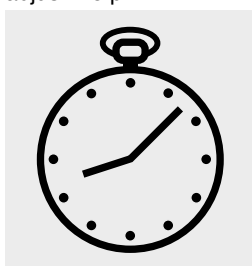
Add 5.0 ml of **Ca-1** with pipette and mix.



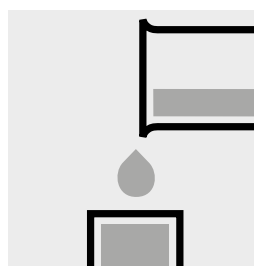
Add 4 drops of **Ca-2** and mix.



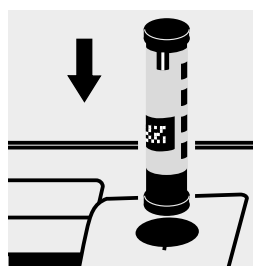
Add 4 drops of **Ca-3** and mix.



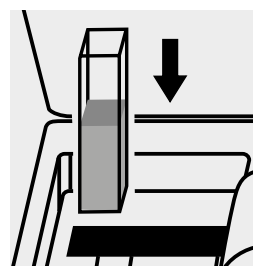
Reaction time: 8 minutes, **measure immediately**.



Transfer the solution into a cell



Select method with AutoSelector measuring range 1.0 – 15.0 mg/l Ca.



Place the cell into the cell compartment.

## Quality assurance:

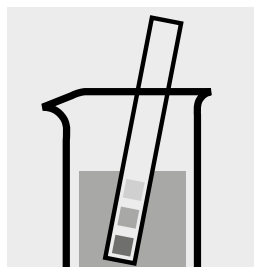
To check the measurement system (test reagents, measurement device, and handling) ready-to-use calcium standard solution Certipur®, Cat.No. 1.19778, concentration 1000 mg/l Ca, can be used after diluting accordingly.

# Calcium

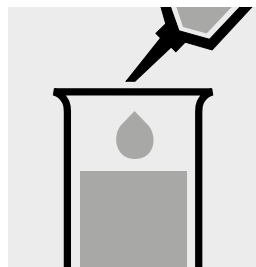
1.00049

Test

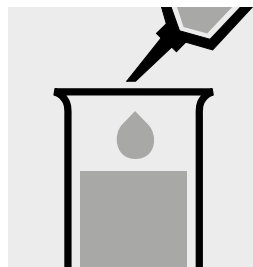
<b>Measuring</b>	0.20 – 4.00 mg/l Ca	10-mm cell
<b>range:</b>	Expression of results also possible in mmol/l.	



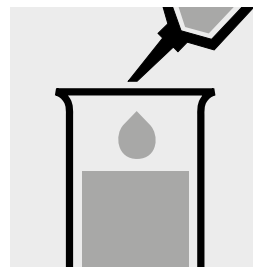
Check the pH of the sample, specified range: pH 3 – 9.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



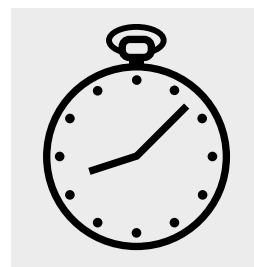
Pipette 5.0 ml of the sample into a test tube.



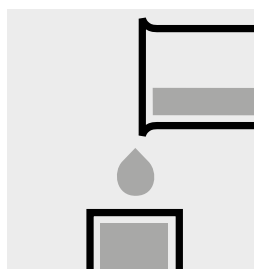
Add 0.50 ml of **Ca-1** with pipette and mix.



Add 0.50 ml of **Ca-2** with pipette and mix.



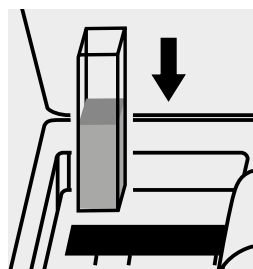
Reaction time: 5 minutes



Transfer the solution into a cell.



Select method no. **304**.



Place the cell into the cell compartment.  
The measurement is performed automatically.

## Important:

**A separate calibration must be made for each batch.**  
It is recommended to perform a calibration with a blank and 5 standard solutions over the entire measuring range. The calibration should be checked regularly using standard solutions.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use calcium standard solution Certipur®, Cat.No. 1.19778, concentration 1000 mg/l Ca, can be used after diluting accordingly.

# Carotene in raw palm oil

corresponds to **EN ISO 17923:2011**

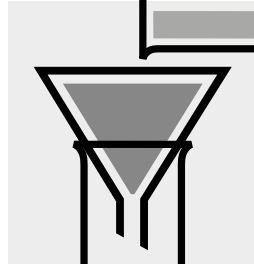
**Application**

**Measuring range:** 10 – 7500 mg/kg  $\beta$ -Car      10-mm cell      Method No. 2523

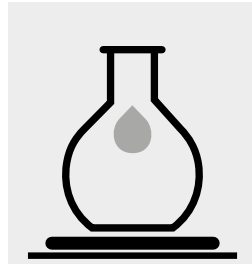
**Attention!** Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from isooctane, is recommended. This zero value remains valid until the method is exited.



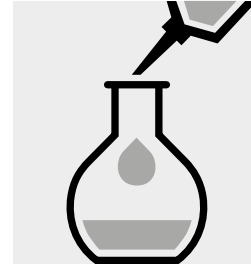
Melt the sample and homogenize.



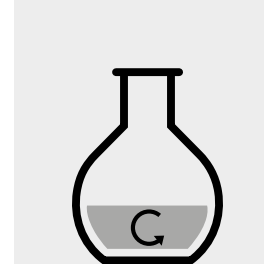
If contaminations are present, filter the sample over a fast filtering paper.



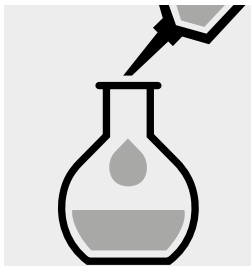
Weigh **between 100.0 mg to 500.0 mg of sample** into a volumetric flask, accurately weighed to 0.1 mg.



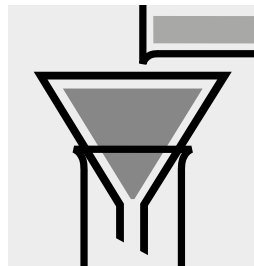
Add a few milliliters of **isooctane for spectroscopy Uvasol®** (Cat. No. 1.04718).



Dissolve the sample at room temperature.



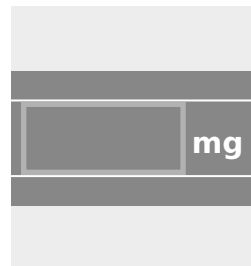
Make up the contents of the volumetric flask to the mark with **isooctane for spectroscopy Uvasol®** (Cat. No. 1.04718) and mix.



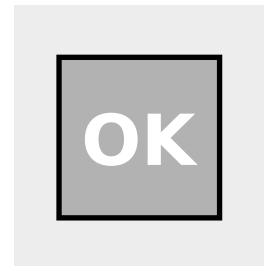
Filter turbid solutions over a paper filter.



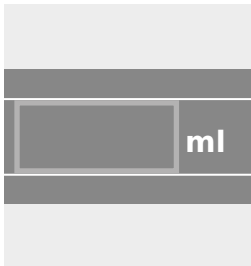
Select method no. **2523**. Perform the zero adjustment and confirm by pressing the **<OK>** button.



Enter the sample weight in milligrams.



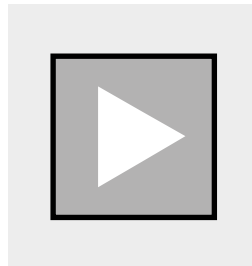
Confirm with **<OK>**.



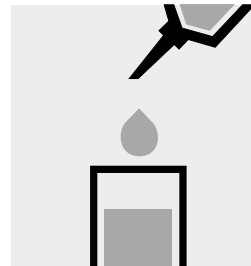
Enter the volume of the sample solution in milliliters.



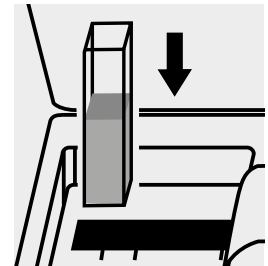
Confirm with **<OK>**.



Tap the **<Start>** button.



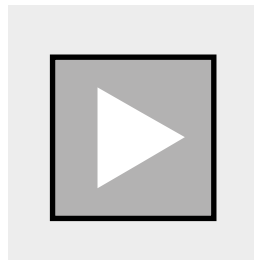
Transfer the solution into a cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with **<OK>**. The  $\beta$ -carotene content is shown in the display in mg/kg.



Tap the **<Start>** button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

### Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

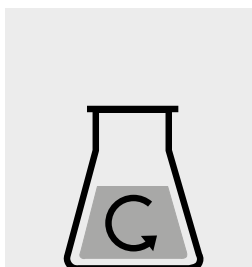


# Cell Density (OD600)

Application

**Measuring range:** -0.020 – 1.200 OD<sub>600</sub>      10-mm cell      Method No. 313

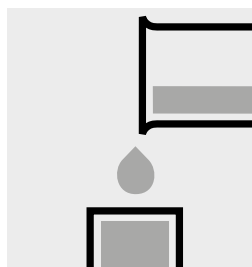
**Attention!** Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from sample solvent, is recommended. This zero value remains valid until the method is exited.



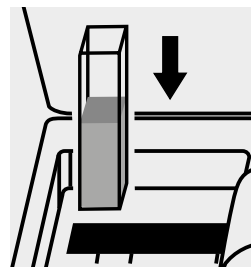
Homogenize the sample **carefully** and dilute, if necessary: **measurement sample**.



Select method no. **313**. Perform the zero adjustment with **sample solvent** and confirm by pressing the <OK> button.



Transfer the **measurement sample** into the cell.



Place the cell into the cell compartment. The measurement is performed automatically.

## Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

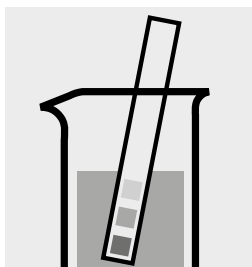
# Chloride

1.14730

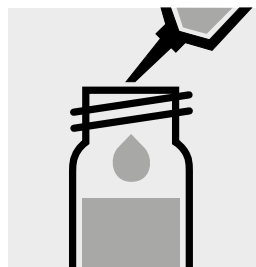
Cell Test

**Measuring** 5 – 1.25 mg/l Cl

**range:** Expression of results also possible in mmol/l.



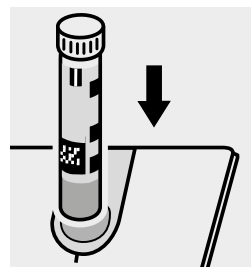
Check the pH of the sample, specified range: pH 1 – 12. If required, add dilute ammonia solution or nitric acid drop by drop to adjust the pH.



Pipette 0.50 ml of **Cl-1K** into a reaction cell, close with the screw cap, and mix.



Add 1.0 ml of the sample with pipette, close with the screw cap, and mix.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10 and 20, Cat.Nos. 1.14676 and 1.14675 or the Standard solutions for photometric applications, Cat.Nos. 1.32229 and 1.32230.

Ready-to-use chloride standard solution Certipur®, Cat.No. 1.19897, concentration 1000 mg/l Cl<sup>-</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck) is highly recommended.

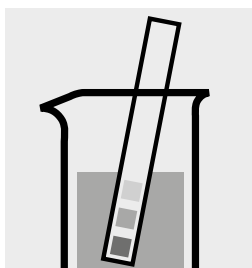
# Chloride

1.14897

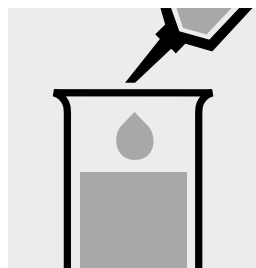
Test

<b>Measuring range:</b>	10 – 250 mg/l Cl	10-mm cell
<b>range:</b>	2.5 – 25.0 mg/l Cl	10-mm cell
Expression of results also possible in mmol/l.		

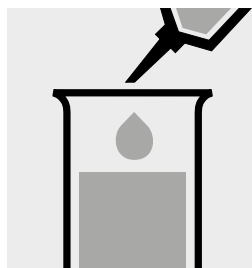
## Measuring range: 10 – 250 mg/l Cl



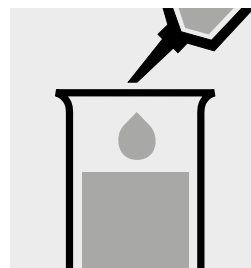
Check the pH of the sample, specified range: pH 1 – 12.  
If required, add dilute ammonia solution or nitric acid drop by drop to adjust the pH.



Pipette 1.0 ml of the sample into a test tube.



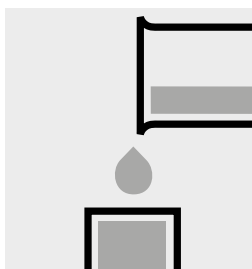
Add 2.5 ml of **Cl-1** with pipette and mix.



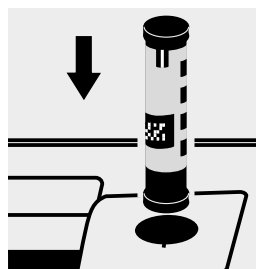
Add 0.50 ml of **Cl-2** with pipette and mix.



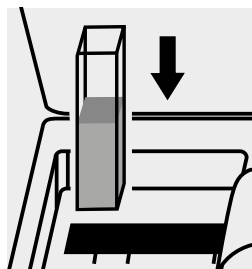
Reaction time: 1 minute



Transfer the solution into a cell.



Select method with AutoSelector measuring range 10 – 250 mg/l Cl.



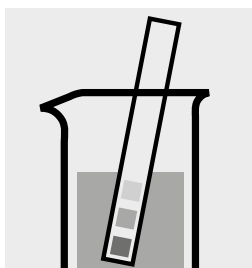
Place the cell into the cell compartment.

# Chloride

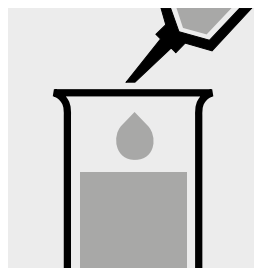
1.14897

Test

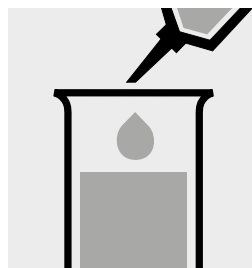
Measuring range: 2.5 – 25.0 mg/l Cl



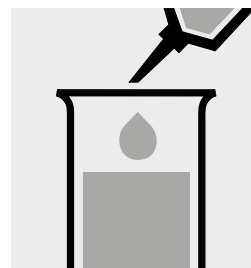
Check the pH of the sample, specified range: pH 1 – 12.  
If required, add dilute ammonia solution or nitric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a test tube.



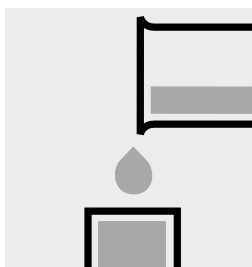
Add 2.5 ml of **Cl-1** with pipette and mix.



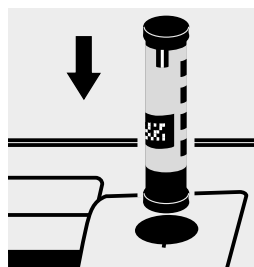
Add 0.50 ml of **Cl-2** with pipette and mix.



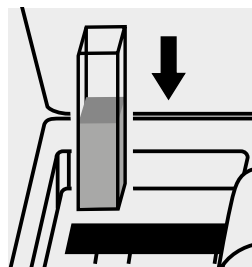
Reaction time:  
1 minute



Transfer the solution into a cell.



Select method with AutoSelector measuring range 2.5 – 25.0 mg/l Cl.



Place the cell into the cell compartment.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 60, Cat.No. 1.14696 or the Standard solutions for photometric applications, Cat.Nos. 1.32229 and 1.32230.

Ready-to-use chloride standard solution Certipur®, Cat.No. 1.19897, concentration 1000 mg/l Cl<sup>-</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 60) is highly recommended.

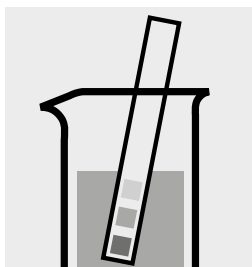
# Chloride

1.01804

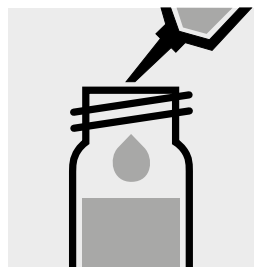
Cell Test

**Measuring** 0.5 – 15.0 mg/l Cl

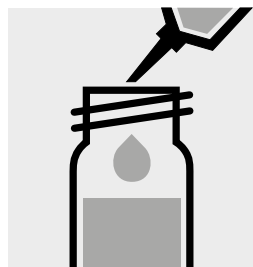
**range:** Expression of results also possible in mmol/l.



Check the pH of the sample, specified range: pH 3 – 11. If required, add dilute ammonia solution or nitric acid drop by drop to adjust the pH.



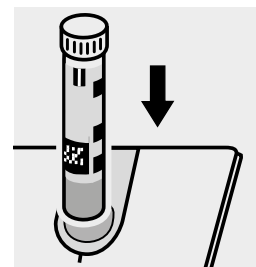
Pipette 10 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 0.25 ml of **Cl-1K** with pipette, close with the screw cap, and mix.



Reaction time:  
10 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use chloride standard solution Certipur®, Cat.No. 1.19897, concentration 1000 mg/l Cl<sup>-</sup>, can be used after diluting accordingly as well as the Standard solutions for photometric applications, Cat.Nos. 1.32229, 1.33010, and 1.33011.

# Chloride

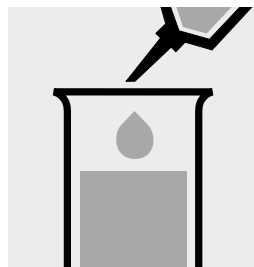
1.01807

Test

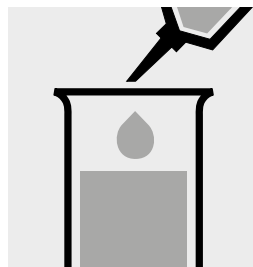
<b>Measuring</b>	0.10 – 5.00 mg/l Cl	50-mm cell
<b>range:</b>	Expression of results also possible in mmol/l.	



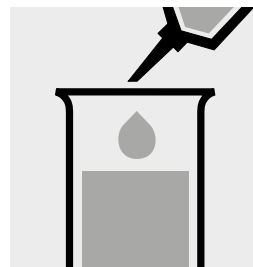
Check the pH of the sample, specified range: pH 3 – 11. If required, add dilute ammonia solution or nitric acid drop by drop to adjust the pH.



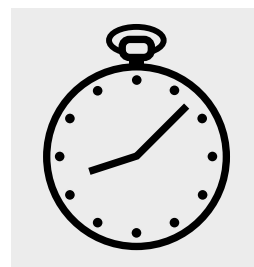
Pipette 0.20 ml each of **CI-1** into two test tubes.



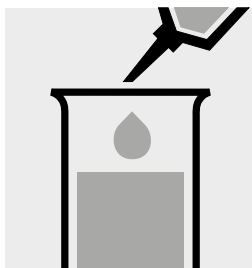
Add to one tube 10 ml of the sample with pipette and mix.



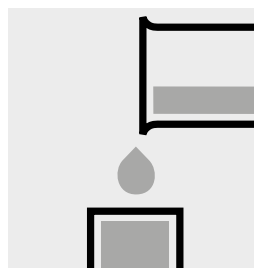
Add to the second tube 10 ml of distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) with pipette and mix. (Blank)



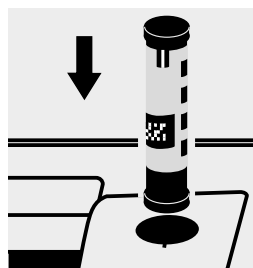
Reaction time:  
10 minutes



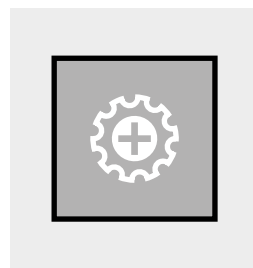
Add to each tube 0.20 ml of **CI-2** with pipette and mix.



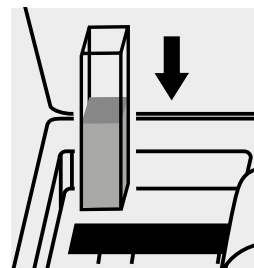
Transfer both solutions into two separate 50-mm-cells.



Select method with AutoSelector.



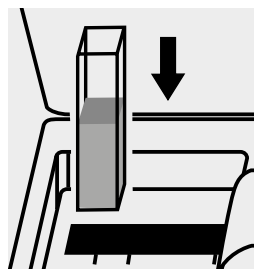
Tap the <Settings> button. Select "Reagent blank".



Place the blank cell into the cell compartment.



Select "User RB". Confirm with <OK>.



Place the cell containing the sample into the cell compartment.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use chloride standard solution Certipur®, Cat.No. 1.19897, concentration 1000 mg/l Cl<sup>-</sup>, can be used after diluting accordingly as well as the Standard solutions for photometric applications, Cat.Nos. 1.33010 and 1.33011.

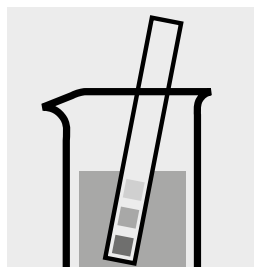
# Chlorine

1.00595

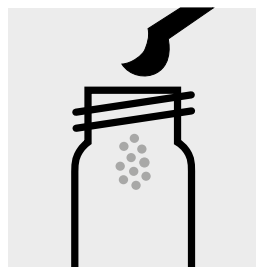
## Determination of free chlorine

Cell Test

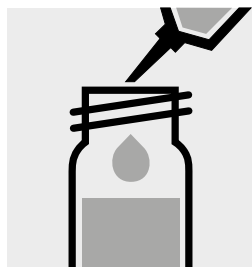
<b>Measuring</b>	0.03 – 6.00 mg/l Cl <sub>2</sub>
<b>range:</b>	Expression of results also possible in mmol/l.



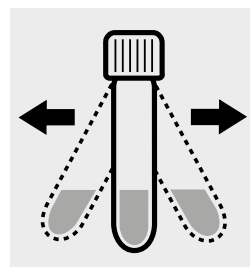
Check the pH of the sample, specified range: pH 4 – 8. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Place 1 level blue micro-spoon of Cl<sub>2</sub>-1 into a round cell.



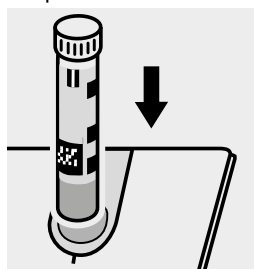
Add 5.0 ml of the sample with pipette, close with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 1 minute



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Important:

Very high chlorine concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

# Chlorine

1.00597

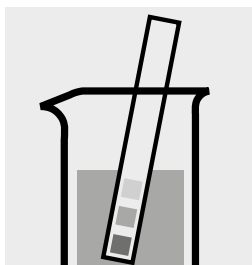
## Determination of free chlorine and total chlorine

Cell Test

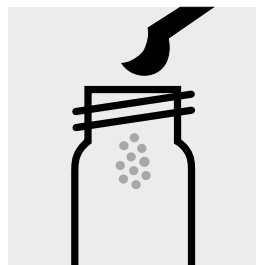
**Measuring** 0.03 – 6.00 mg/l  $\text{Cl}_2$

**range:** Expression of results also possible in mmol/l.

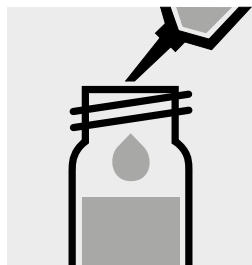
### Determination of free chlorine



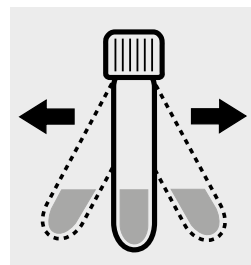
Check the pH of the sample, specified range: pH 4 – 8.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Place 1 level blue micro-spoon of  $\text{Cl}_2\text{-1}$  into a round cell.



Add 5.0 ml of the sample with pipette, close with the screw cap.

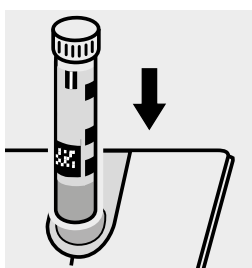


Shake the cell vigorously to dissolve the solid substance.

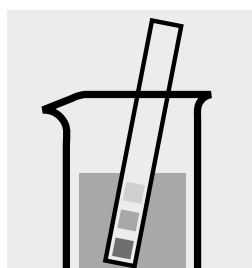


Reaction time:  
1 minute

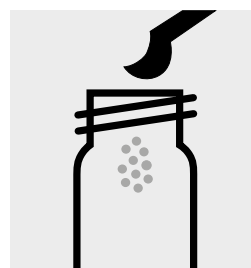
### Determination of total chlorine



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.



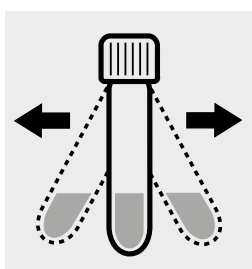
Check the pH of the sample, specified range: pH 4 – 8.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



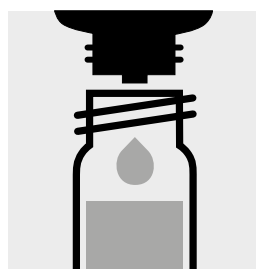
Place 1 level blue micro-spoon of  $\text{Cl}_2\text{-1}$  into a round cell.



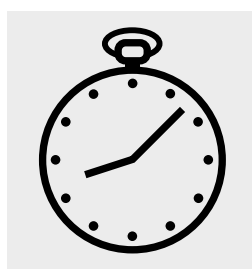
Add 5.0 ml of the sample with pipette, close with the screw cap.



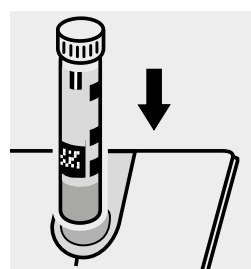
Shake the cell vigorously to dissolve the solid substance.



Add 2 drops of  $\text{Cl}_2\text{-2}$ , close the cell with the screw cap, and mix.



Reaction time:  
1 minute



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

#### Important:

Very high chlorine concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).  
After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.

#### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").



# Chlorine

1.00597

Differentiation between free chlorine and total chlorine

Cell Test

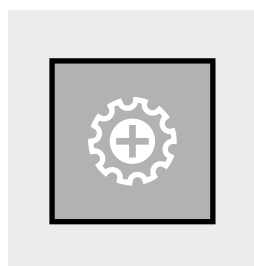
**Measuring range:** 0.03 – 6.00 mg/l Cl<sub>2</sub>

After selecting the method it is possible to set the method-specific "Differentiation" mode.

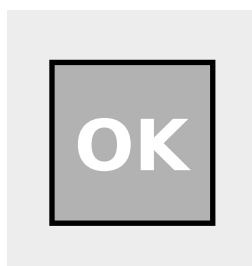
**Note:** If the aim is to measure **only** free chlorine or total chlorine, the "Differentiation" mode must be deactivated again.



Select method no. **142**.



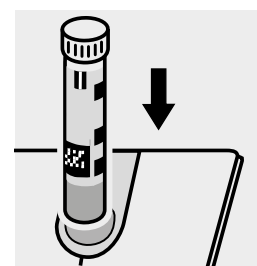
Tap the <Settings> button. Select "Differentiation" and activate.



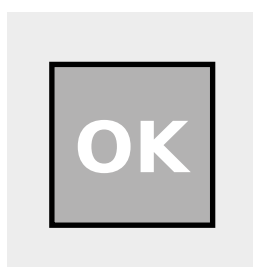
Confirm with <OK>.

Perform determination of **free chlorine** (see analytical procedure "Determination of free chlorine" with 1.00597). = **cell A**

After the reaction time has expired:



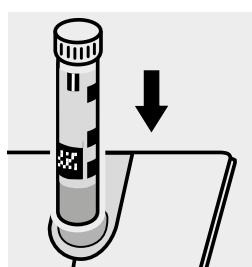
Place the **cell A** into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically.



Confirm with <OK>.

Perform determination of **total chlorine** (see analytical procedure "Determination of total chlorine" with 1.00597). = **cell B**

After the reaction time has expired:



Place the **cell B** into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically.



Confirm with <OK>. The results A (Cl<sub>2</sub> (f)), B (Cl<sub>2</sub> (t)), and C (Cl<sub>2</sub> (b)) are shown in the display in mg/l.

## Important:

Very high chlorine concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check). After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

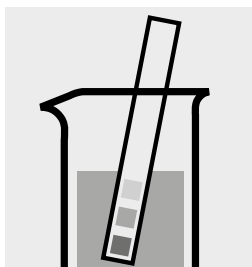
# Chlorine

1.00598

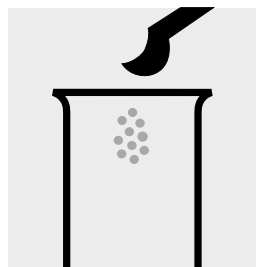
## Determination of free chlorine

Test

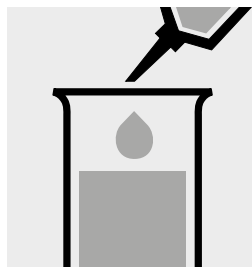
<b>Measuring</b>	0.05 – 6.00	mg/l Cl <sub>2</sub>	10-mm cell
<b>range:</b>	0.02 – 3.00	mg/l Cl <sub>2</sub>	20-mm cell
	0.010 – 1.000	mg/l Cl <sub>2</sub>	50-mm cell
Expression of results also possible in mmol/l.			



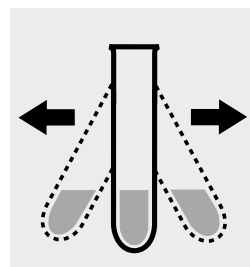
Check the pH of the sample, specified range: pH 4 – 8. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Place 1 level blue micro-spoon of Cl<sub>2</sub>-1 into a test tube.



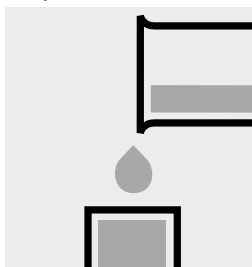
Add 10 ml of the sample with pipette.



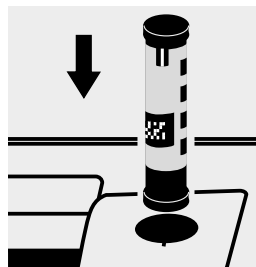
Shake vigorously to dissolve the solid substance.



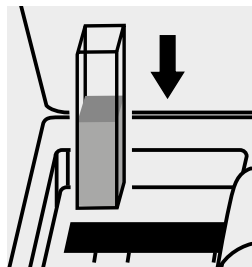
Reaction time: 1 minute



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

### Important:

Very high chlorine concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

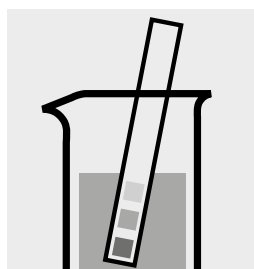
# Chlorine

1.00602

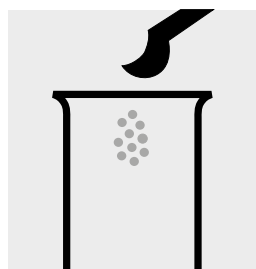
## Determination of total chlorine

Test

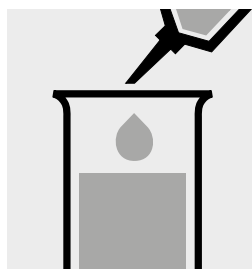
<b>Measuring range:</b>	0.05 – 6.00 mg/l Cl <sub>2</sub>	10-mm cell
	0.02 – 3.00 mg/l Cl <sub>2</sub>	20-mm cell
	0.010 – 1.000 mg/l Cl <sub>2</sub>	50-mm cell
Expression of results also possible in mmol/l.		



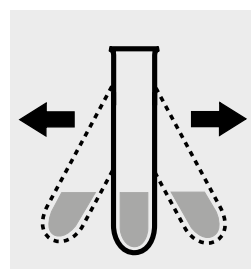
Check the pH of the sample, specified range: pH 4 – 8. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



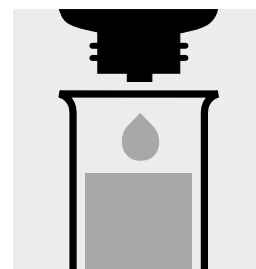
Place 1 level blue micro-spoon of Cl<sub>2</sub>-1 into a test tube.



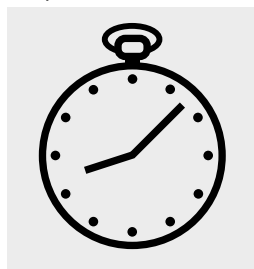
Add 10 ml of the sample with pipette.



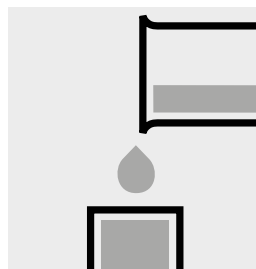
Shake vigorously to dissolve the solid substance.



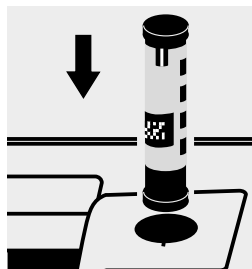
Add 2 drops of Cl<sub>2</sub>-2 and mix.



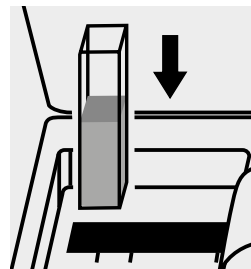
Reaction time: 1 minute



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

### Important:

Very high chlorine concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check). After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard from Chloramine T GR can be used (see section "Standard solutions").

# Chlorine

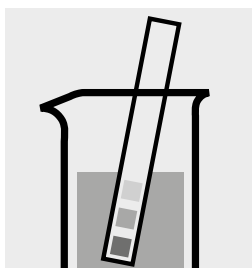
1.00599

## Determination of free chlorine and total chlorine

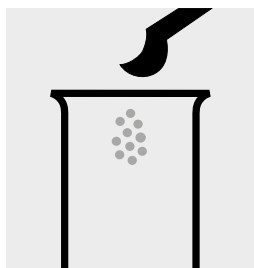
Test

<b>Measuring</b>	0.05 – 6.00 mg/l Cl <sub>2</sub>	10-mm cell
<b>range:</b>	0.02 – 3.00 mg/l Cl <sub>2</sub>	20-mm cell
	0.010 – 1.000 mg/l Cl <sub>2</sub>	50-mm cell
	Expression of results also possible in mmol/l.	

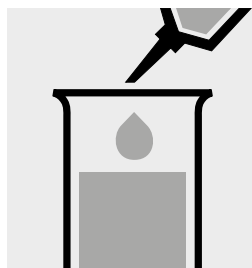
### Determination of free chlorine



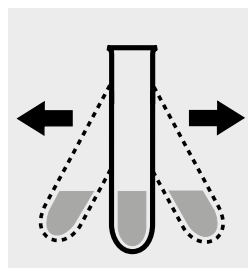
Check the pH of the sample, specified range: pH 4 – 8.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Place 1 level blue micro-spoon of Cl<sub>2</sub>-1 into a test tube.



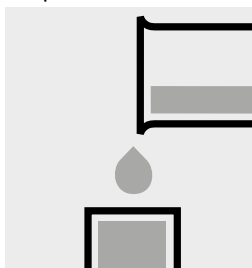
Add 10 ml of the sample with pipette.



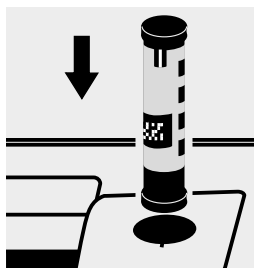
Shake vigorously to dissolve the solid substance.



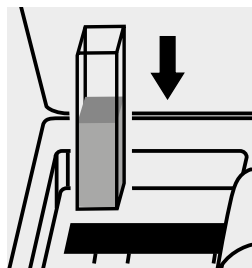
Reaction time: 1 minute



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

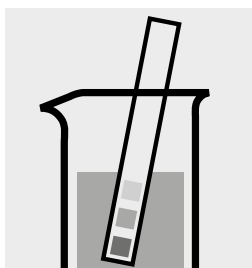
# Chlorine

1.00599

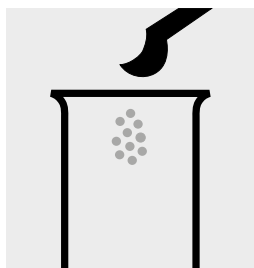
Determination of free chlorine and total chlorine

Test

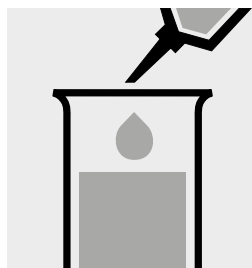
## Determination of total chlorine



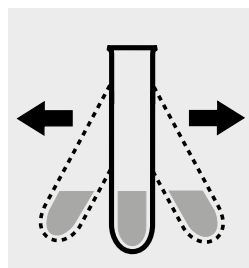
Check the pH of the sample, specified range: pH 4 – 8.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



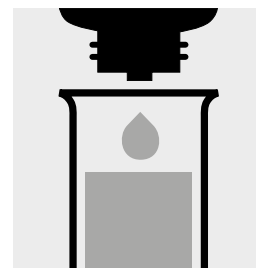
Place 1 level blue micro-spoon of **Cl<sub>2</sub>-1** into a test tube.



Add 10 ml of the sample with pipette.



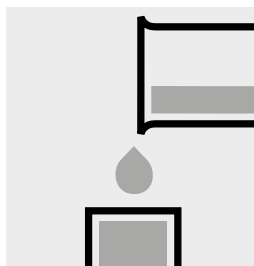
Shake vigorously to dissolve the solid substance.



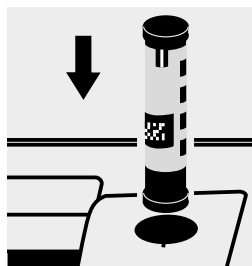
Add 2 drops of **Cl<sub>2</sub>-2** and mix.



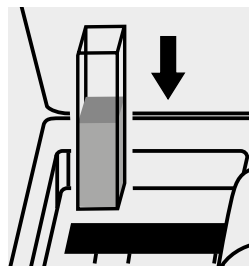
Reaction time:  
1 minute



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

### Important:

Very high chlorine concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).  
After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

# Chlorine

1.00599

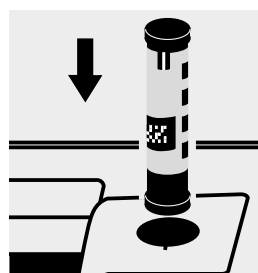
Differentiation between free chlorine and total chlorine

Test

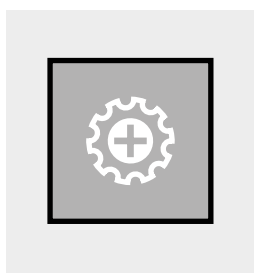
<b>Measuring</b>	0.05 – 6.00 mg/l Cl <sub>2</sub>	10-mm cell
<b>range:</b>	0.02 – 3.00 mg/l Cl <sub>2</sub>	20-mm cell
	0.010 – 1.000 mg/l Cl <sub>2</sub>	50-mm cell

After selecting the method it is possible to set the method-specific "Differentiation" mode.

**Note:** If the aim is to measure **only** free chlorine or total chlorine, the "Differentiation" mode must be deactivated again.



Select method with AutoSelector.



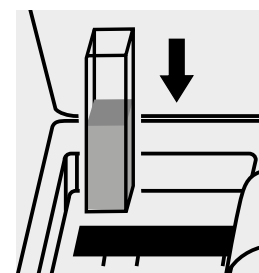
Tap the <Settings> button. Select "Differentiation" and activate.



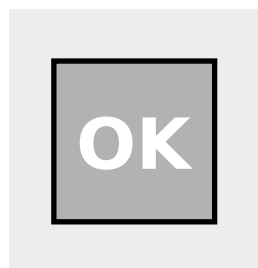
Confirm with <OK>.

Perform determination of **free chlorine** (see analytical procedure "Determination of free chlorine" with 1.00599). = **cell A**

After the reaction time has expired:



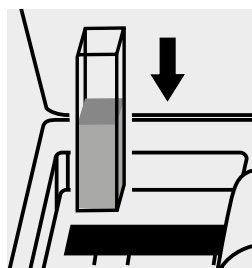
Place the **cell A** into the cell compartment. The measurement is performed automatically.



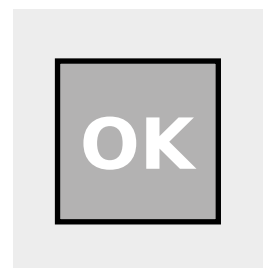
Confirm with <OK>.

Perform determination of **total chlorine** (see analytical procedure "Determination of total chlorine" with 1.00599). = **cell B**

After the reaction time has expired:



Place the **cell B** into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The results A (Cl<sub>2</sub> (f)), B (Cl<sub>2</sub> (t)), and C (Cl<sub>2</sub> (b)) are shown in the display in mg/l.

## Important:

Very high chlorine concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check). After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

# Chlorine (with liquid reagents)

1.00086 / 1.00087 /  
1.00088 / 1.00089

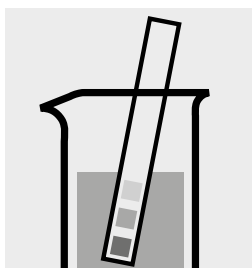
## Determination of free chlorine and total chlorine

Cell Test

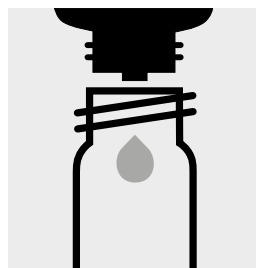
**Measuring** 0.03 – 6.00 mg/l Cl<sub>2</sub>

**range:** Expression of results also possible in mmol/l.

### Determination of free chlorine



Check the pH of the sample, specified range: pH 4 – 8.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Place 6 drops of **Cl<sub>2</sub>-1** into a round cell.



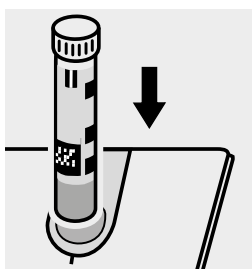
Add 3 drops of **Cl<sub>2</sub>-2**, close with the screw cap, and mix.



Add 10 ml of the sample with pipette, close with the screw cap, and mix.



Reaction time:  
1 minute



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

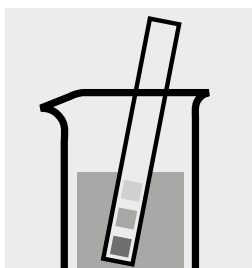
# Chlorine (with liquid reagents)

1.00086 / 1.00087 /  
1.00088 / 1.00089

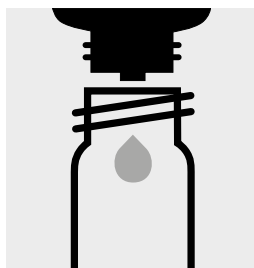
## Determination of free chlorine and total chlorine

Cell Test

### Determination of total chlorine



Check the pH of the sample, specified range: pH 4 – 8.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Place 6 drops of **Cl<sub>2</sub>-1** into a round cell.



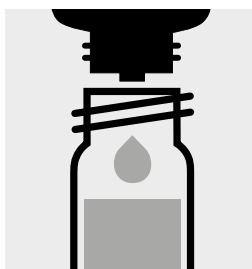
Add 3 drops of **Cl<sub>2</sub>-2**, close with the screw cap, and mix.



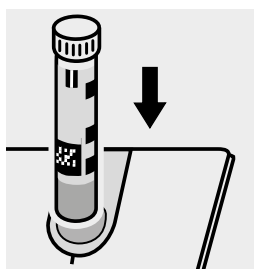
Add 10 ml of the sample with pipette, close with the screw cap, and mix.



Reaction time:  
1 minute



Add 2 drops of **Cl<sub>2</sub>-3**, close with the screw cap, and mix.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

#### Important:

Very high chlorine concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).  
After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.

#### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").



# Chlorine (with liquid reagents)

1.00086 / 1.00087 /  
1.00088 / 1.00089

Differentiation between free chlorine and total chlorine

Cell Test

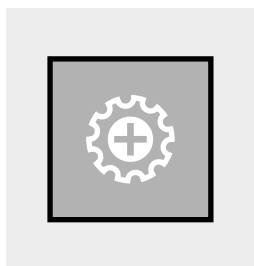
**Measuring range:** 0.03 – 6.00 mg/l Cl<sub>2</sub>

After selecting the method it is possible to set the method-specific "Differentiation" mode.

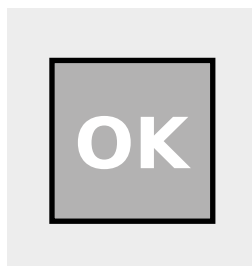
**Note:** If the aim is to measure **only** free chlorine or total chlorine, the "Differentiation" mode must be deactivated again.



Select method no. **194**.



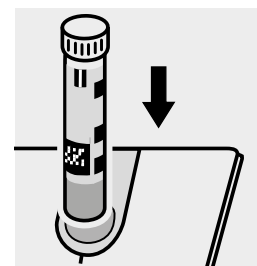
Tap the <Settings> button. Select "Differentiation" and activate.



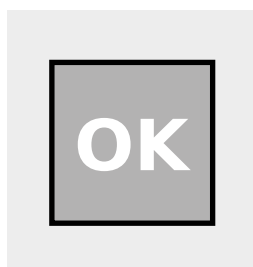
Confirm with <OK>.

Perform determination of **free chlorine** (see analytical procedure "Determination of free chlorine" with 1.00086/1.00087/1.00088/1.00089).  
= **cell A**

After the reaction time has expired:



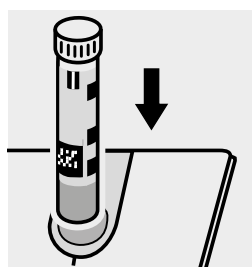
Place the **cell A** into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically.



Confirm with <OK>.

Perform determination of **total chlorine** (see analytical procedure "Determination of total chlorine" with 1.00086/1.00087/1.00088/1.00089).  
= **cell B**

After the reaction time has expired:



Place the **cell B** into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically.



Confirm with <OK>. The results A (Cl<sub>2</sub> (f)), B (Cl<sub>2</sub> (t)), and C (Cl<sub>2</sub> (b)) are shown in the display in mg/l.

## Important:

Very high chlorine concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check). After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

# Chlorine (with liquid reagents)

1.00086/1.00087/  
1.00088

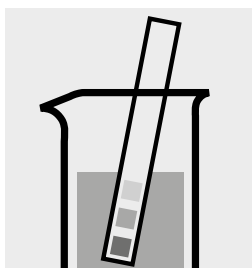
## Determination of free chlorine and total chlorine

Test

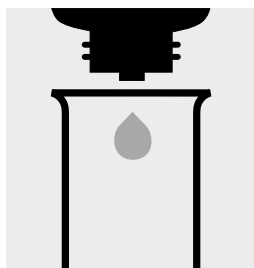
**Measuring** 0.010 – 1.000 mg/l Cl<sub>2</sub> 50-mm cell

**range:** Expression of results also possible in mmol/l.

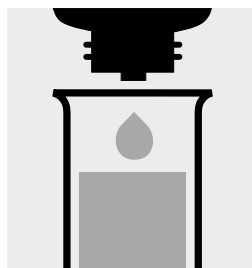
### Determination of free chlorine



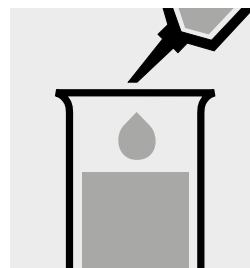
Check the pH of the sample, specified range: pH 4 – 8.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Place 6 drops of **Cl<sub>2</sub>-1** into a test tube.



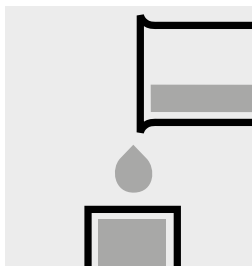
Add 3 drops of **Cl<sub>2</sub>-2**, close with the screw cap, and mix.



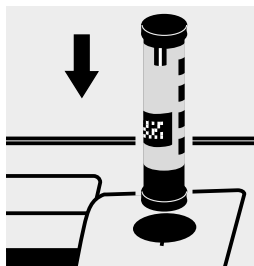
Add 10 ml of the sample with pipette, close with the screw cap, and mix.



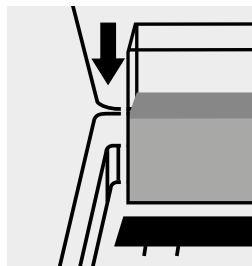
Reaction time:  
1 minute



Transfer the solution into a cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

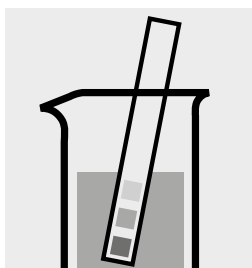
# Chlorine (with liquid reagents)

1.00086/1.00087/  
1.00088

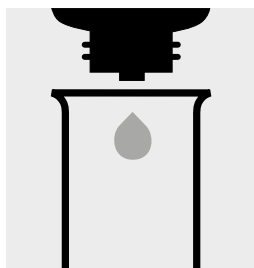
## Determination of free chlorine and total chlorine

Test

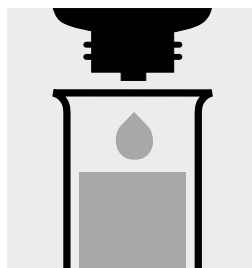
### Determination of total chlorine



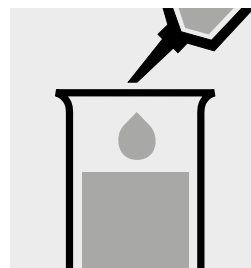
Check the pH of the sample, specified range: pH 4 – 8.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Place 6 drops of **Cl<sub>2</sub>-1** into a test tube.



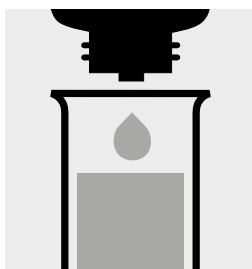
Add 3 drops of **Cl<sub>2</sub>-2**, close with the screw cap, and mix.



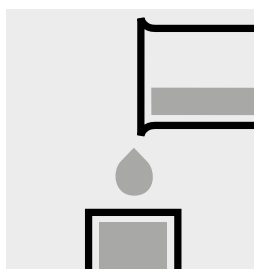
Add 10 ml of the sample with pipette, close with the screw cap, and mix.



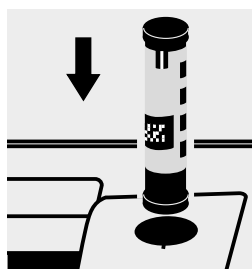
Reaction time:  
1 minute



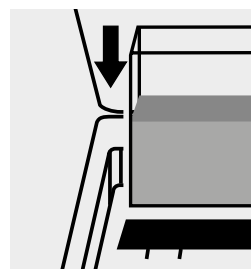
Add 2 drops of **Cl<sub>2</sub>-3**, close with the screw cap, and mix.



Transfer the solution into a cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

#### Important:

Very high chlorine concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).  
After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.

#### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

# Chlorine (with liquid reagents)

1.00086/1.00087/  
1.00088

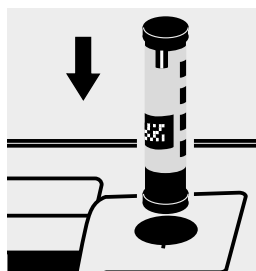
Differentiation between free chlorine and total chlorine

Test

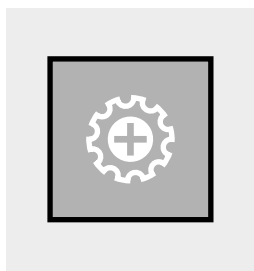
Measuring range: 0.010 – 1.000 mg/l Cl<sub>2</sub> 50-mm cell

After selecting the method it is possible to set the method-specific "Differentiation" mode.

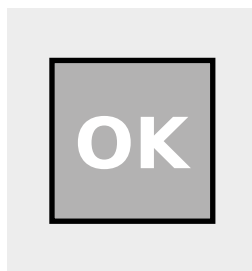
**Note:** If the aim is to measure **only** free chlorine or total chlorine, the "Differentiation" mode must be deactivated again.



Select method with AutoSelector.



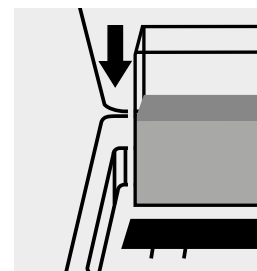
Tap the <Settings> button. Select "Differentiation" and activate.



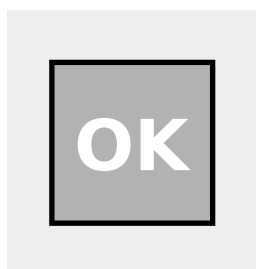
Confirm with <OK>.

Perform determination of **free chlorine** (see analytical procedure "Determination of free chlorine" with 1.00086/1.00087/1.00088). = **cell A**

After the reaction time has expired:



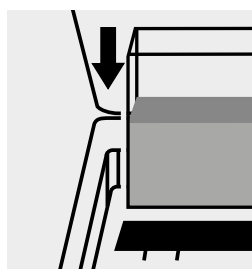
Place the **cell A** into the cell compartment. The measurement is performed automatically.



Confirm with <OK>.

Perform determination of **total chlorine** (see analytical procedure "Determination of total chlorine" with 1.00086/1.00087/1.00088). = **cell B**

After the reaction time has expired:



Place the **cell B** into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The results A (Cl<sub>2</sub> (f)), B (Cl<sub>2</sub> (t)), and C (Cl<sub>2</sub> (b)) are shown in the display in mg/l.

## Important:

Very high chlorine concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check). After each determination of total chlorine rinse the cell with sulfuric acid 25 % and subsequently several times with distilled water.

## Quality assurance:

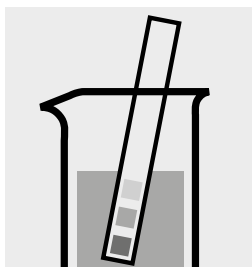
To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

# Chlorine Dioxide

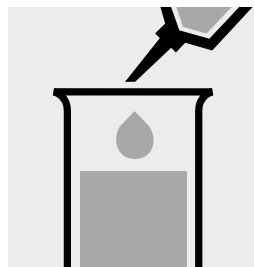
1.00608

Test

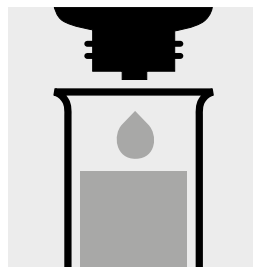
<b>Measuring</b>	0.10 – 10.00 mg/l ClO <sub>2</sub>	10-mm cell
<b>range:</b>	0.05 – 5.00 mg/l ClO <sub>2</sub>	20-mm cell
	0.020 – 2.000 mg/l ClO <sub>2</sub>	50-mm cell
Expression of results also possible in mmol/l.		



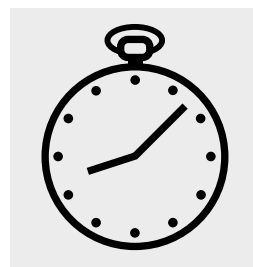
Check the pH of the sample, specified range: pH 4 – 8.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



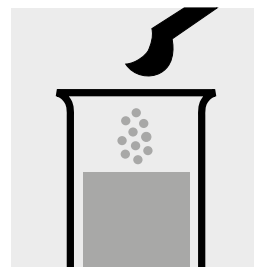
Pipette 10 ml of the sample into a test tube.



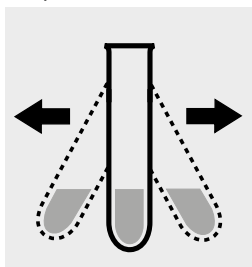
Add 2 drops of ClO<sub>2</sub>-1 and mix.



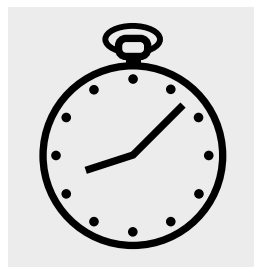
Reaction time:  
2 minutes



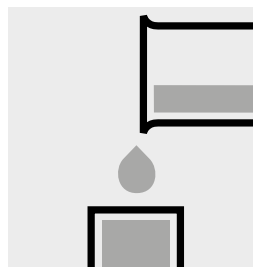
Add 1 level blue micro-spoon of ClO<sub>2</sub>-2.



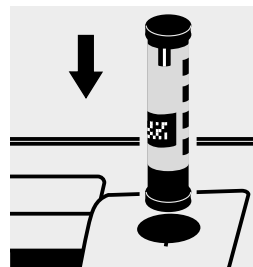
Shake vigorously to dissolve the solid substance.



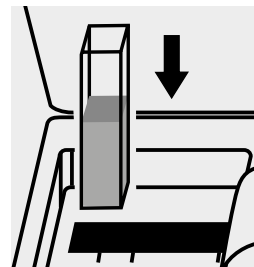
Reaction time:  
1 minute



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

Very high chlorine dioxide concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

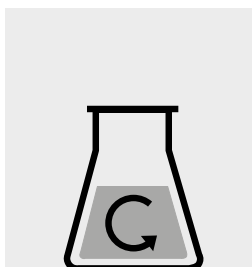
# Chlorophyll

## Determination of chlorophyll-a and phaeophytin

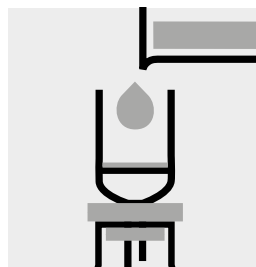
corresponds to **DIN 38412** and **ISO 10260**

**Application**

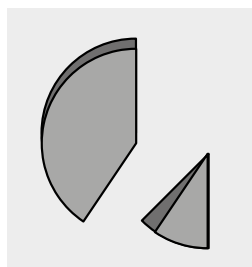
<b>Measuring</b>	depending on the ratio of original sample to extract	10-mm cell	Method No. 2509
<b>range:</b>	in µg/l Chl-a or Phaeo	20-mm cell	Method No. 2509
		50-mm cell	Method No. 2509



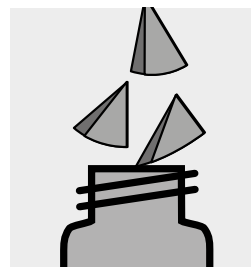
Sufficiently homogenize 0.5 – 2 l of sample. **Note the sample volume.**



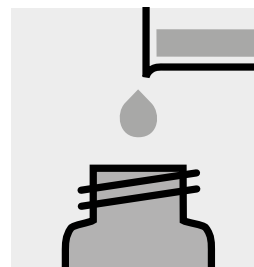
Filter the sample through a suitable filter (e.g. glass-fibre filter).



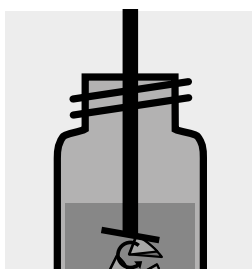
Fold the loaded filter and tear into small pieces.



Place the pieces of the filter in an extraction vessel (e.g. 100-ml amber glass bottle).



Add approx. 30 ml of boiling **ethanol** (w = 90 %) and allow to cool to room temperature.



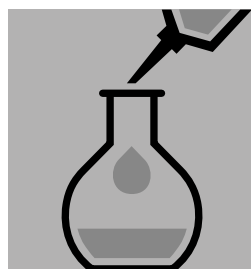
Disintegrate the filter in the homogenizer. Rinse together with a small portion of ethanol.



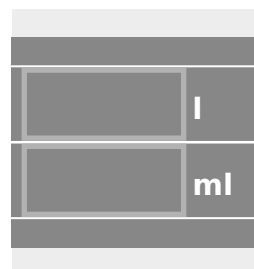
Allow to stand for 6 - 24 hours for the extraction to take place.



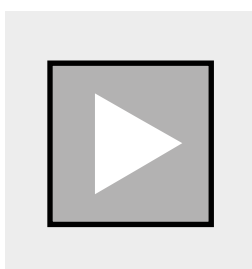
Filter the extract **protected from light** through a paper filter ("Blauband") into a volumetric flask (for DIN 38412: 100 ml). Rinse the filter with a small portion of ethanol.



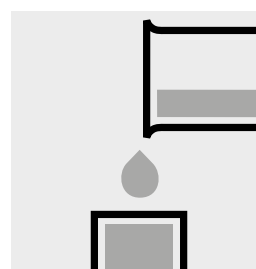
Make the contents of the volumetric flask up to the mark with ethanol, keeping them **protected from light** in the process!



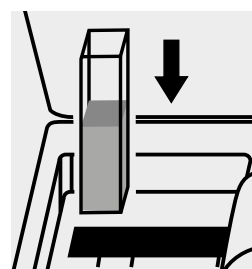
Select method no. **2509**. Enter the volumes of the original sample in liters and extract (volumetric flask) in milliliters.



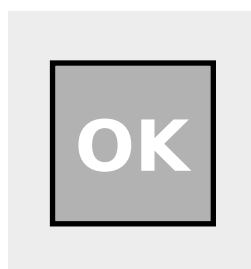
Tap the <Start> button.



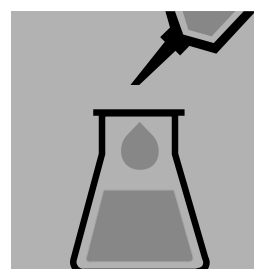
Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>.



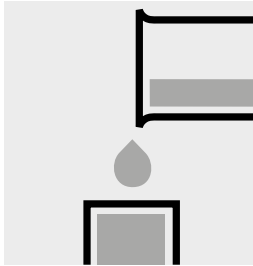
Acidify a portion of the extract with **hydrochloric acid 2 mol/l Titripur®** (Cat. No. 1.09063) (0.3 ml per 100 ml of extract).

# Chlorophyll

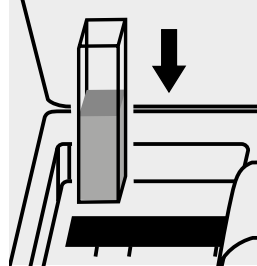
## Determination of chlorophyll-a and phaeophytin

corresponds to **DIN 38412** and **ISO 10260**

Application



Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The chlorophyll-a and phaeophytin content is shown in the display in  $\mu\text{g/l}$ .

### Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

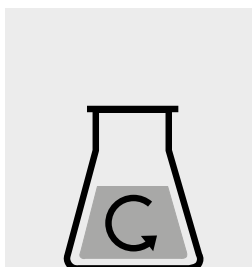
# Chlorophyll

## Determination of chlorophyll-a and phaeophytin

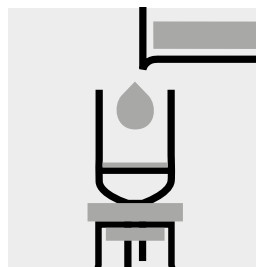
analogous to APHA 10200-H

Application

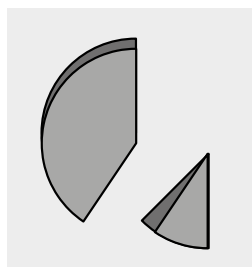
<b>Measuring</b>	depending on the ratio of original sample to extract	10-mm cell	Method No. 2504
<b>range:</b>	in mg/m <sup>3</sup> Chl-a or Phaeo	20-mm cell	Method No. 2504
		50-mm cell	Method No. 2504



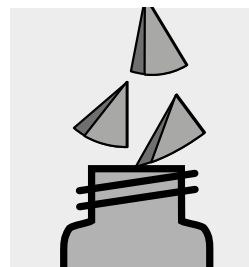
Sufficiently homogenize the sample. **Note the sample volume.**



Filter the sample through a suitable filter (e.g. glass-fibre filter).



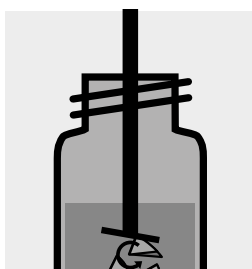
Fold the loaded filter and tear into small pieces.



Place the pieces of the filter in an extraction vessel (**protected from light**).



Add 2 - 3 ml of **extracting agent**.



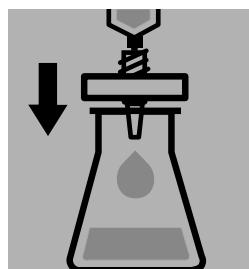
Disintegrate the filter in the homogenizer.



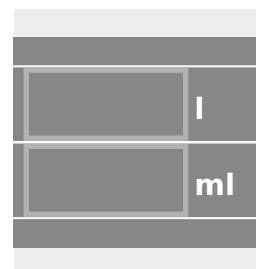
Make up to 10 ml with **extracting agent**.



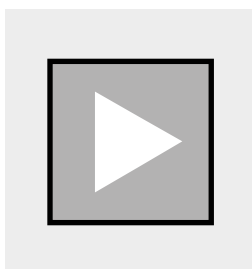
Allow to stand at +4 °C for at least 2 hours for the extraction to take place.



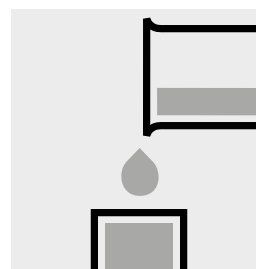
Filter the extract **protected from light** through a suitable filter.



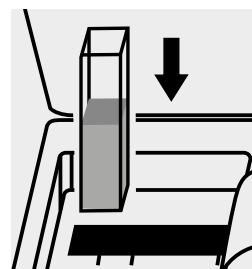
Select method no. **2504**. Enter the volumes of the original sample in liters and extract in milliliters (here: 10 ml).



Tap the <Start> button.



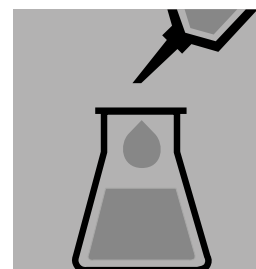
Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>.



Acidify a portion of the extract with **hydrochloric acid 0.1 mol/l Titripur®** (Cat. No. 1.09060) (0.15 ml per 5 ml of extract).

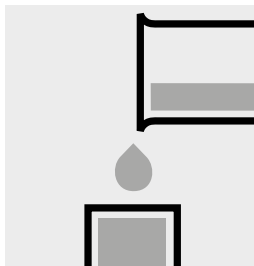


# Chlorophyll

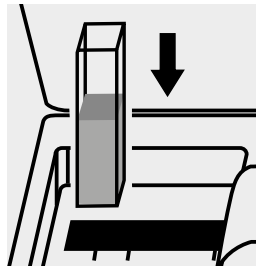
## Determination of chlorophyll-a and phaeophytin

analogous to **APHA 10200-H**

Application



Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The chlorophyll-a and phaeophytin content is shown in the display in  $\text{mg/m}^3$ .

### Important:

The exact procedure and the composition and preparation of the extraction agent used are given in the corresponding application, which also includes further information on the method employed. This application can be downloaded from the website.

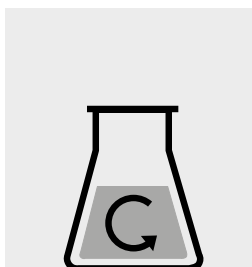
# Chlorophyll

## Determination of chlorophyll-a and phaeophytin

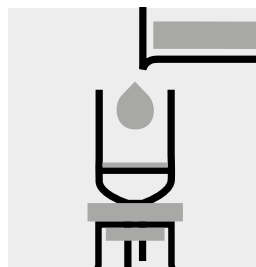
analogous to **ASTM D3731 - 87**

**Application**

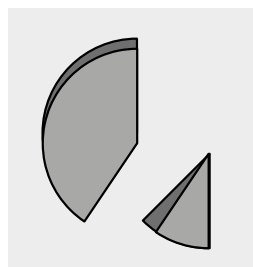
<b>Measuring</b>	depending on the ratio of original sample to extract	10-mm cell	Method No. 2504
<b>range:</b>	in mg/m <sup>3</sup> Chl-a or Phaeo	20-mm cell	Method No. 2504
		50-mm cell	Method No. 2504



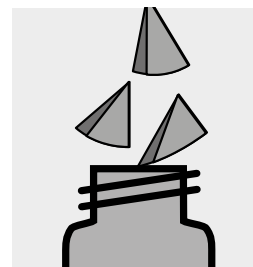
Homogenize the sample, stabilized with magnesiumcarbonate, to a sufficient degree. **Note the sample volume.**



Filter the sample through a suitable filter (e.g. glass-fibre filter).



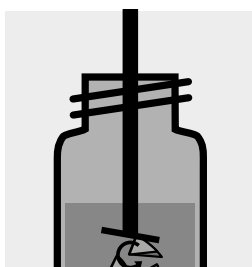
Fold the loaded filter and tear into small pieces.



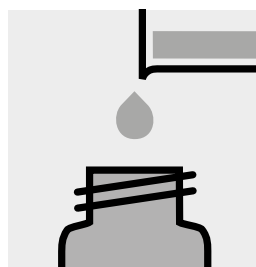
Place the pieces of the filter in an extraction vessel (**protected from light**).



Add 2 - 3 ml of **extracting agent**.



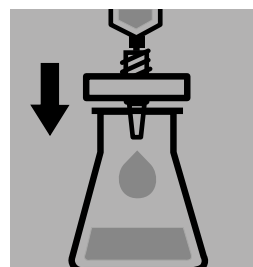
Disintegrate the filter in the homogenizer.



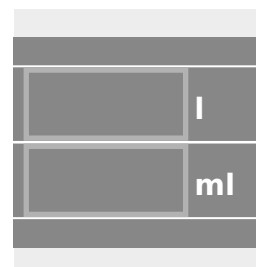
Make up to 10 ml with **extracting agent**.



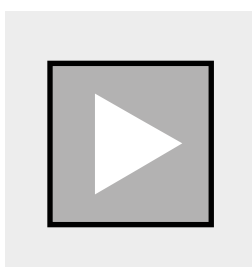
Allow to stand at +4 °C for 0.25 - 24 hours for the extraction to take place.



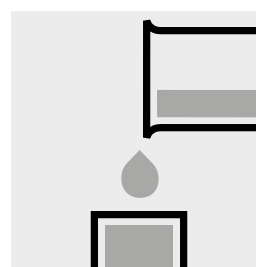
Filter the extract **protected from light** through a suitable filter.



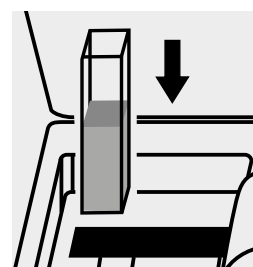
Select method no. **2504**. Enter the volumes of the original sample in liters and extract in milliliters (here: 10 ml).



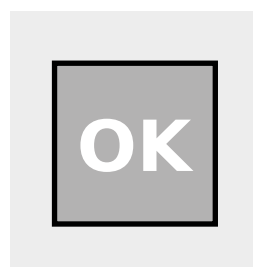
Tap the <Start> button.



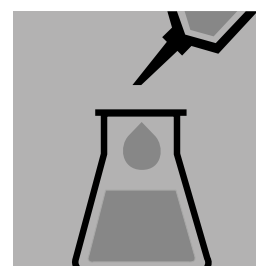
Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>.



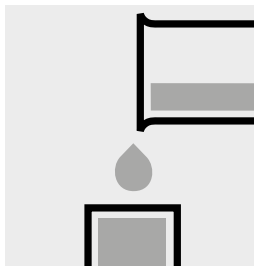
Acidify a portion of the extract with **hydrochloric acid 1 mol/l Titripur®** (Cat. No. 1.09057) (50 µl per 5 ml of extract).

# Chlorophyll

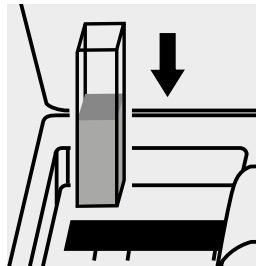
## Determination of chlorophyll-a and phaeophytin

analogous to ASTM D3731 - 87

Application



Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The chlorophyll-a and phaeophytin content is shown in the display in  $\text{mg/m}^3$ .

### Important:

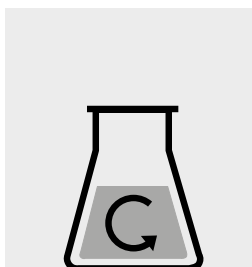
The exact procedure and the composition and preparation of the extraction agent used are given in the corresponding application, which also includes further information on the method employed. This application can be downloaded from the website.

# Chlorophyll-a, -b, -c (Trichromatic Method)

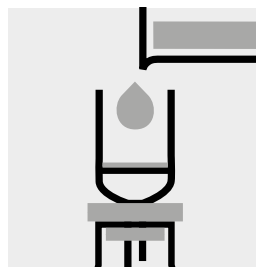
analogous to **APHA 10200-H**

**Application**

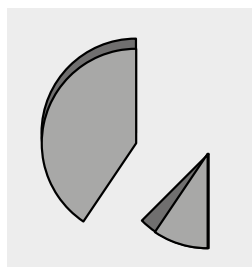
<b>Measuring</b>	depending on the ratio of original sample to extract	10-mm cell	Method No. 2507
<b>range:</b>	in mg/m <sup>3</sup> Chl-a, -b, -c	50-mm cell	Method No. 2507



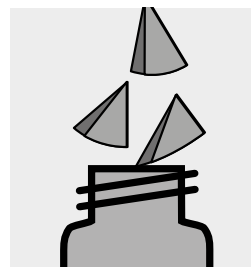
Sufficiently homogenize the sample. **Note the sample volume.**



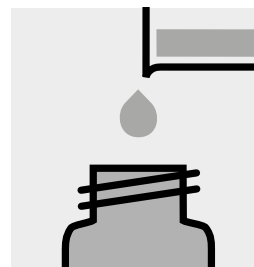
Filter the sample through a suitable filter (e.g. glass-fibre filter).



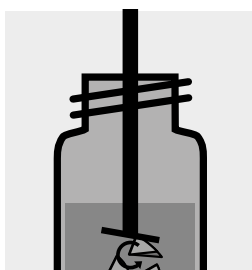
Fold the loaded filter and tear into small pieces.



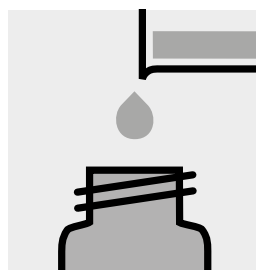
Place the pieces of the filter in an extraction vessel (**protected from light**).



Add 2 - 3 ml of **extracting agent**.



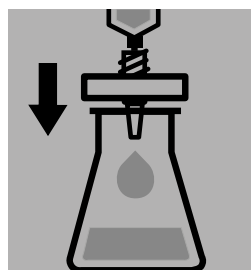
Disintegrate the filter in the homogenizer.



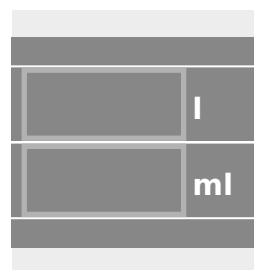
Make up to 10 ml with **extracting agent**.



Allow to stand at +4 °C for at least 2 hours for the extraction to take place.



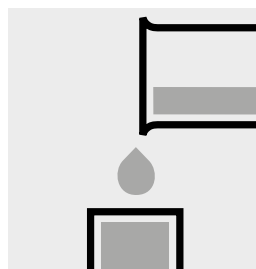
Filter the extract **protected from light** through a suitable filter.



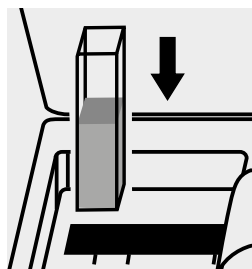
Select method no. **2507**. Enter the volumes of the original sample in liters and extract in milliliters (here: 10 ml).



Tap the <Start> button.



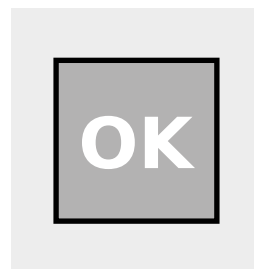
Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Tap the <OK> button.



Confirm with <OK>. The chlorophyll-a, chlorophyll-b, and chlorophyll-c contents are shown in the display in mg/m<sup>3</sup>.

### Important:

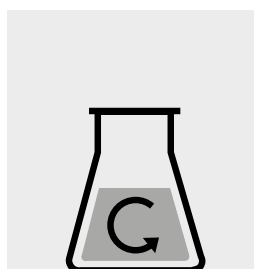
The exact procedure and the composition and preparation of the extraction agent used are given in the corresponding application, which also includes further information on the method employed. This application can be downloaded from the website.

# Chlorophyll-a, -b, -c (Trichromatic Method)

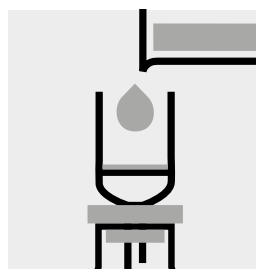
analogous to **ASTM D3731 - 87**

**Application**

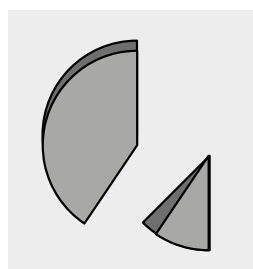
<b>Measuring</b>	depending on the ratio of original sample to extract	10-mm cell	Method No. 2507
<b>range:</b>	in mg/m <sup>3</sup> Chl-a, -b, -c	50-mm cell	Method No. 2507



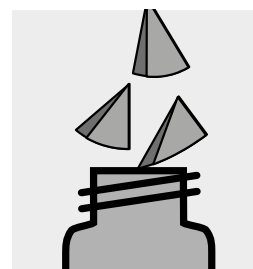
Homogenize the sample, stabilized with magnesium carbonate, to a sufficient degree. **Note the sample volume.**



Filter the sample through a suitable filter (e.g. glass-fibre filter).



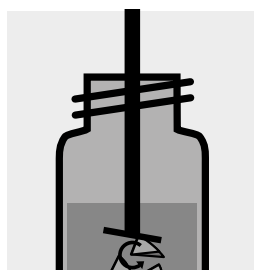
Fold the loaded filter and tear into small pieces.



Place the pieces of the filter in an extraction vessel (**protected from light**).



Add 2 - 3 ml of **extracting agent**.



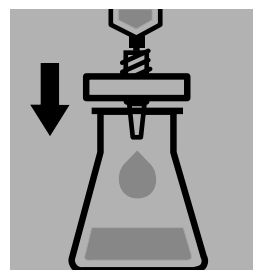
Disintegrate the filter in the homogenizer.



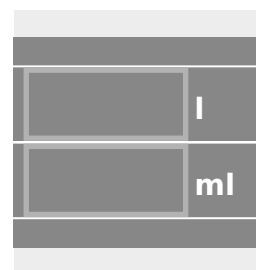
Make up to 10 ml with **extracting agent**.



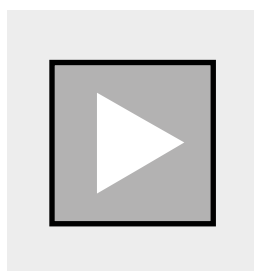
Allow to stand at +4 °C for 0.25 - 24 hours for the extraction to take place.



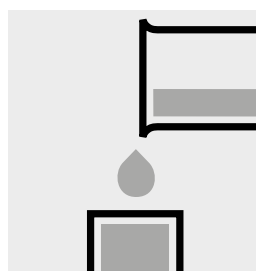
Filter the extract **protected from light** through a suitable filter.



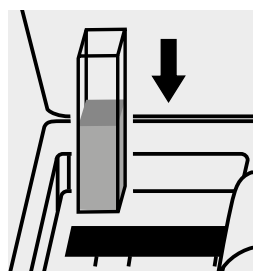
Select method no. **2507**. Enter the volumes of the original sample in liters and extract in milliliters (here: 10 ml).



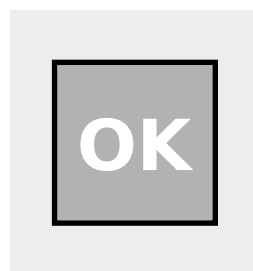
Tap the <Start> button.



Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Tap the <OK> button.



Confirm with <OK>. The chlorophyll-a, chlorophyll-b, and chlorophyll-c contents are shown in the display in mg/m<sup>3</sup>.

### Important:

The exact procedure and the composition and preparation of the extraction agent used are given in the corresponding application, which also includes further information on the method employed. This application can be downloaded from the website.

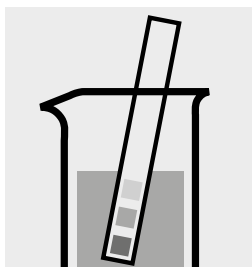
# Chromate

1.14552

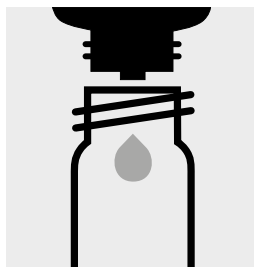
## Determination of chromium(VI)

Cell Test

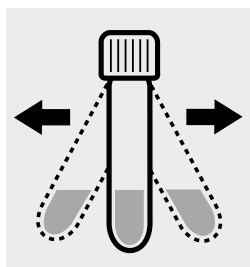
<b>Measuring</b>	0.05 – 2.00 mg/l Cr
<b>range:</b>	0.11 – 4.46 mg/l CrO <sub>4</sub>
	Expression of results also possible in mmol/l.



Check the pH of the sample, specified range: pH 1 – 9. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Add 6 drops of **Cr-3K** into a reaction cell, close with the screw cap.



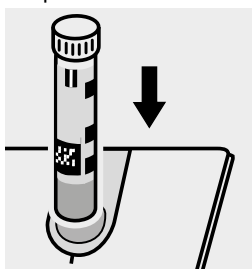
Shake the cell vigorously to dissolve the solid substance and leave to stand for **1 minute**.



Add 5.0 ml of the sample with pipette, close the cell with the screw cap, and mix.



Reaction time:  
1 minute



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use chromate standard solution Certipur®, Cat.No. 1.19780, concentration 1000 mg/l CrO<sub>4</sub><sup>2-</sup>, can be used after diluting accordingly as well as the Standard solution for photometric applications, Cat.No. 1.33013.

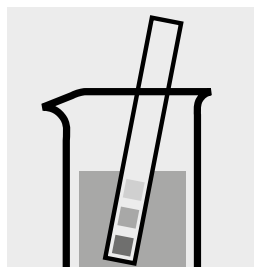
# Chromate

Determination of total chromium  
= sum of chromium(VI) and chromium(III)

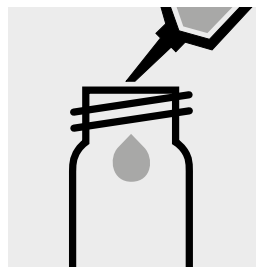
1.14552

Cell Test

<b>Measuring</b>	0.05 – 2.00 mg/l Cr
<b>range:</b>	0.11 – 4.46 mg/l CrO <sub>4</sub>
	Expression of results also possible in mmol/l.



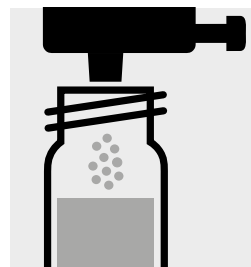
Check the pH of the sample, specified range: pH 1 – 9. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



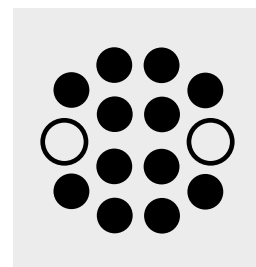
Pipette 10 ml of the sample into an empty round cell (Empty cells, Cat.No. 1.14724).



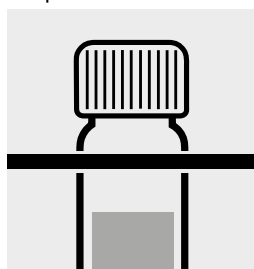
Add 1 drop of **Cr-1K**, close with the screw cap, and mix.



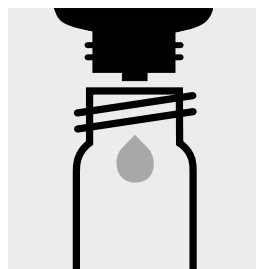
Add 1 dose of **Cr-2K** using the blue dosing cap, close the reaction cell with the screw cap.



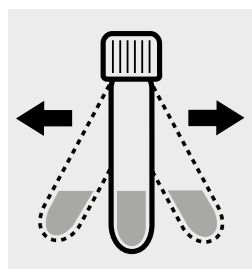
Heat the cell in the thermoreactor at 120 °C for 1 hour.



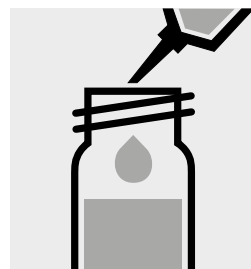
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature: **pretreated sample**.



Add 6 drops of **Cr-3K** into a reaction cell, close the cell with the screw cap.



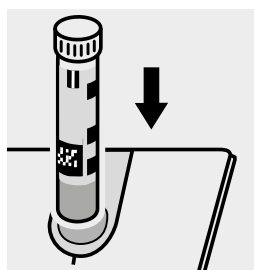
Shake the cell vigorously to dissolve the solid substance and leave to stand for **1 minute**.



Add 5.0 ml of the **pretreated sample** with pipette, close with the screw cap, and mix.



Reaction time: 1 minute



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use chromate standard solution Certipur®, Cat.No. 1.19780, concentration 1000 mg/l CrO<sub>4</sub><sup>2-</sup>, can be used after diluting accordingly as well as the Standard solution for photometric applications, Cat.No. 1.33013.

# Chromate

1.14552

Differentiation between chromium(VI) and chromium(III)

Cell Test

**Measuring** 0.05 – 2.00 mg/l Cr

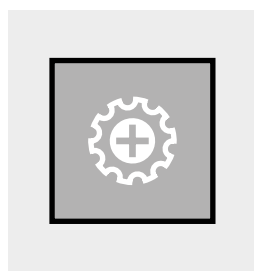
**range:** 0.11 – 4.46 mg/l CrO<sub>4</sub>

If the aim is to differentiate between chromium(VI) and chromium(III), after selecting the method it is possible to set the method-specific "Differentiation" mode.

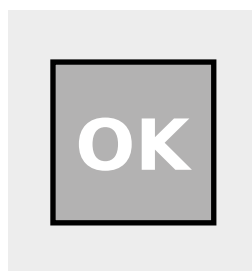
**Note:** If no differentiation is to be measured, the "Differentiation" mode must be deactivated again.



Select method no. **39**.



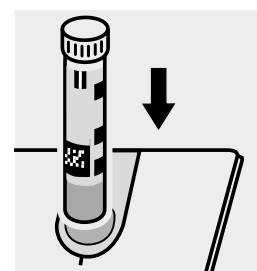
Tap the <Settings> button. Select "Differentiation" and activate.



Confirm with <OK>.

Perform determination of **total chromium** (see analytical procedure "Determination of total chromium" with 1.14552). = **cell A**

After the reaction time has expired:



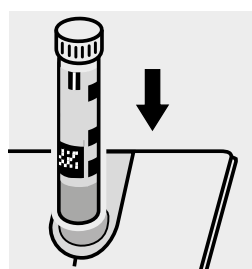
Place the **cell A** into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically.



Confirm with <OK>.

Perform determination of **chromium(VI)** (see analytical procedure "Determination of chromium(VI)" with 1.14552). = **cell B**

After the reaction time has expired:



Place the **cell B** into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically.



Confirm with <OK>. The results A ( $\Sigma$  Cr), B (Cr(VI)), and C (Cr(III)) are shown in the display in mg/l.



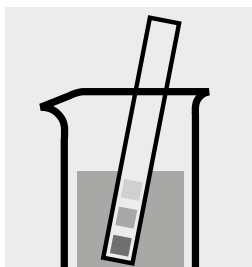
# Chromate

1.14758

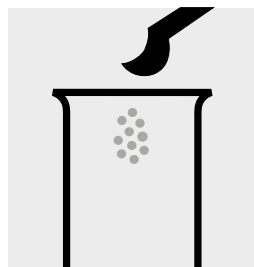
## Determination of chromium(VI)

Test

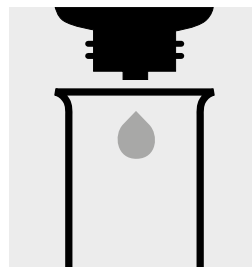
<b>Measuring range:</b>	0.05 – 3.00 mg/l Cr	0.11 – 6.69 mg/l CrO <sub>4</sub>	10-mm cell
	0.03 – 1.50 mg/l Cr	0.07 – 3.35 mg/l CrO <sub>4</sub>	20-mm cell
	0.010 – 0.600 mg/l Cr	0.02 – 1.34 mg/l CrO <sub>4</sub>	50-mm cell
Expression of results also possible in mmol/l.			



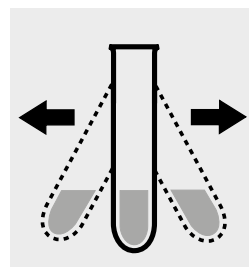
Check the pH of the sample, specified range: pH 1 – 9.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



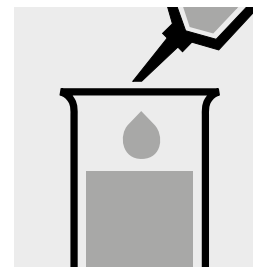
Place 1 level grey micro-spoon of **Cr-1** into a dry test tube.



Add 6 drops of **Cr-2**.



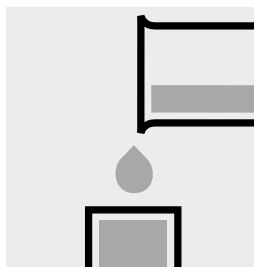
Shake the test tube vigorously to dissolve the solid substance.



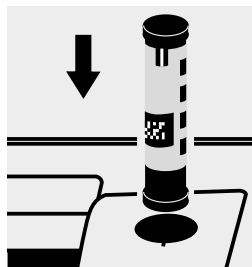
Add 5.0 ml of the sample with pipette and mix.



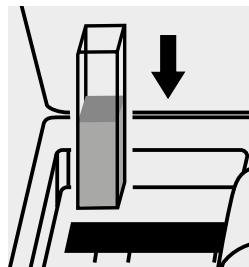
Reaction time:  
1 minute



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

### Important:

For the determination of **total chromium = sum of chromium(VI) and chromium(III)** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687 and thermoreactor is necessary.

Result can be expressed as sum of chromium ( $\Sigma$  Cr).

To measure in the 50-mm cell, the sample volume and the volume of the reagents have to be doubled for each. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

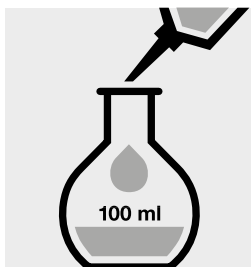
### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use chromate standard solution Certipur®, Cat.No. 1.19780, concentration 1000 mg/l CrO<sub>4</sub><sup>2-</sup>, can be used after diluting accordingly as well as the Standard solutions for photometric applications, Cat.Nos. 1.33012 and 1.33013.

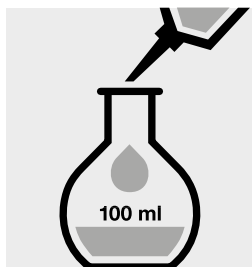
# Chromium in electroplating baths

## Inherent color

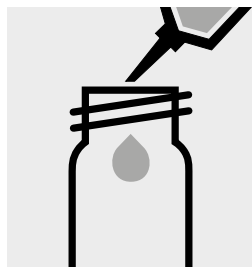
<b>Measuring range:</b>	20 – 400 g/l CrO <sub>3</sub>	10-mm cell	Method No. 20
	10 – 200 g/l CrO <sub>3</sub>	20-mm cell	Method No. 20
	4.0 – 80.0 g/l CrO <sub>3</sub>	50-mm cell	Method No. 20



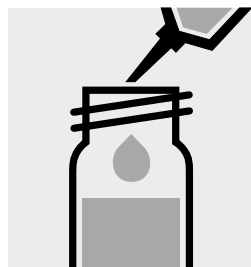
Pipette 5.0 ml of the sample into a 100-ml volumetric flask, fill to the mark with distilled water and mix thoroughly.



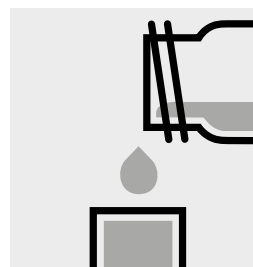
Pipette 4.0 ml of the dilute sample into a 100-ml volumetric flask, fill to the mark with distilled water and mix thoroughly.



Pipette 5.0 ml of the 1:500 dilute sample into an empty round cell (Empty cells, Cat. No. 1.14724).



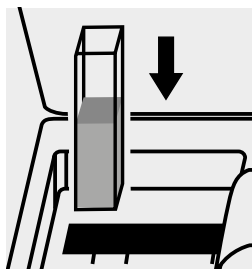
Add 5.0 ml of **sulfuric acid 40 %**, close the cell with the screw cap, and mix.



Transfer the solution into a corresponding cell.



Select method no. 20.



Place the cell into the cell compartment. The measurement is performed automatically.

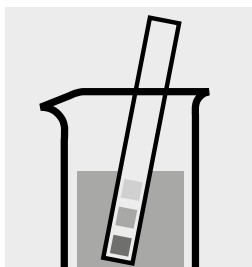
# Cobalt

1.17244

Cell Test

**Measuring** 0.05 – 2.00 mg/l Co

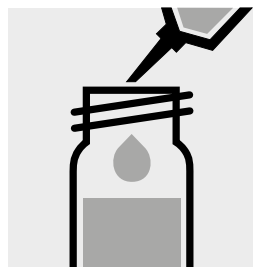
**range:** Expression of results also possible in mmol/l.



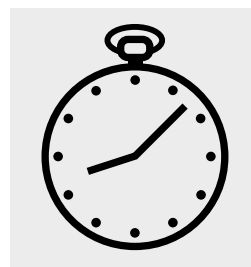
Check the pH of the sample, specified range: pH 2.5 – 7.5. If required, add dilute sodium hydroxide solution or nitric acid drop by drop to adjust the pH.



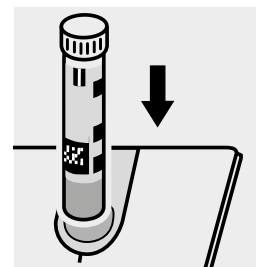
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 0.5 ml of **Co-1K** with pipette, close with the screw cap, and mix.



Reaction time:  
10 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

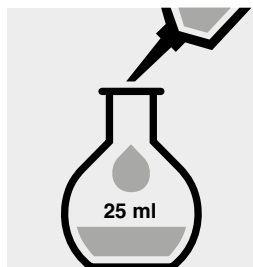
To check the measurement system (test reagents, measurement device, and handling) ready-to-use cobalt standard solution Certipur®, Cat.No. 1.19785, concentration 1000 mg/l Co, can be used after diluting accordingly.

# Cobalt in water

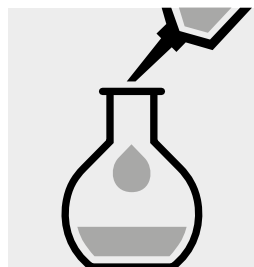
Application

**Measuring range:** 0.5 – 10.0 mg/l Co      10-mm cell      Method No. 305

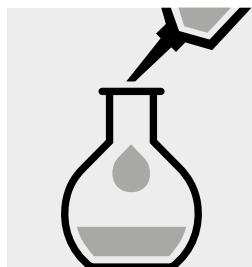
**Attention!** The measurement is carried out at 495 nm in a 10-mm rectangular cell against a blank, prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) and the reagents in an analogous manner.



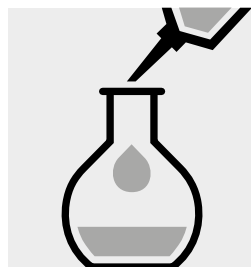
Pipette 10 ml of the sample into a 25-ml volumetric flask, fill to the mark with distilled water and mix thoroughly.



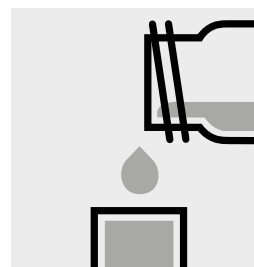
Add 0.25 ml of **reagent 1** with pipette.



Add 2.0 ml of **reagent 2** with pipette.



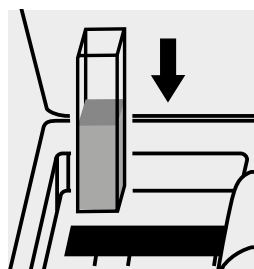
Add 1.0 ml of **reagent 3** with pipette, fill to the mark with distilled water, and mix thoroughly.



Transfer the solution into a cell.



Select method no. **305**.



Place the cell into the cell compartment. The measurement is performed automatically.

## Important:

The exact composition and preparation of the reagents 1, 2, and 3 used are given in the corresponding application, which also includes further information on the method employed. This application can be downloaded from the website.

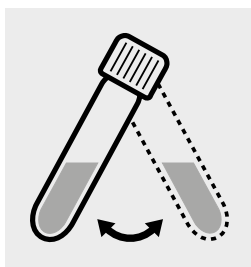
# COD

## Chemical Oxygen Demand

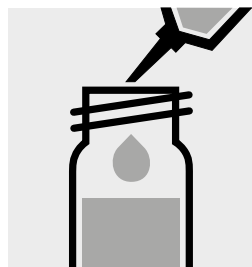
1.14560

Cell Test

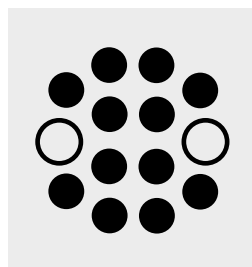
<b>Measuring</b>	4.0 – 40.0 mg/l COD or O <sub>2</sub>
<b>range:</b>	Expression of results also possible in mmol/l.



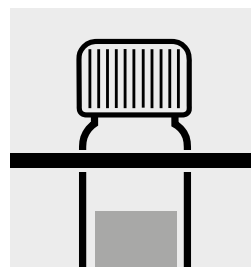
Suspend the bottom sediment in the cell by swirling.



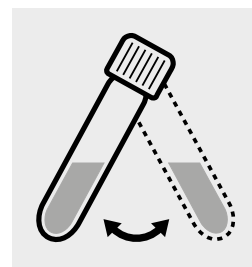
**Carefully** pipette 3.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**



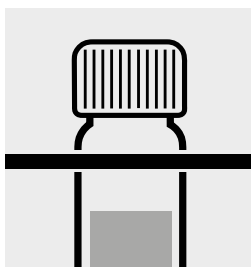
Heat the reaction cell in the thermoreactor at 148 °C for 2 hours.



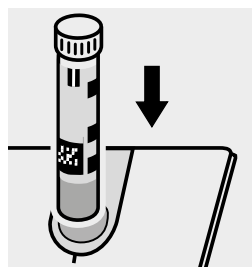
Remove the cell from the thermoreactor and place in a test-tube rack to cool.



Swirl the cell after 10 minutes.



Replace the cell in the rack for complete cooling to room temperature. **Very important!**



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Note:

To increase the accuracy is recommended to measure against an own prepared blank sample (reaction cell + COD-free water).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 50, Cat.No. 1.14695, or the Standard solution for photometric applications, Cat.No. 1.25028.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 50) is highly recommended.

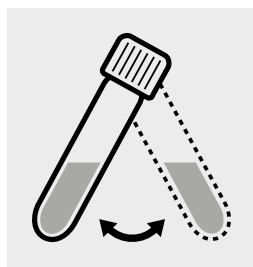
# COD

1.01796

## Chemical Oxygen Demand

Cell Test

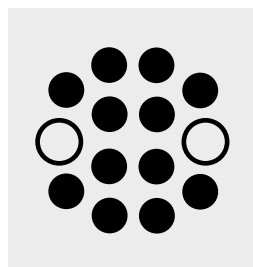
<b>Measuring</b>	5.0 – 80.0 mg/l COD or O <sub>2</sub>
<b>range:</b>	Expression of results also possible in mmol/l.



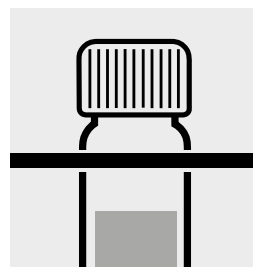
Suspend the bottom sediment in the cell by swirling.



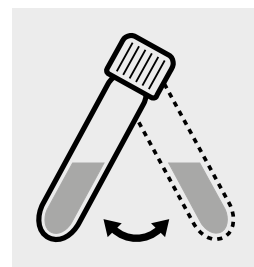
**Carefully** pipette 2.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**



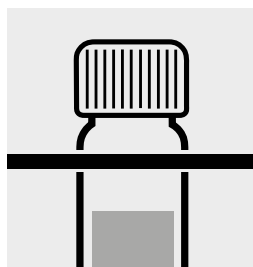
Heat the reaction cell in the thermoreactor at 148 °C for 2 hours.



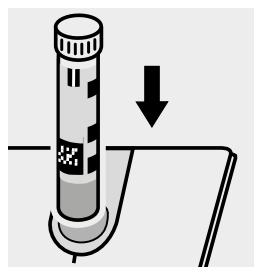
Remove the cell from the thermoreactor and place in a test-tube rack to cool.



Swirl the cell after 10 minutes.



Replace the cell in the rack for complete cooling to room temperature. **Very important!**



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Note:

To increase the accuracy is recommended to measure against an own prepared blank sample (reaction cell + COD-free water).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 50, Cat.No. 1.14695, or the Standard solution for photometric applications, Cat.No. 1.25028.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 50) is highly recommended.

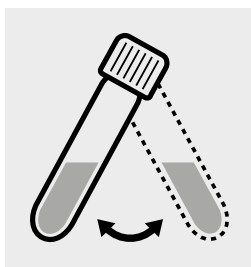
# COD

## Chemical Oxygen Demand

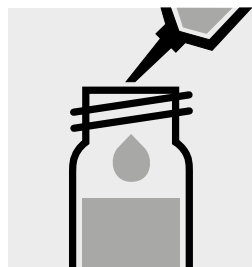
1.14540

Cell Test

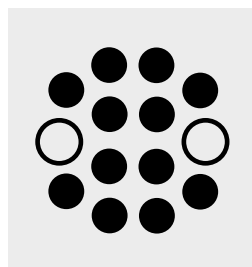
<b>Measuring</b>	10 – 150 mg/l COD or O <sub>2</sub>
<b>range:</b>	Expression of results also possible in mmol/l.



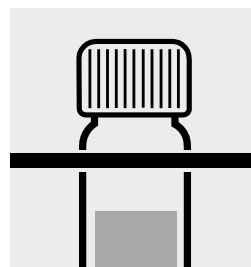
Suspend the bottom sediment in the cell by swirling.



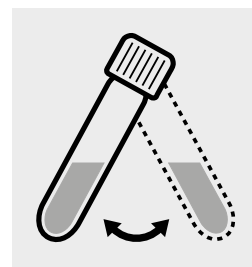
**Carefully** pipette 3.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**



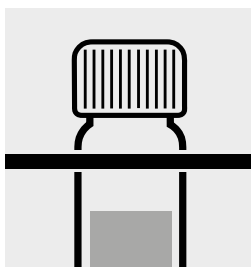
Heat the reaction cell in the thermoreactor at 148 °C for 2 hours.



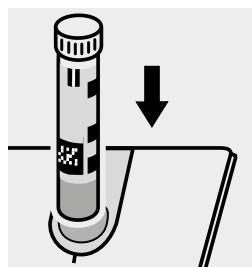
Remove the cell from the thermoreactor and place in a test-tube rack to cool.



Swirl the cell after 10 minutes.



Replace the cell in the rack for complete cooling to room temperature. **Very important!**



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Note:

To increase the accuracy is recommended to measure against an own prepared blank sample (reaction cell + COD-free water).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 1.14676, or the Standard solution for photometric applications, Cat.No. 1.25029.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

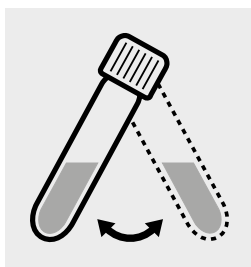
# COD

## Chemical Oxygen Demand

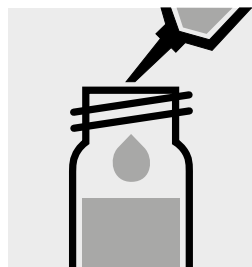
1.14895

Cell Test

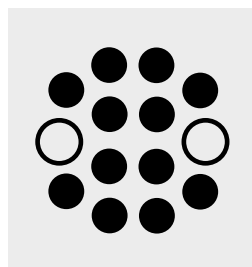
<b>Measuring</b>	15 – 300 mg/l COD or O <sub>2</sub>
<b>range:</b>	Expression of results also possible in mmol/l.



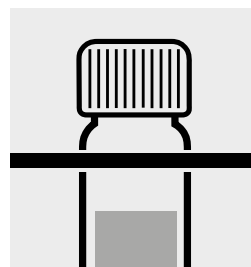
Suspend the bottom sediment in the cell by swirling.



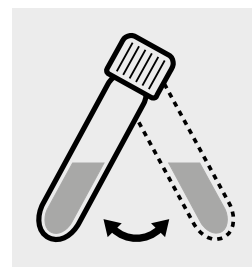
**Carefully** pipette 2.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**



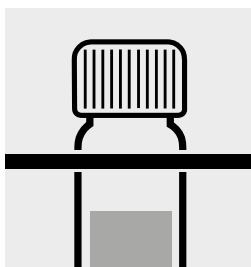
Heat the reaction cell in the thermoreactor at 148 °C for 2 hours.



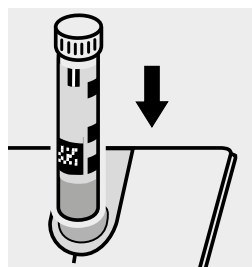
Remove the cell from the thermoreactor and place in a test-tube rack to cool.



Swirl the cell after 10 minutes.



Replace the cell in the rack for complete cooling to room temperature. **Very important!**



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Note:

To increase the accuracy is recommended to measure against an own prepared blank sample (reaction cell + COD-free water).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 60, Cat.No. 1.14696, or the Standard solutions for photometric applications, Cat.Nos. 1.25029 and 1.25030.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 60) is highly recommended.



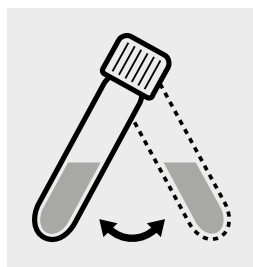
# COD

## Chemical Oxygen Demand

1.14690

Cell Test

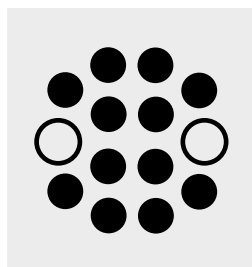
<b>Measuring</b>	50 – 500 mg/l COD or O <sub>2</sub>
<b>range:</b>	Expression of results also possible in mmol/l.



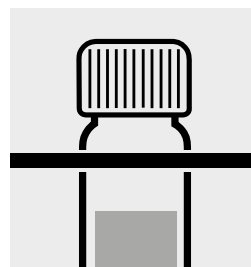
Suspend the bottom sediment in the cell by swirling.



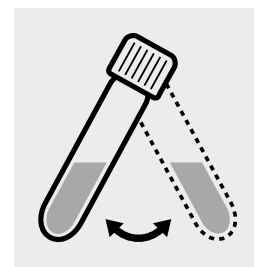
**Carefully** pipette 2.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**



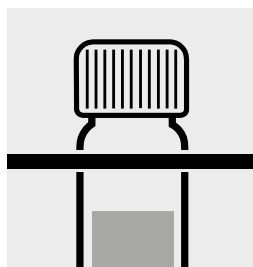
Heat the reaction cell in the thermoreactor at 148 °C for 2 hours.



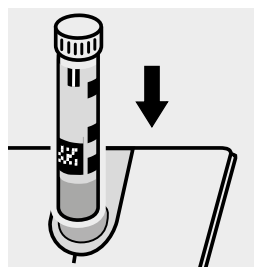
Remove the cell from the thermoreactor and place in a test-tube rack to cool.



Swirl the cell after 10 minutes.



Replace the cell in the rack for complete cooling to room temperature. **Very important!**



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Note:

To increase the accuracy is recommended to measure against an own prepared blank sample (reaction cell + COD-free water).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 60, Cat.No. 1.14696, or the Standard solutions for photometric applications, Cat.Nos. 1.25029, 1.25030, and 1.25031.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 60) is highly recommended.

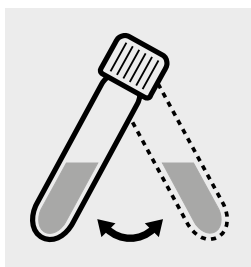
# COD

1.14541

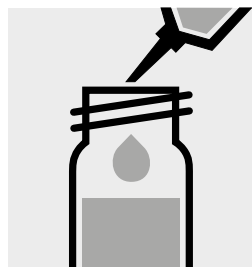
## Chemical Oxygen Demand

Cell Test

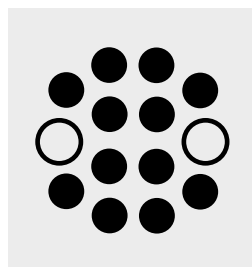
<b>Measuring</b>	25 – 1500 mg/l COD or O <sub>2</sub>
<b>range:</b>	Expression of results also possible in mmol/l.



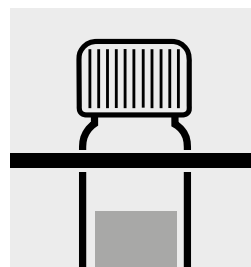
Suspend the bottom sediment in the cell by swirling.



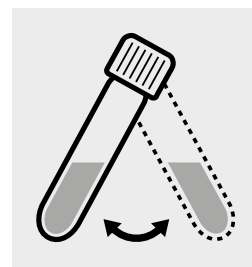
**Carefully** pipette 3.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**



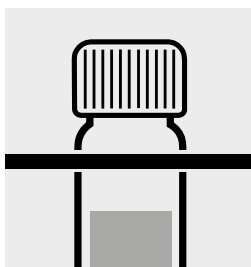
Heat the reaction cell in the thermoreactor at 148 °C for 2 hours.



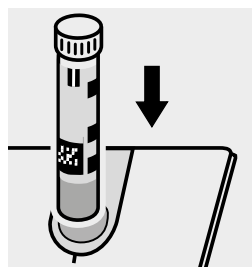
Remove the cell from the thermoreactor and place in a test-tube rack to cool.



Swirl the cell after 10 minutes.



Replace the cell in the rack for complete cooling to room temperature. **Very important!**



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Note:

To increase the accuracy is recommended to measure against an own prepared blank sample (reaction cell + COD-free water).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20, Cat.No. 1.14675, or the Standard solutions for photometric applications, Cat.Nos. 1.25029, 1.25030, 1.25031, and 1.25032.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 20) is highly recommended.

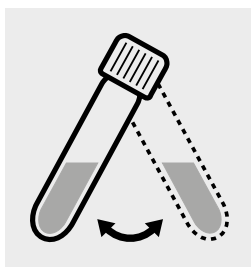
# COD

## Chemical Oxygen Demand

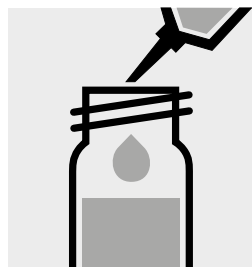
1.14691

Cell Test

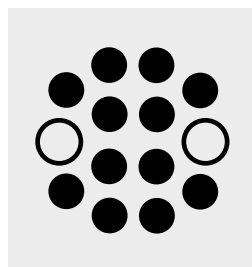
<b>Measuring</b>	300 – 3500 mg/l COD or O <sub>2</sub>
<b>range:</b>	Expression of results also possible in mmol/l.



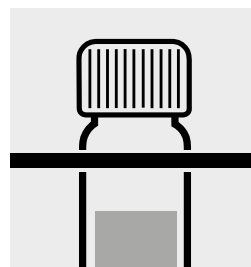
Suspend the bottom sediment in the cell by swirling.



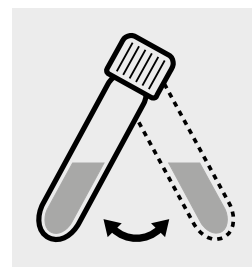
**Carefully** pipette 2.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**



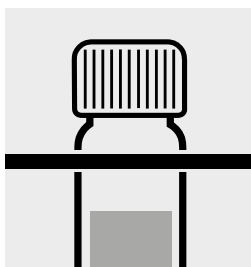
Heat the reaction cell in the thermoreactor at 148 °C for 2 hours.



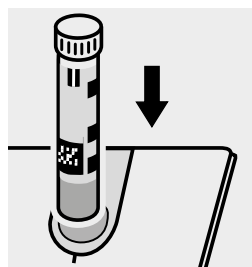
Remove the cell from the thermoreactor and place in a test-tube rack to cool.



Swirl the cell after 10 minutes.



Replace the cell in the rack for complete cooling to room temperature. **Very important!**



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Note:

To increase the accuracy it is recommended to measure against an own prepared blank sample (reaction cell + COD-free water).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommend to use Spectroquant® CombiCheck 80, Cat.No. 1.14738, or the Standard solutions for photometric applications, Cat.Nos. 1.25031, 1.25032, and 1.25033.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 80) is highly recommended.

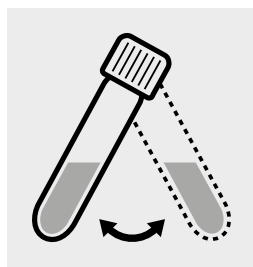
# COD

## Chemical Oxygen Demand

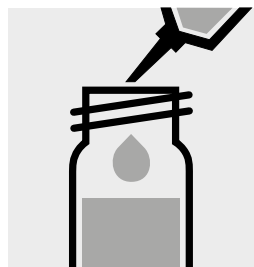
1.14555

Cell Test

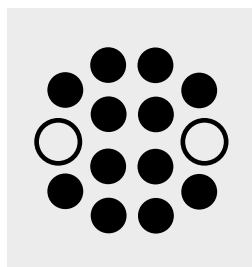
<b>Measuring</b>	500 – 10000 mg/l COD or O <sub>2</sub>
<b>range:</b>	Expression of results also possible in mmol/l.



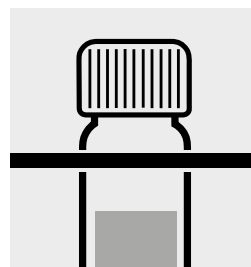
Suspend the bottom sediment in the cell by swirling.



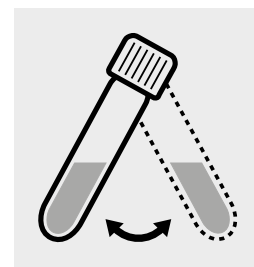
**Carefully** pipette 1.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**



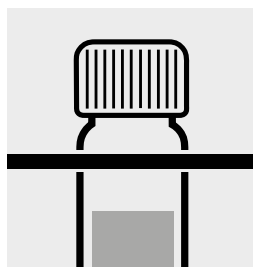
Heat the reaction cell in the thermoreactor at 148 °C for 2 hours.



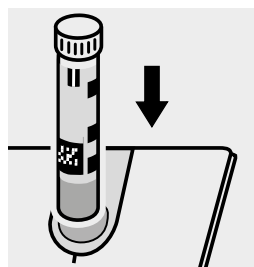
Remove the cell from the thermoreactor and place in a test-tube rack to cool.



Swirl the cell after 10 minutes.



Replace the cell in the rack for complete cooling to room temperature. **Very important!**



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Note:

To increase the accuracy is recommended to measure against an own prepared blank sample (reaction cell + COD-free water).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 70, Cat.No. 1.14689, or the Standard solutions for photometric applications, Cat.Nos. 1.25032, 1.25033, and 1.25034.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 70) is highly recommended.

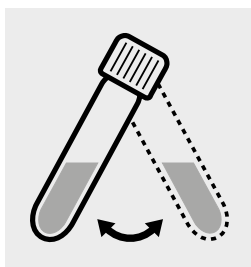
# COD

## Chemical Oxygen Demand

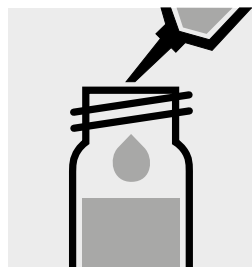
1.01797

Cell Test

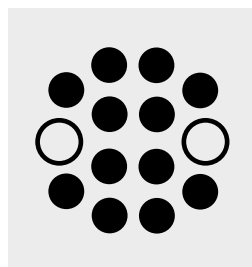
<b>Measuring</b>	5000 – 90000 mg/l COD or O <sub>2</sub>
<b>range:</b>	Expression of results also possible in mmol/l.



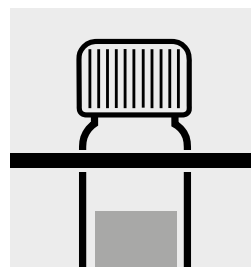
Suspend the bottom sediment in the cell by swirling.



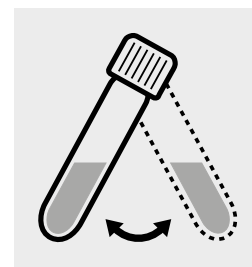
**Carefully** pipette 0.10 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**



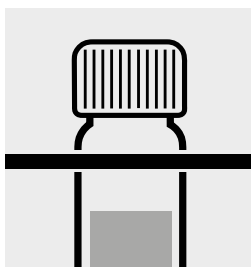
Heat the reaction cell in the thermoreactor at 148 °C for 2 hours.



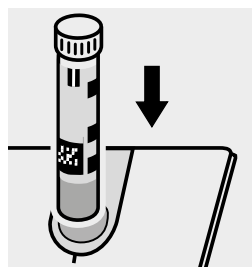
Remove the cell from the thermoreactor and place in a test-tube rack to cool.



Swirl the cell after 10 minutes.



Replace the cell in the rack for complete cooling to room temperature. **Very important!**



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Note:

To increase the accuracy is recommended to measure against an own prepared blank sample (reaction cell + COD-free water).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use the Standard solutions for photometric applications, Cat.Nos. 1.25034 and 1.25035.

# COD (Hg-free)

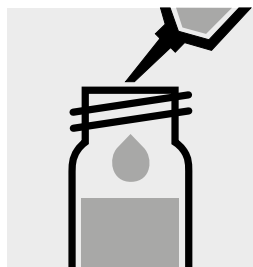
Chemical Oxygen Demand

1.09772

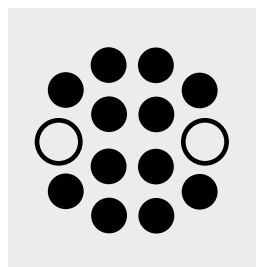
Cell Test

**Measuring** 10 – 150 mg/l COD or O<sub>2</sub>

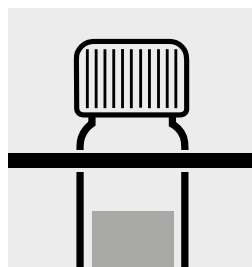
**range:** Expression of results also possible in mmol/l.



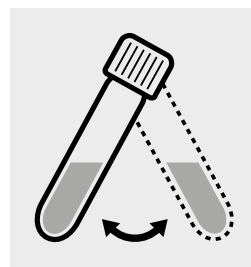
**Carefully** pipette 2.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**



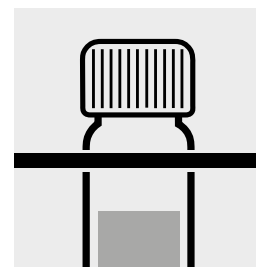
Heat the reaction cell in the thermoreactor at 148 °C for 2 hours.



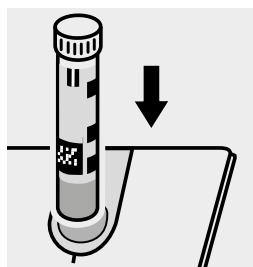
Remove the cell from the thermoreactor and place in a test-tube rack to cool.



Swirl the cell after 10 minutes.



Replace the cell in the rack for complete cooling to room temperature. **Very important!**



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Note:

To increase the accuracy is recommended to measure against an own prepared blank sample (reaction cell + COD-free water).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use the Standard solutions for photometric applications, Cat.Nos. 1.25028 and 1.25029.

# COD (Hg-free)

Chemical Oxygen Demand

1.09773

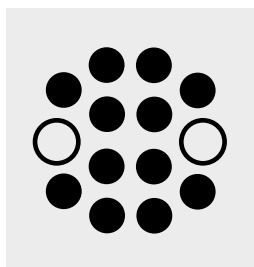
Cell Test

**Measuring** 100 – 1500 mg/l COD or O<sub>2</sub>

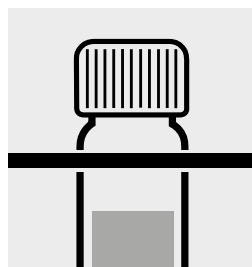
**range:** Expression of results also possible in mmol/l.



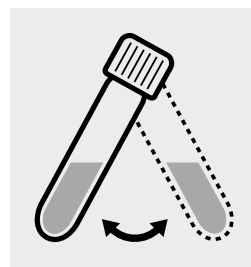
**Carefully** pipette 2.0 ml of the sample into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**



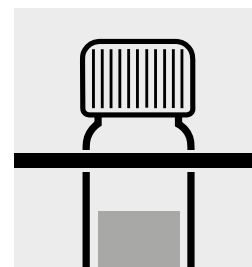
Heat the reaction cell in the thermoreactor at 148 °C for 2 hours.



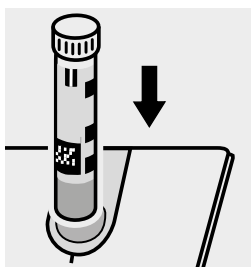
Remove the cell from the thermoreactor and place in a test-tube rack to cool.



Swirl the cell after 10 minutes.



Replace the cell in the rack for complete cooling to room temperature. **Very important!**



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Note:

To increase the accuracy is recommended to measure against an own prepared blank sample (reaction cell + COD-free water).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use the Standard solutions for photometric applications, Cat.Nos. 1.25029, 1.25030, 1.25031, and 1.25032.

# COD

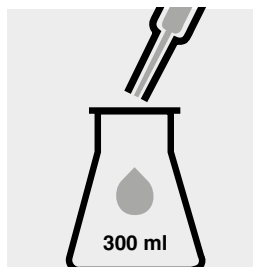
## Chemical Oxygen Demand for seawater / high chloride contents

1.17058

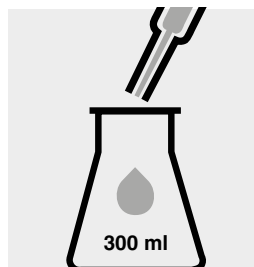
Cell Test

<b>Measuring</b>	5.0 – 60.0 mg/l COD or O <sub>2</sub>
<b>range:</b>	Expression of results also possible in mmol/l.

### Chloride depletion:



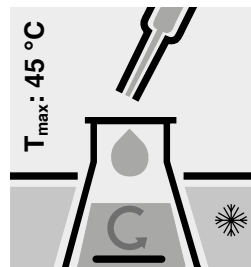
Pipette with glass pipette 20 ml of the sample into a 300-ml Erlenmeyer flask with NS 29/32.



Pipette with glass pipette 20 ml of distilled water (Water for chromatography LiChrosolv®, Cat.No. 1.15333, is recommended) into a second 300-ml Erlenmeyer flask with NS 29/32.



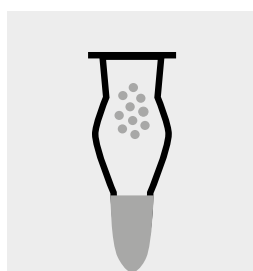
Add to each a magnetic stirring rod, and cool in the ice bath.



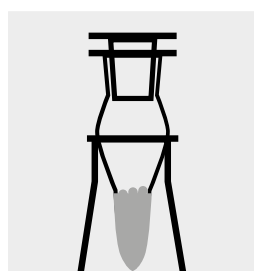
Add **slowly** to each Erlenmeyer flask 25 ml of **Sulfuric acid for the determination of COD** (Cat. No. 1.17048) with glass pipette **under cooling and stirring**.



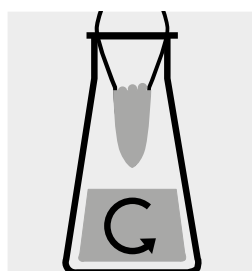
Cool both Erlenmeyer flasks to room temperature in the ice bath.



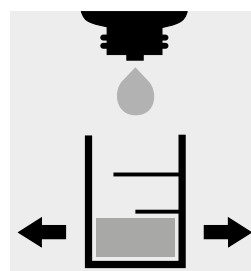
Fill 6 - 7 g each of **Sodalime with indicator** (Cat. No. 1.06733) into two absorption tubes (Cat. No. 1.15955).



Close the absorption tubes with the glass stoppers, and attach to the top of the Erlenmeyer flasks.



Stir at 250 rpm for 2 h at room temperature: depleted sample / depleted blank



Check the chloride content of the depleted sample using MQuant® Chloride Test (Cat. No. 1.11132) according to the application (see the website): Specified value <2000 mg/l Cl<sup>-</sup>.

### Chloride determination (acc. the application instructions - abridged version):

Fill 5.0 ml of sodium hydroxide solution 2 mol/l, Cat. No. 1.09136, into the test vessel of the MQuant® Chloride Test, Cat. No. 1.11132.

Carefully allow to run from the pipette 0.5 ml of depleted sample down the inside of the tilted test vessel onto the sodium hydroxide solution and mix (**Wear eye protection! The cell becomes hot!**).

Add 2 drops of reagent Cl-1 and swirl. The sample directly turns yellow in color. (Reagent Cl-2 is not required.)

Holding the reagent bottle vertically, slowly add reagent Cl-3 dropwise to the sample while swirling until its color changes from yellow to blue-violet. Shortly before the color changes, wait a few seconds after adding each drop.

**Result in mg/l chloride = number of drops x 250**



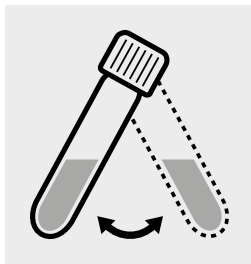
# COD

Chemical Oxygen Demand  
for seawater / high chloride contents

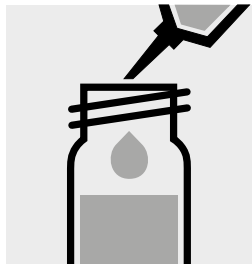
1.17058

Cell Test

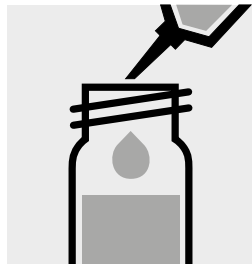
## Determination:



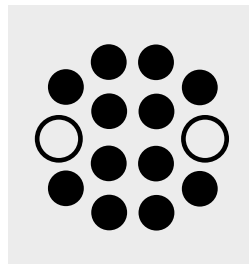
Suspend the bottom sediment in two cells by swirling.



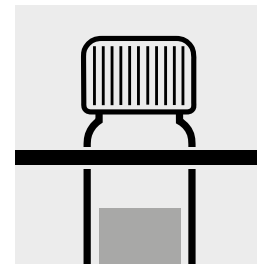
Carefully pipette 5.0 ml of the **depleted sample** into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**



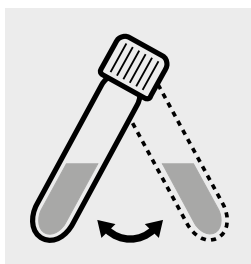
Carefully pipette 5.0 ml of the **depleted blank** into a second reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**  
(Blank cell)



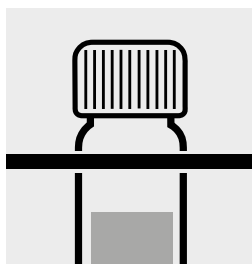
Heat both cells in the thermoreactor at 148 °C for 2 hours.



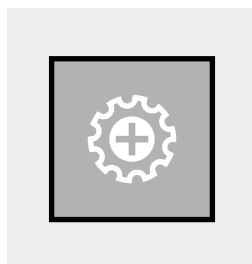
Remove both cells from the thermoreactor and place in a test-tube rack to cool.



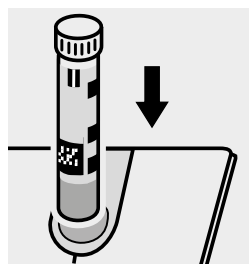
Swirl both cells after 10 minutes.



Replace both cells in the rack for complete cooling to room temperature. **(Very important!)**



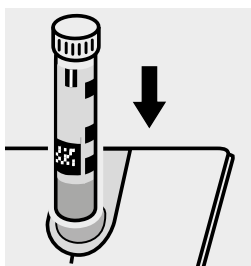
Tap the <Settings> button. Select "Reagent blank".



Place the blank cell into the cell compartment. Align the mark on the cell with that on the photometer.



Select "User RB". Confirm with <OK>.



Place the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a COD/chloride standard solution must be prepared from Potassium hydrogen phthalate, Cat.No. 1.02400 and Sodium chloride, Cat.No. 1.06406 (see section "Standard solutions").

# COD

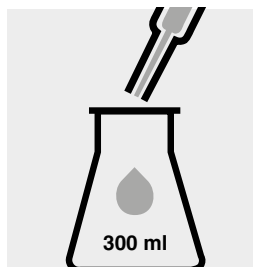
## Chemical Oxygen Demand for seawater / high chloride contents

1.17059

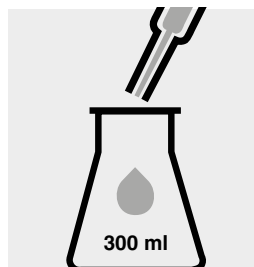
Cell Test

<b>Measuring</b>	50 – 3000 mg/l COD or O <sub>2</sub>
<b>range:</b>	Expression of results also possible in mmol/l.

### Chloride depletion:



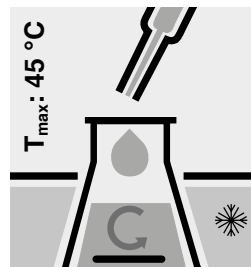
Pipette with glass pipette 20 ml of the sample into a 300-ml Erlenmeyer flask with NS 29/32.



Pipette with glass pipette 20 ml of distilled water (Water for chromatography LiChrosolv®, Cat.No. 1.15333, is recommended) into a second 300-ml Erlenmeyer flask with NS 29/32.



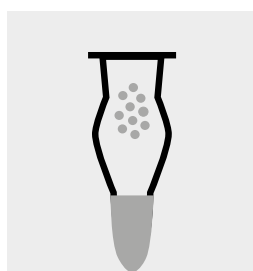
Add to each a magnetic stirring rod, and cool in the ice bath.



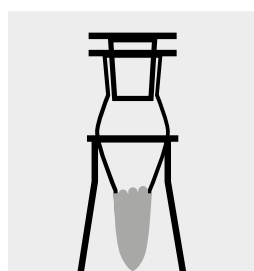
Add **slowly** to each Erlenmeyer flask 25 ml of **Sulfuric acid for the determination of COD** (Cat. No. 1.17048) with glass pipette **under cooling and stirring**.



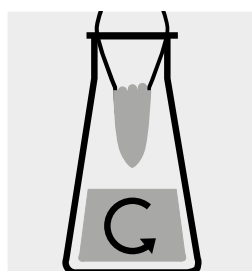
Cool both Erlenmeyer flasks to room temperature in the ice bath.



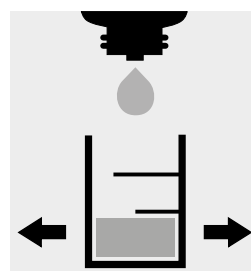
Fill 6 - 7 g each of **Sodalime with indicator** (Cat. No. 1.06733) into two absorption tubes (Cat. No. 1.15955).



Close the absorption tubes with the glass stoppers, and attach to the top of the Erlenmeyer flasks.



Stir at 250 rpm for 2 h at room temperature: depleted sample / depleted blank



Check the chloride content of the depleted sample using MQuant® Chloride Test (Cat. No. 1.11132) according to the application (see the website): specified value <250 mg/l Cl<sup>-</sup>.

### Chloride determination (acc. the application instructions - abridged version):

Fill 5.0 ml of sodium hydroxide solution 2 mol/l, Cat. No. 1.09136, into the test vessel of the MQuant® Chloride Test, Cat. No. 1.11132.

Carefully allow to run from the pipette 0.5 ml of depleted sample down the inside of the tilted test vessel onto the sodium hydroxide solution and mix (**Wear eye protection! The cell becomes hot!**).

Add 2 drops of reagent Cl-1 and swirl. The sample directly turns yellow in color. (Reagent Cl-2 is not required.)

Holding the reagent bottle vertically, slowly add reagent Cl-3 dropwise to the sample while swirling until its color changes from yellow to blue-violet. Shortly before the color changes, wait a few seconds after adding each drop.

**Result in mg/l chloride = number of drops x 250**

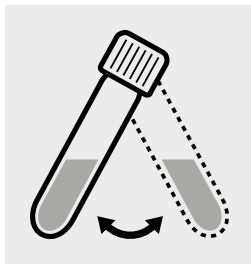
# COD

Chemical Oxygen Demand  
for seawater / high chloride contents

1.17059

Cell Test

## Determination:



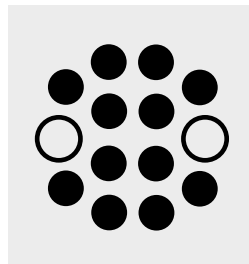
Suspend the bottom sediment in two cells by swirling.



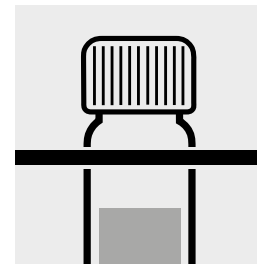
Carefully pipette 3.0 ml of the **depleted sample** into a reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**



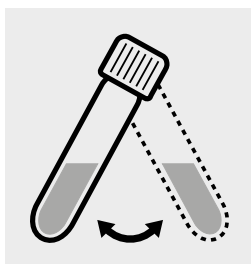
Carefully pipette 3.0 ml of the **depleted blank** into a second reaction cell, close tightly with the screw cap, and mix vigorously. **Caution, the cell becomes hot!**  
(Blank cell)



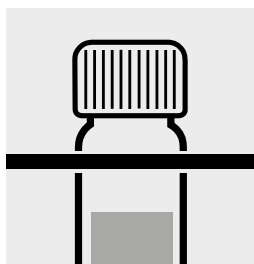
Heat both cells in the thermoreactor at 148 °C for 2 hours.



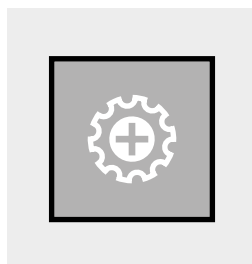
Remove both cells from the thermoreactor and place in a test-tube rack to cool.



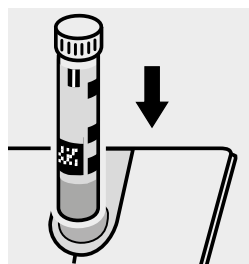
Swirl both cells after 10 minutes.



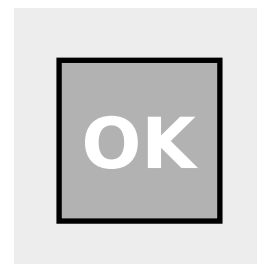
Replace both cells in the rack for complete cooling to room temperature. **(Very important!)**



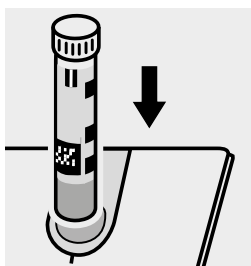
Tap the <Settings> button. Select "Reagent blank".



Place the blank cell into the cell compartment. Align the mark on the cell with that on the photometer.



Select "User RB". Confirm with <OK>.



Place the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

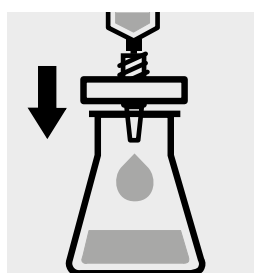
To check the measurement system (test reagents, measurement device, and handling) a COD/chloride standard solution must be prepared from Potassium hydrogen phthalate, Cat.No. 1.02400 and Sodium chloride, Cat.No. 1.06406 (see section "Standard solutions").

# Color

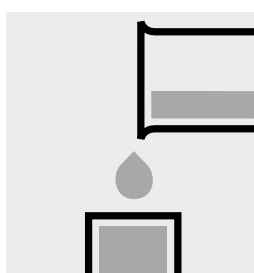
## (Spectral Absorption Coefficient)

analogous to **EN ISO 7887**

<b>Measuring range:</b>	1 – 250 m <sup>-1</sup>	436 nm	10-mm cell	Method No. 015 α(436)
	0.3 – 125.0 m <sup>-1</sup>	436 nm	20-mm cell	Method No. 015 α(436)
	0.1 – 50.0 m <sup>-1</sup>	436 nm	50-mm cell	Method No. 015 α(436)
	1 – 250 m <sup>-1</sup>	525 nm	10-mm cell	Method No. 061 α(525)
	0.3 – 125.0 m <sup>-1</sup>	525 nm	20-mm cell	Method No. 061 α(525)
	0.1 – 50.0 m <sup>-1</sup>	525 nm	50-mm cell	Method No. 061 α(525)
	1 – 250 m <sup>-1</sup>	620 nm	10-mm cell	Method No. 078 α(620)
	0.3 – 125.0 m <sup>-1</sup>	620 nm	20-mm cell	Method No. 078 α(620)
	0.1 – 50.0 m <sup>-1</sup>	620 nm	50-mm cell	Method No. 078 α(620)



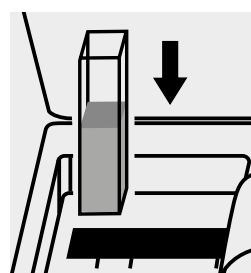
Filter sample solution through a membrane filter with 0.45 µm pore size.



Transfer the solution into a corresponding cell.



Select method no. **15**, **61**, or **78**.



Place the cell into the cell compartment. The measurement is performed automatically.

### Notes:

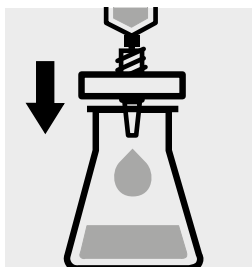
Filtered sample = true color.

Unfiltered sample = apparent color.

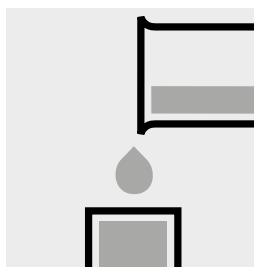
# Color

(True Color - 410 nm)  
analogous to **EN ISO 7887**

<b>Measuring range:</b>	10 – 2500 mg/l Pt	10 – 2500 mg/l Pt/Co	10 – 2500 CU	10-mm cell	Method No. 303
	5 – 1250 mg/l Pt	5 – 1250 mg/l Pt/Co	5 – 1250 CU	20-mm cell	Method No. 303
	2 – 500 mg/l Pt	2 – 500 mg/l Pt/Co	2 – 500 CU	50-mm cell	Method No. 303



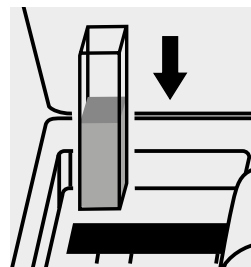
Filter sample solution through a membrane filter with 0.45 µm pore size.



Transfer the solution into a corresponding cell.



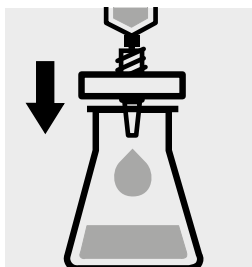
Select method no. **303**.



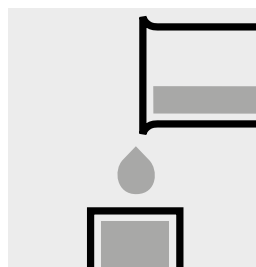
Place the cell into the cell compartment. The measurement is performed automatically.

# Color Hazen (Platinum-Cobalt Standard Method)

<b>Measuring range:</b>	1 – 500 mg/l Pt/Co	1 – 500 mg/l Pt	1 – 500 Hazen	1 – 500 CU	340 nm	10-mm cell
	1 – 250 mg/l Pt/Co	1 – 250 mg/l Pt	1 – 250 Hazen	1 – 250 CU	340 nm	20-mm cell
	0.2 – 100.0 mg/l Pt/Co	0.2 – 100.0 mg/l Pt	0.2 – 100.0 Hazen	0.2 – 100.0 CU	340 nm	50-mm cell



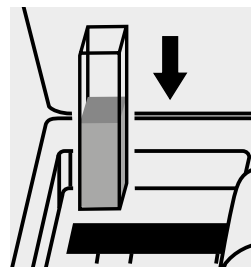
Filter sample solution through a membrane filter with 0.45 µm pore size.



Transfer the solution into a corresponding cell.



Select method no. **32**.



Place the cell into the cell compartment. The measurement is performed automatically.

**Notes:**

Filtered sample = true color.  
Unfiltered sample = apparent color.

**Quality assurance:**

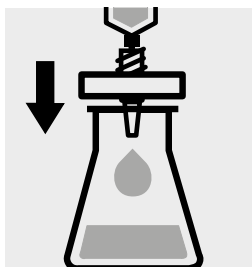
To check the measurement system (measurement device, handling) ready-to-use Platinum Cobalt Color Reference Solution (Hazen 500) Certipur®, Cat.No. 1.00246, concentration 500 mg/l Pt, can be used after diluting accordingly.

# Color Hazen (Platinum-Cobalt Standard Method)

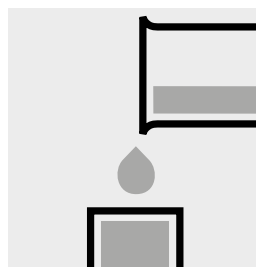
analogous to APHA 2120C, EN ISO 6271-2, Water Research Vol. 30, No. 11, 2771-2775, 1996

<b>Measuring range:</b>	1–1000 mg/l Pt/Co	1–1000 mg/l Pt	1–1000 Hazen	1–1000 CU	445 nm	50-mm cell	Method No. 179*
	1–1000 mg/l Pt/Co	1–1000 mg/l Pt	1–1000 Hazen	1–1000 CU	455 nm	50-mm cell	Method No. 180
	1–1000 mg/l Pt/Co	1–1000 mg/l Pt	1–1000 Hazen	1–1000 CU	465 nm	50-mm cell	Method No. 181

\* not analogous to APHA 2120C



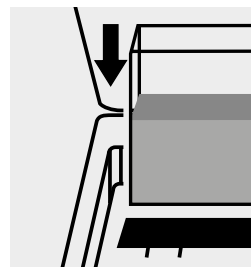
Filter sample solution through a membrane filter with 0.45 µm pore size.



Transfer the solution into the cell.



Select method no. **179**, **180**, or **181**.



Place the cell into the cell compartment. The measurement is performed automatically.

#### Notes:

Filtered sample = true color.

Unfiltered sample =

apparent color.

#### Quality assurance:

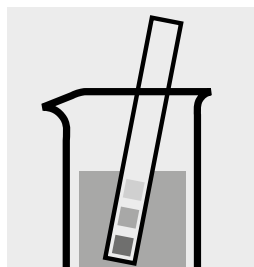
To check the measurement system (measurement device, handling) ready-to-use Platinum Cobalt Color Reference Solution (Hazen 500) Certipur®, Cat.No. 1.00246, concentration 500 mg/l Pt, can be used.

# Copper

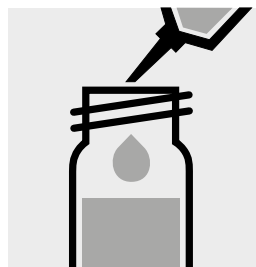
1.14553

Cell Test

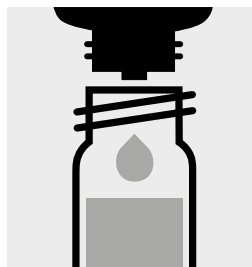
<b>Measuring</b>	0.05 – 8.00 mg/l Cu
<b>range:</b>	Expression of results also possible in mmol/l.



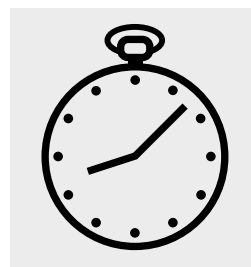
Check the pH of the sample, specified range: pH 4 – 10. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



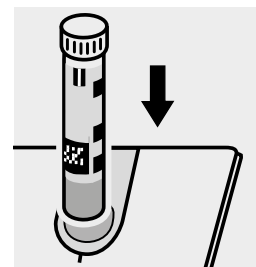
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 5 drops of **Cu-1K**, close the cell with the screw cap, and mix.



Reaction time:  
5 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Important:

Very high copper concentrations in the sample produce turquoise-colored solutions (measurement solution should be blue) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

For the determination of **total copper** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687 and thermoreactor is necessary.

Result can be expressed as sum of copper ( $\Sigma$  Cu).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 90, Cat.No. 1.18700.

Ready-to-use copper standard solution Certipur®, Cat.No. 1.19786, concentration 1000 mg/l Cu, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 90) is highly recommended.

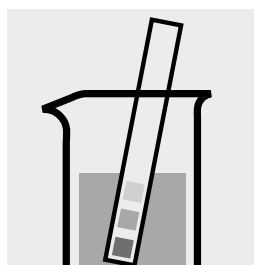


# Copper

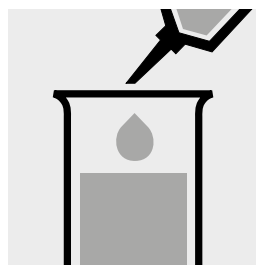
1.14767

Test

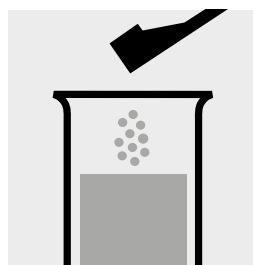
<b>Measuring</b>	0.10 – 6.00 mg/l Cu	10-mm cell
<b>range:</b>	0.05 – 3.00 mg/l Cu	20-mm cell
	0.02 – 1.20 mg/l Cu	50-mm cell
Expression of results also possible in mmol/l.		



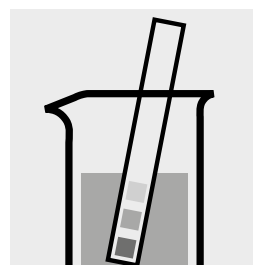
Check the pH of the sample, specified range: pH 4 – 10. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



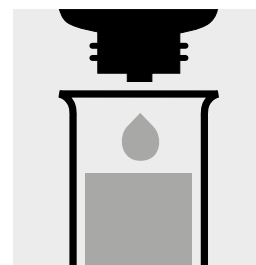
Pipette 5.0 ml of the sample into a test tube.



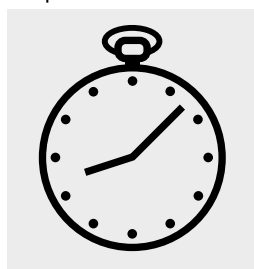
Add 1 green dosing spoon of **Cu-1** and dissolve the solid substance.



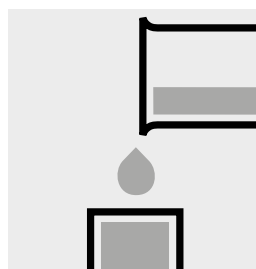
Check the pH, specified range: pH 7.0 – 9.5. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



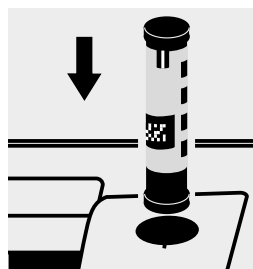
Add 5 drops of **Cu-2** and mix.



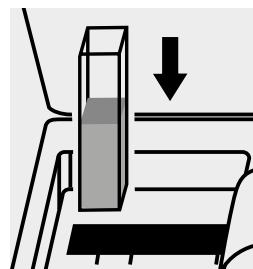
Reaction time: 5 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

Very high copper concentrations in the sample produce turquoise-colored solutions (measurement solution should be blue) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

For the determination of **total copper** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687 and thermoreactor is necessary.

Result can be expressed as sum of copper ( $\Sigma$  Cu).

To measure in the 50-mm cell, only the sample volume has to be doubled. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 90, Cat.No. 1.18700.

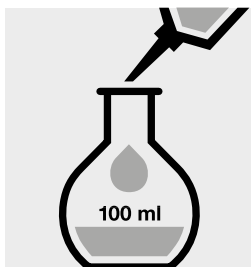
Ready-to-use copper standard solution Certipur®, Cat.No. 1.19786, concentration 1000 mg/l Cu, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 90) is highly recommended.

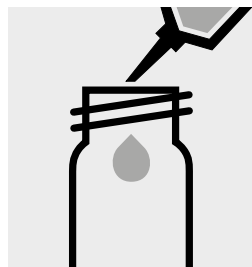
# Copper in electroplating baths

## Inherent color

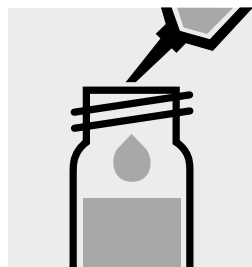
<b>Measuring range:</b>	10.0 – 80.0 g/l Cu	10-mm cell	Method No. 83
	5.0 – 40.0 g/l Cu	20-mm cell	Method No. 83
	2.0 – 16.0 g/l Cu	50-mm cell	Method No. 83



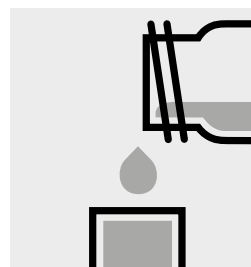
Pipette 25 ml of the sample into a 100-ml volumetric flask, fill to the mark with distilled water and mix thoroughly.



Pipette 5.0 ml of the 1:4 dilute sample into an empty round cell (Empty cells, Cat.No. 1.14724).



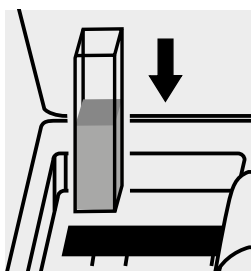
Add 5.0 ml of **sulfuric acid 40 %**, close the cell with the screw cap, and mix.



Transfer the solution into a corresponding cell.



Select method no. **83**.



Place the cell into the cell compartment. The measurement is performed automatically.

# Cyanide

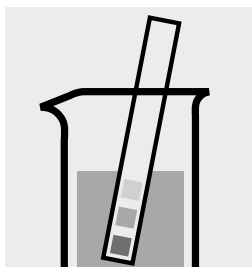
1.02531

## Determination of free cyanide

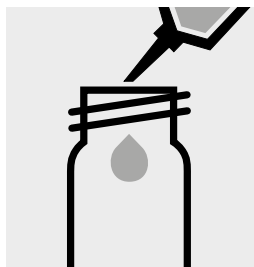
Cell Test

**Measuring** 0.010 – 0.500 mg/l CN

**range:** Expression of results also possible in mmol/l and cyanide free [CN(f)].



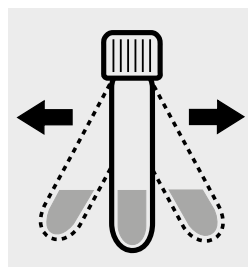
Check the pH of the sample, specified range: pH 4.5 – 8.0. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and dissolve the solid substance.



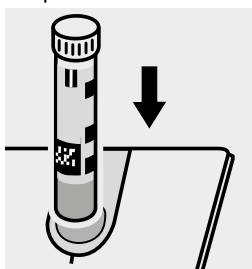
Add 1 level blue microspoon of **CN-1K**, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 10 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use cyanide standard solution Certipur®, Cat.No. 1.19533, concentration 1000 mg/l CN<sup>-</sup>, can be used after diluting accordingly.

# Cyanide

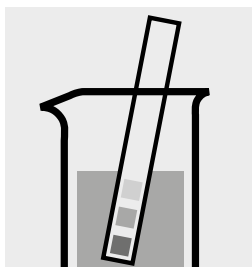
1.14561

## Determination of free cyanide

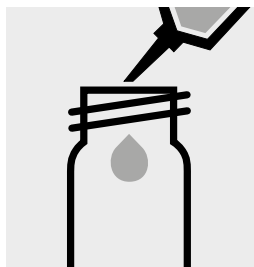
Cell Test

**Measuring** 0.010 – 0.500 mg/l CN

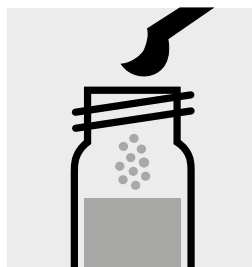
**range:** Expression of results also possible in mmol/l and cyanide free [CN(f)].



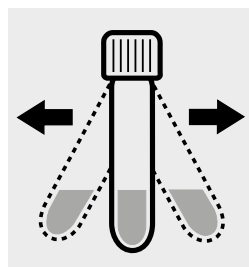
Check the pH of the sample, specified range: pH 4.5 – 8.0. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and dissolve the solid substance.



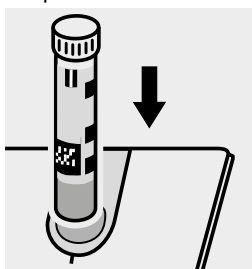
Add 1 level blue microspoon of **CN-3K**, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 10 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use cyanide standard solution Certipur®, Cat.No. 1.19533, concentration 1000 mg/l CN<sup>-</sup>, can be used after diluting accordingly.

# Cyanide

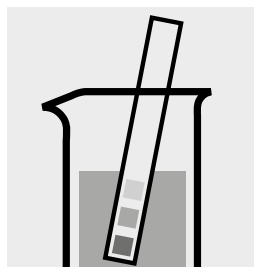
1.14561

## Determination of readily liberated cyanide

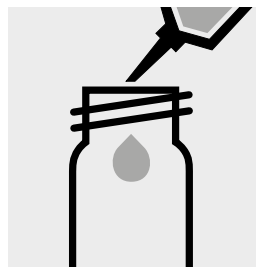
Cell Test

**Measuring** 0.010 – 0.500 mg/l CN

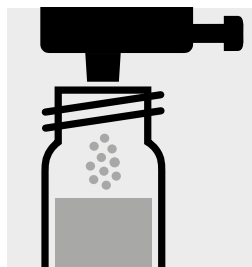
**range:** Expression of results also possible in mmol/l and cyanide readily liberated [CN(v)].



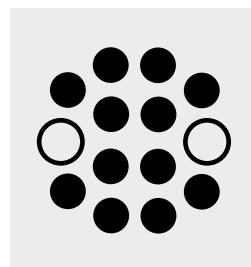
Check the pH of the sample, specified range: pH 4.5 – 8.0. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



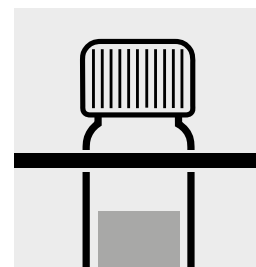
Pipette 10 ml of the sample into an empty round cell (Empty cells, Cat.No. 1.14724).



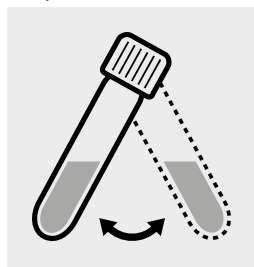
Add 1 dose of **CN-1K** using the green dose-metering cap, close the cell with the screw cap.



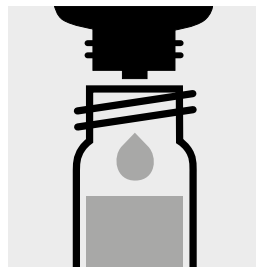
Heat the cell in the thermoreactor at 120 °C for 30 minutes.



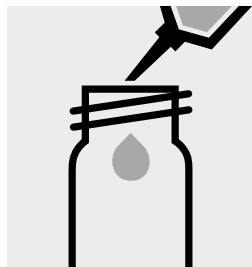
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature.



Swirl the cell before opening.



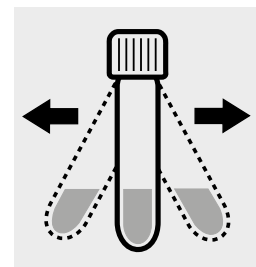
Add 3 drops of **CN-2K**, close with the screw cap, and mix: **pretreated sample**.



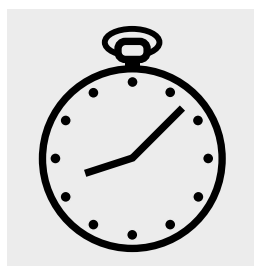
Pipette 5.0 ml of the **pretreated sample** into a reaction cell, close with the screw cap, and dissolve the solid substance.



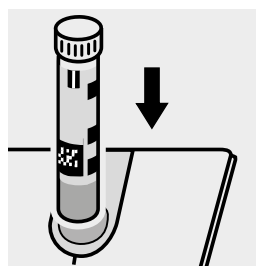
Add 1 level blue micro-spoon of **CN-3K**, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 10 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use cyanide standard solution Certipur®, Cat.No. 1.19533, concentration 1000 mg/l CN<sup>-</sup>, can be used after diluting accordingly.

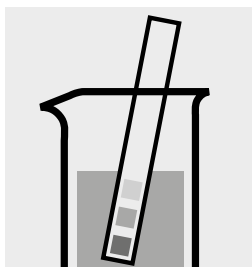
# Cyanide

1.09701

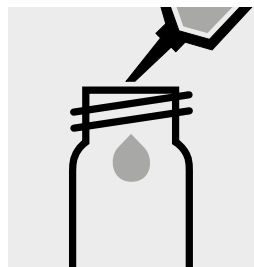
## Determination of free cyanide

Test

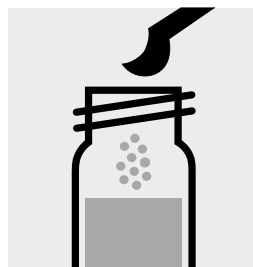
<b>Measuring</b>	0.010 – 0.500 mg/l CN	10-mm cell
<b>range:</b>	0.005 – 0.250 mg/l CN	20-mm cell
	0.0020 – 0.1000 mg/l CN	50-mm cell
Expression of results also possible in mmol/l and cyanide free [CN(f)].		



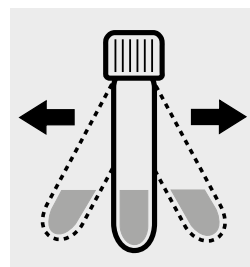
Check the pH of the sample, specified range: pH 4.5 – 8.0. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into an empty round cell (Empty cells, Cat.No. 1.14724).



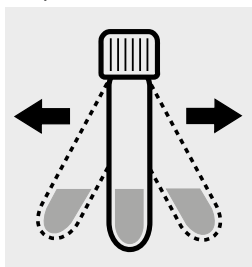
Add 1 level green micro-spoon of **CN-3**, close the cell with the screw cap.



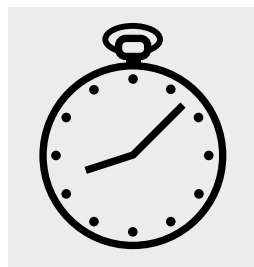
Shake the cell vigorously to dissolve the solid substance.



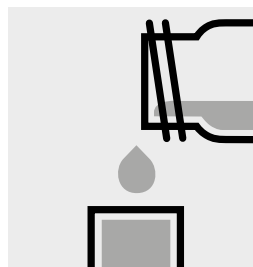
Add 1 level blue micro-spoon of **CN-4**, close the cell with the screw cap.



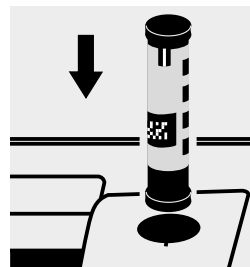
Shake the cell vigorously to dissolve the solid substance.



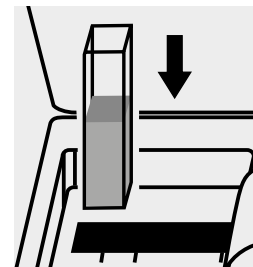
Reaction time: 10 minutes



Transfer the solution into a corresponding rectangular cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

### Note:

Empty cells with screw caps, Cat.No. 1.14724 are recommended for the preparation. These cells can be sealed with the screw caps, thus preventing any gas losses.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use cyanide standard solution Certipur®, Cat.No. 1.19533, concentration 1000 mg/l CN<sup>-</sup>, can be used after diluting accordingly.

### Important:

To measure in the 50-mm cell, the sample volume and the volume of the reagents CN-3 and CN-4 have to be doubled for each. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

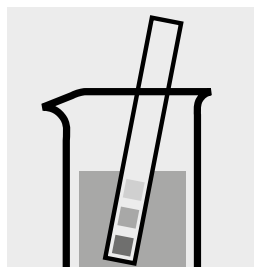
# Cyanide

1.09701

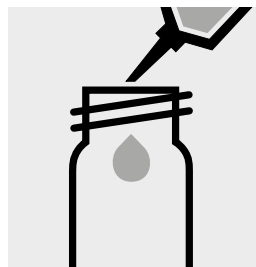
## Determination of readily liberated cyanide

Test

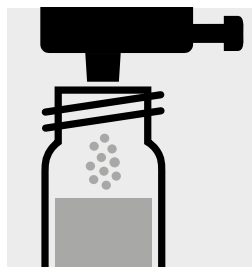
<b>Measuring</b>	0.010 – 0.500 mg/l CN	10-mm cell
<b>range:</b>	0.005 – 0.250 mg/l CN	20-mm cell
	0.0020 – 0.1000 mg/l CN	50-mm cell
Expression of results also possible in mmol/l and cyanide readily liberated [CN(v)].		



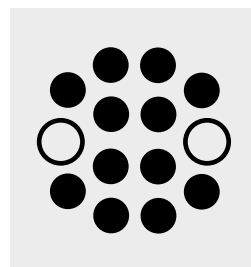
Check the pH of the sample, specified range: pH 4.5 – 8.0. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



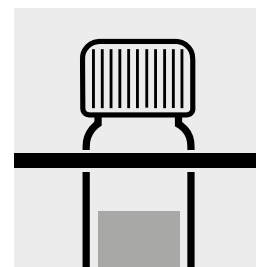
Add 10 ml of the sample into an empty round cell (Empty cells, Cat.No. 1.14724).



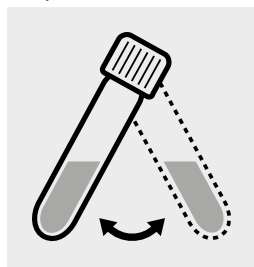
Add 1 dose of **CN-1** using the green dosing cap, close the cell with the screw cap.



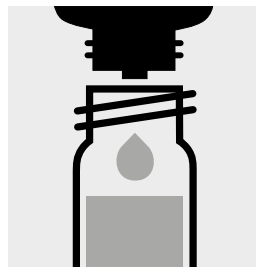
Heat the cell in the thermoreactor at 120 °C for 30 minutes.



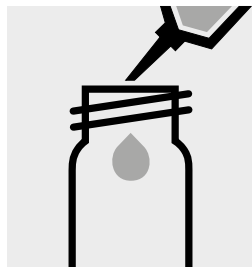
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature.



Swirl the cell before opening.



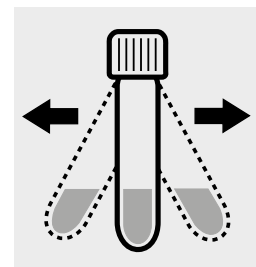
Add 3 drops of **CN-2**, close with the screw cap, and mix: **pretreated sample**.



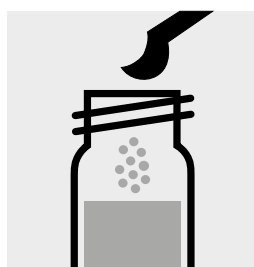
Pipette 5.0 ml of the **pretreated sample** into an empty round cell (Empty cells, Cat.No. 1.14724).



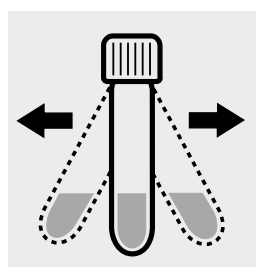
Add 1 level green microspoon of **CN-3**, close the cell with the screw cap.



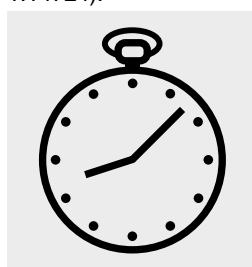
Shake the cell vigorously to dissolve the solid substance.



Add 1 level blue microspoon of **CN-4**, close the cell with the screw cap.



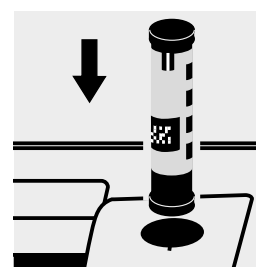
Shake the cell vigorously to dissolve the solid substance.



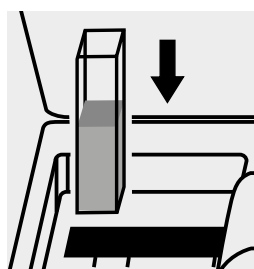
Reaction time: 10 minutes



Transfer the solution into a corresponding rectangular cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

### Note:

Empty cells with screw caps, Cat.No. 1.14724 are recommended for the preparation. These cells can be sealed with the screw caps, thus preventing any gas losses.

### Important:

To measure in the 50-mm cell, the sample volume and the volume of the reagents CN-3 and CN-4 have to be doubled for each. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

### Quality assurance:

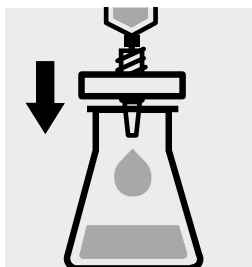
To check the measurement system (test reagents, measurement device, and handling) ready-to-use cyanide standard solution Certipur®, Cat.No. 1.19533, concentration 1000 mg/l CN<sup>-</sup>, can be used after diluting accordingly.

# Cyanuric Acid

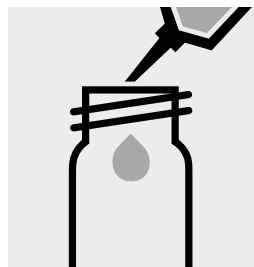
1.19253

Test

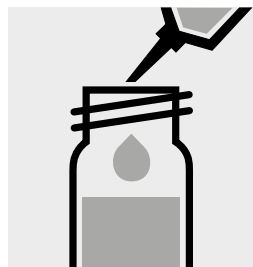
**Measuring** 2 – 160 mg/l cyanuric acid 20-mm cell  
**range:** Expression of results also possible in mmol/l.



Filter turbid samples.



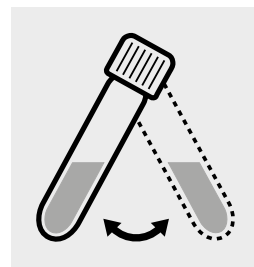
Pipette 5.0 ml of the sample into an empty test tube (e.g. flat-bottomed tubes, Cat.No. 1.14902).



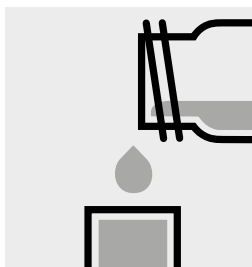
Add **5.0 ml of distilled water** (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) with pipette, close with the screw cap, and mix.



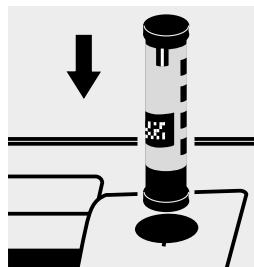
Add 1 **reagent tablet Cyanuric Acid**, crush with stirring rod, and close with the screw cap.



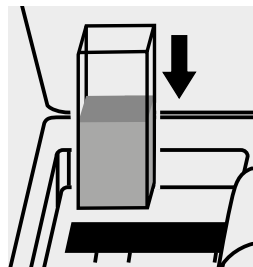
Swirl the cell to dissolve the solid substance.



Transfer the solution into a rectangular cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a cyanuric acid standard solution must be prepared from Cyanuric acid, Cat.No. 8.20358 (see section "Standard solutions").



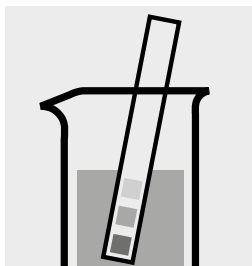
# Fluoride

1.00809

Cell Test

<b>Measuring range:</b>	0.10 – 1.80 mg/l F	Round cell
<b>range:</b>	0.025 – 0.500 mg/l F	50-mm cell
Expression of results also possible in mmol/l.		

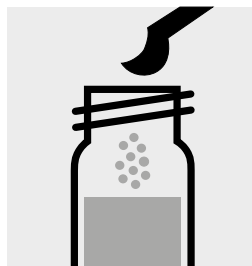
## Measuring range: 0.10 – 1.80 mg/l F



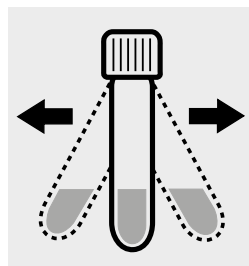
Check the pH of the sample, specified range: pH 3 – 8. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



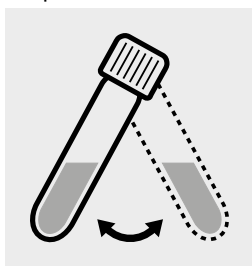
Add 1 level blue micro-spoon of **F-1K**, close the cell with the screw cap.



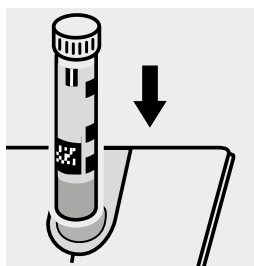
Shake the cell vigorously to dissolve the solid substance.



Reaction time: 15 minutes

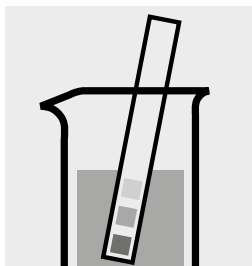


Swirl the cell before measurement.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

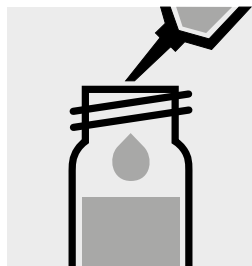
Measuring range: 0.025 – 0.500 mg/l F



Check the pH of the sample, specified range: pH 3 – 8. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Select method no. 216.



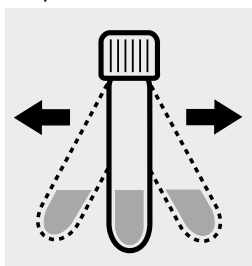
Pipette 10 ml of the sample into a reaction cell, close with the screw cap, and mix.



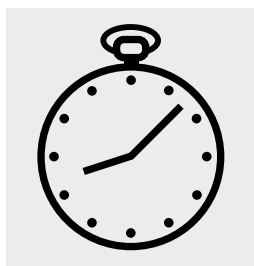
Pipette 10 ml of distilled water into a second reaction cell, close with the screw cap, and mix. (Blank)



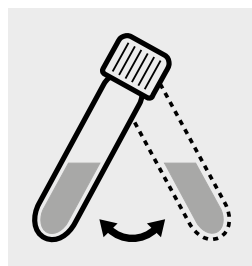
Add 1 level blue micro-spoon of F-1K to each cell, close with the screw cap.



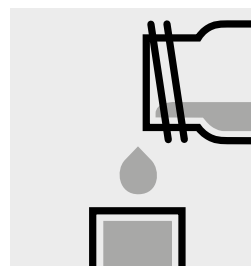
Shake both cells vigorously to dissolve the solid substance.



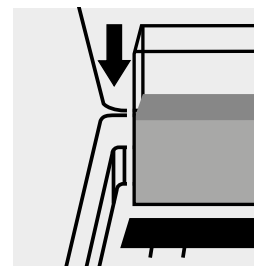
Reaction time: 15 minutes



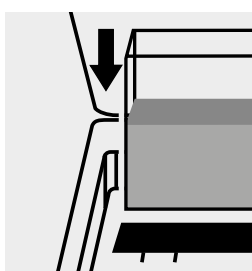
Swirl the cells.



Transfer both solutions into two separate 50-mm-cells.



Place the blank cell into the cell compartment.



Place the cell containing the sample into the cell compartment.

### Important:

Very high fluoride concentrations in the sample produce brown-colored solutions (measurement solution should be violet) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use fluoride standard solution Certipur®, Cat.No. 1.19814, concentration 1000 mg/l F<sup>-</sup>, can be used after diluting accordingly as well as the Standard solutions for photometric applications, Cat.Nos. 1.32233, 1.32234, 1.32235, and 1.32236.

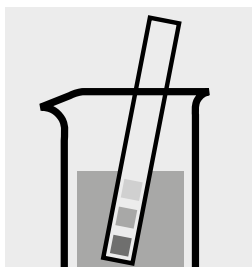
# Fluoride

1.17243

Cell Test

**Measuring** 0.10 – 2.50 mg/l F

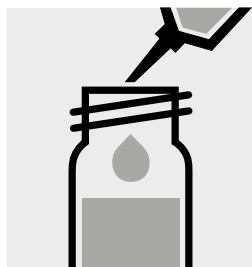
**range:** Expression of results also possible in mmol/l.



Check the pH of the sample, specified range: pH 2 – 12. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



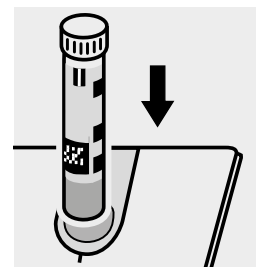
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



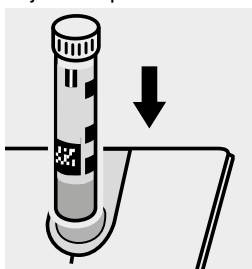
Pipette 5.0 ml of distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) into a second reaction cell, close with the screw cap, and mix. (Blank)



Reaction time:  
1 minute



Place the blank cell into the cell compartment. Align the mark on the cell with that on the photometer.



Place the cell containing the sample into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use fluoride standard solution Certipur®, Cat.No. 1.19814, concentration 1000 mg/l F<sup>-</sup>, can be used after diluting accordingly as well as the Standard solutions for photometric applications, Cat.Nos. 1.32233, 1.32234, 1.32235, and 1.32236.

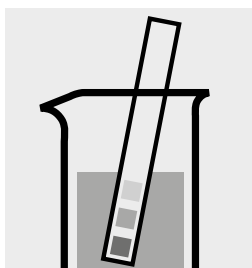
# Fluoride

1.14598

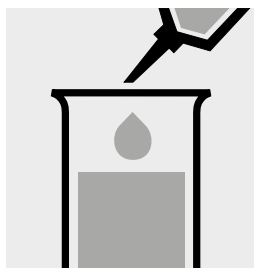
Test

Measuring range: 0.10 – 2.00 mg/l F	10-mm cell
1.0 – 20.0 mg/l F	10-mm cell
Expression of results also possible in mmol/l.	

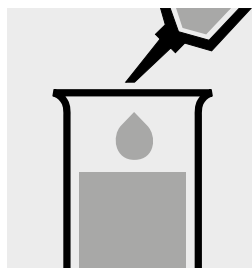
## Measuring range: 0.10 – 2.00 mg/l F



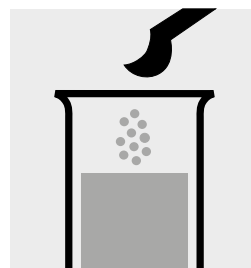
Check the pH of the sample, specified range: pH 3 – 8.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



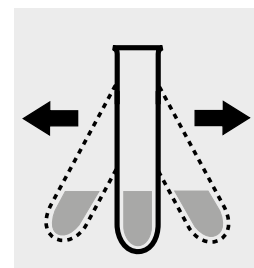
Pipette 2.0 ml of F-1 into a test tube.



Add 5.0 ml of the sample with pipette and mix.



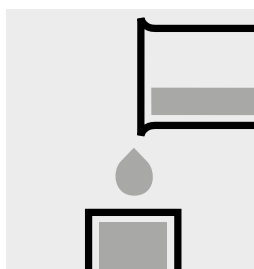
Add 1 level microspoon of F-2 and mix.



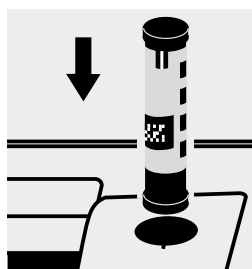
Shake the test tube vigorously to dissolve the solid substance.



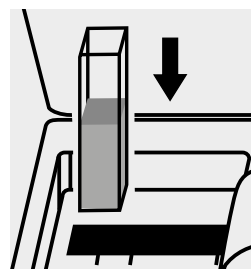
Reaction time: 5 minutes



Transfer the solution into a cell.

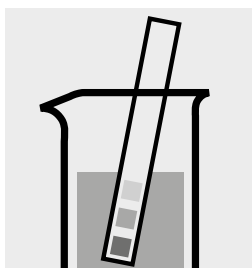


Select method with AutoSelector measuring range 0.10 – 2.00 mg/l F.

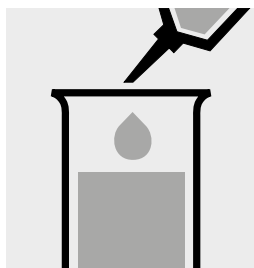


Place the cell into the cell compartment.

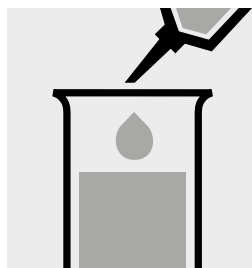
Measuring range: 1.0 – 20.0 mg/l F



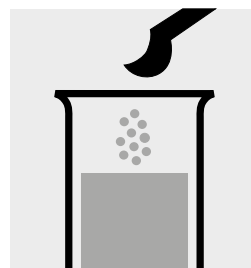
Check the pH of the sample, specified range: pH 3 – 8.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



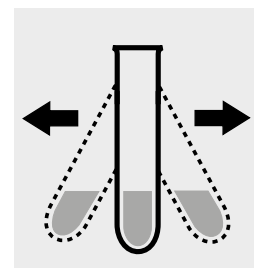
Pipette 2.0 ml of F-1 into a test tube.



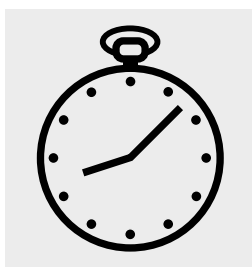
Add 5.0 ml of water and 0.5 ml of the sample with pipette and mix.



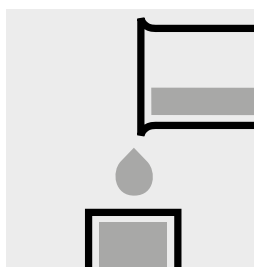
Add 1 level microspoon of F-2 and mix.



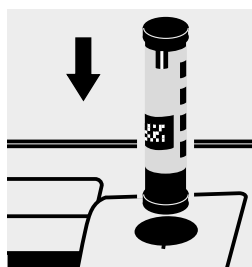
Shake the test tube vigorously to dissolve the solid substance.



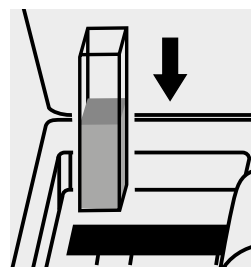
Reaction time: 5 minutes



Transfer the solution into a cell.



Select method with AutoSelector measuring range 1.0 – 20.0 mg/l F.



Place the cell into the cell compartment.

### Important:

Very high fluoride concentrations in the sample produce brown-colored solutions (measurement solution should be violet) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use fluoride standard solution Certipur®, Cat.No. 1.19814, concentration 1000 mg/l F<sup>-</sup>, can be used after diluting accordingly as well as the Standard solutions for photometric applications, Cat.Nos. 1.32233, 1.32234, 1.32235, and 1.32236.

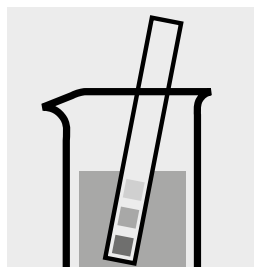
# Fluoride

1.00822

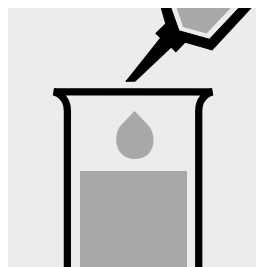
Test

**Measuring range:** 0.02 – 2.00 mg/l F 50-mm semi-microcell, Cat. No. 1.73502

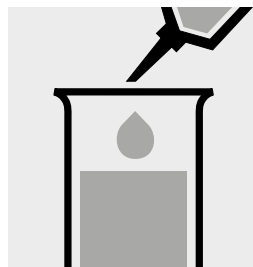
Expression of results also possible in mmol/l.



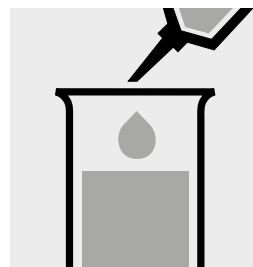
Check the pH of the sample, specified range: pH 1 – 10. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a test tube.



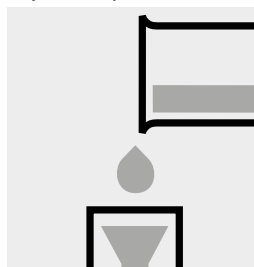
Pipette 5.0 ml of distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) into a second test tube. (Blank)



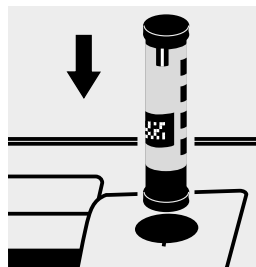
Add to each tube 1.0 ml of F-1 with pipette and mix.



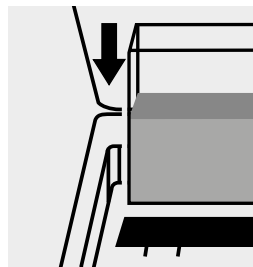
Reaction time: 1 minute



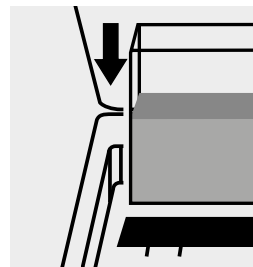
Transfer both solutions into a separate **semi-microcell**.



Select method with AutoSelector.



Place the blank cell into the cell compartment.



Place the cell containing the sample into the cell compartment.

## Important:

For measurement in the 50-mm **rectangular cell**, **Cat. No. 1.14944**, the sample volume and the volume of the reagent must be doubled for each.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use fluoride standard solution Certipur®, Cat.No. 1.19814, concentration 1000 mg/l F<sup>-</sup>, can be used after diluting accordingly as well as the Standard solutions for photometric applications, Cat.Nos. 1.32233, 1.32234, 1.32235, and 1.32236.

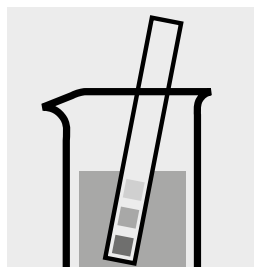
# Fluoride

1.17236

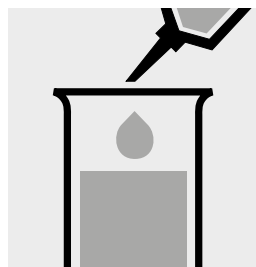
Test

**Measuring range:** 0.02 – 2.00 mg/l F 50-mm semi-microcell, Cat. No. 1.73502

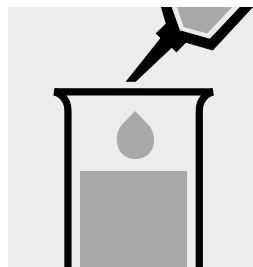
Expression of results also possible in mmol/l.



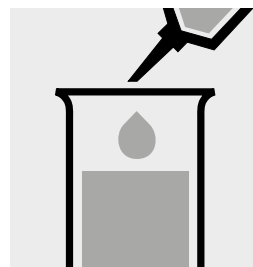
Check the pH of the sample, specified range: pH 2 – 12. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a test tube.



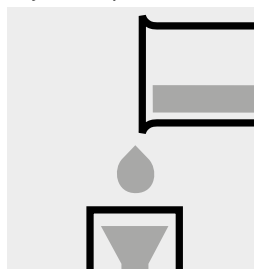
Pipette 5.0 ml of distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) into a second test tube. (Blank)



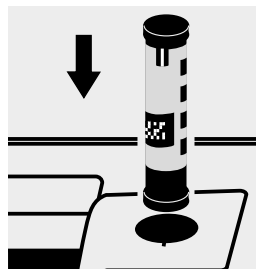
Add to each tube 1.0 ml of F-1 with pipette and mix.



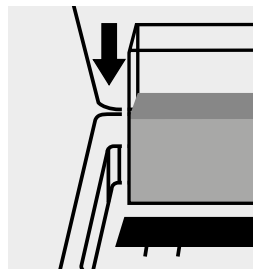
Reaction time: 1 minute



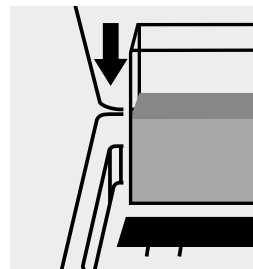
Transfer both solutions into a separate **semi-microcell**.



Select method with AutoSelector.



Place the blank cell into the cell compartment.



Place the cell containing the sample into the cell compartment.

## Important:

For measurement in the 50-mm **rectangular cell**, **Cat. No. 1.14944**, the sample volume and the volume of the reagent must be doubled for each.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use fluoride standard solution Certipur®, Cat.No. 1.19814, concentration 1000 mg/l F<sup>-</sup>, can be used after diluting accordingly as well as the Standard solutions for photometric applications, Cat.Nos. 1.32233, 1.32234, 1.32235, and 1.32236.

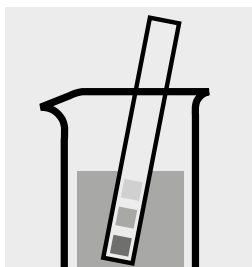
# Formaldehyde

1.14500

Cell Test

**Measuring** 0.10 – 8.00 mg/l HCHO

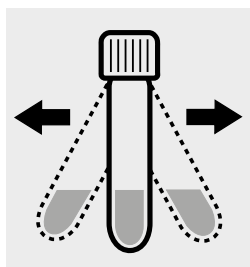
**range:** Expression of results also possible in mmol/l.



Check the pH of the sample, specified range: pH 0 – 13.



Add 1 level green micro-**spoon** of **HCHO-1K** into a reaction cell, close with the screw cap.



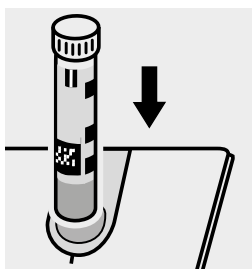
Shake the cell vigorously to dissolve the solid substance.



Add 2.0 ml of the sample with pipette, close the cell with the screw cap, and mix. **Caution, cell becomes hot!**



Reaction time: 5 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Important:

Very high formaldehyde concentrations (exceeding 1000 mg/l) in the sample yield false readings. In such cases the sample must be diluted (plausibility check).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a formaldehyde standard solution must be prepared from Formaldehyde solution 37%, Cat.No. 1.04003 (see section "Standard solutions").

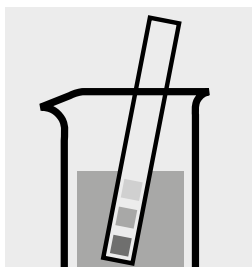


# Formaldehyde

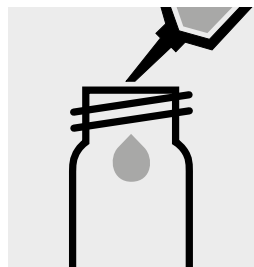
1.14678

Test

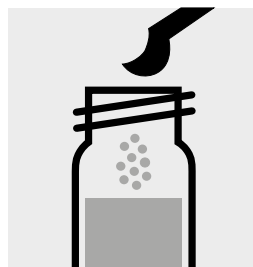
<b>Measuring</b>	0.10 – 8.00 mg/l HCHO	10-mm cell
<b>range:</b>	0.05 – 4.00 mg/l HCHO	20-mm cell
	0.02 – 1.50 mg/l HCHO	50-mm cell
	Expression of results also possible in mmol/l.	



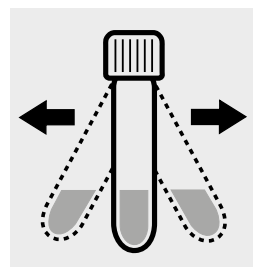
Check the pH of the sample, specified range: pH 0 – 13.



Pipette 4.5 ml of **HCHO-1** into an empty round cell (Empty cells, Cat.No. 1.14724).



Add 1 level green micro-spoon of **HCHO-2**, close the cell with the screw cap.



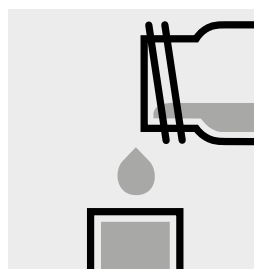
Shake the cell vigorously to dissolve the solid substance.



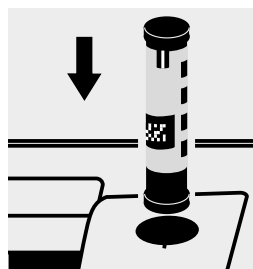
Add 3.0 ml of the sample with pipette, close the cell with the screw cap, and mix. **Caution, cell becomes hot!**



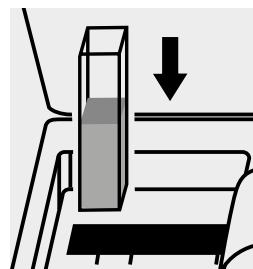
Reaction time: 5 minutes



Transfer the solution into a corresponding rectangular cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Note:

Empty cells with screw caps, Cat.No. 1.14724 are recommended for the preparation. These cells can be sealed with the screw caps, thus enabling a hazard-free mixing of the sample.

## Important:

Very high formaldehyde concentrations (exceeding 1000 mg/l) in the sample yield false readings. In such cases the sample must be diluted (plausibility check).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a formaldehyde standard solution must be prepared from Formaldehyde solution 37%, Cat.No. 1.04003 (see section "Standard solutions").

# Gardner Color Measurement

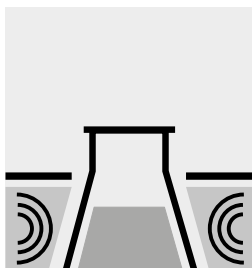
Application

analogous to **ASTM D6166** and **EN ISO 4630-2**

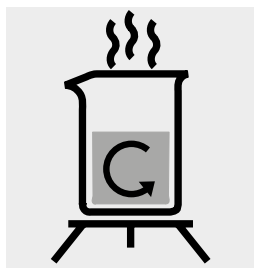
**Measuring range:** 1.0 – 18.0 Gardner Color    10-mm cell    Method No. 2561

**Attention!** Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended. This zero value remains valid until the method is exited.

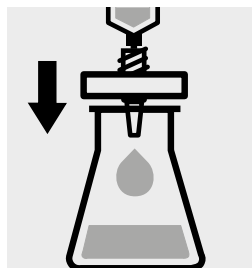
## Preparation:



Contains the sample air or gas bubbles: degassing in ultrasonic bath.



Melt solid samples and homogenize.

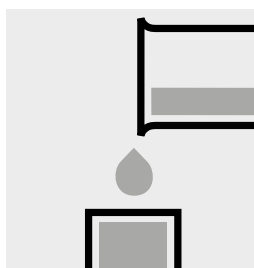


Filter or centrifuge turbid samples.

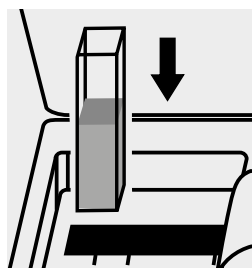
## Determination:



Select method no. **2561**. Perform the zero adjustment and confirm by pressing the <OK> button.



Transfer the solution into the cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. Gardner Color is shown in the display.



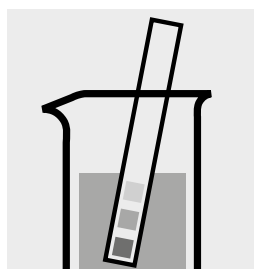
Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

# Gold

1.14821

Test

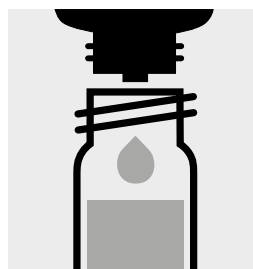
<b>Measuring</b>	0.5 – 12.0 mg/l Au	10-mm cell
<b>range:</b>	Expression of results also possible in mmol/l.	



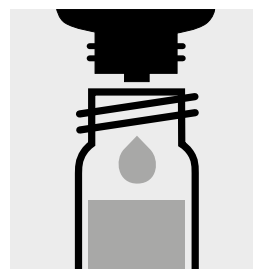
Check the pH of the sample, specified range: pH 1 – 9. If required, add dilute hydrochloric acid drop by drop to adjust the pH.



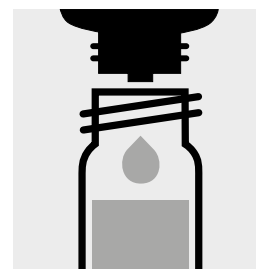
Pipette 2.0 ml of the sample into a test tube with screw cap.



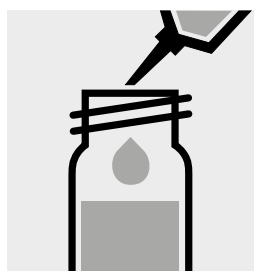
Add 2 drops of **Au-1** and mix.



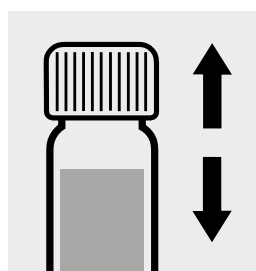
Add 4 drops of **Au-2** and mix.



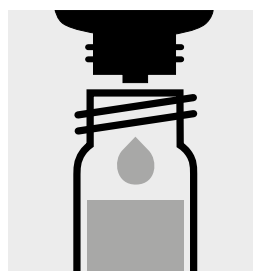
Add 6 drops of **Au-3** and mix.



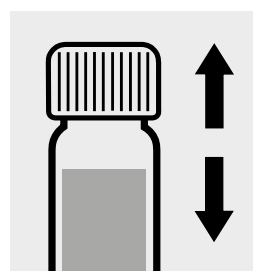
Add 6.0 ml of **Au-4** with pipette, close with the screw cap.



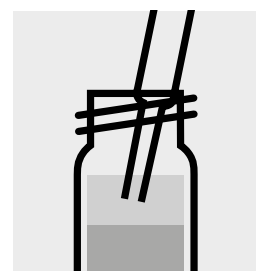
Shake the tube vigorously for 1 minute.



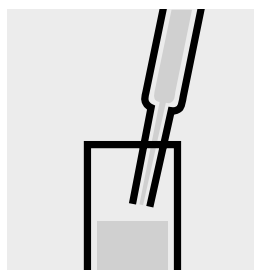
Add 6 drops of **Au-5**, close with the screw cap.



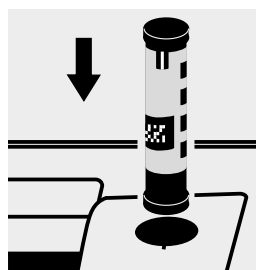
Shake the tube vigorously for 1 minute.



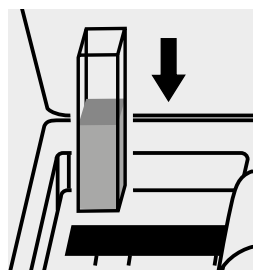
Aspirate the clear upper phase from the tube with pipette.



Transfer the solution into a cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

### Quality assurance:

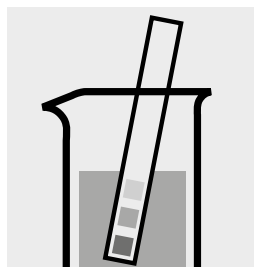
To check the measurement system (test reagents, measurement device, and handling) ready-to-use gold standard solution Certipur®, Cat.No. 1.70216, concentration 1000 mg/l Au, can be used after diluting accordingly.

# Hydrazine

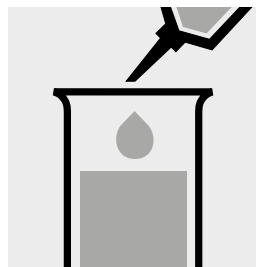
1.09711

Test

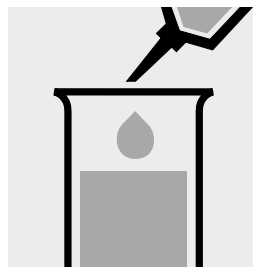
<b>Measuring</b>	0.02 – 2.00 mg/l N <sub>2</sub> H <sub>4</sub>	10-mm cell
<b>range:</b>	0.01 – 1.00 mg/l N <sub>2</sub> H <sub>4</sub>	20-mm cell
	0.005 – 0.400 mg/l N <sub>2</sub> H <sub>4</sub>	50-mm cell
	Expression of results also possible in mmol/l.	



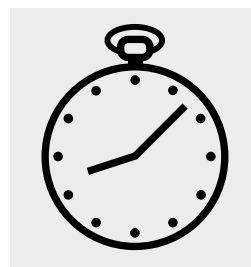
Check the pH of the sample, specified range: pH 2 – 10.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



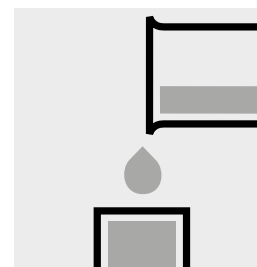
Pipette 5.0 ml of the sample into a test tube.



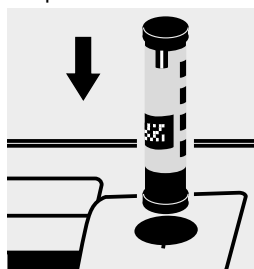
Add 2.0 ml of **Hy-1** with pipette and mix.



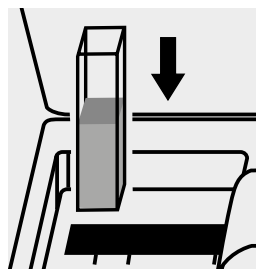
Reaction time: 5 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

To measure in the 50-mm cell, the sample volume and the volume of the reagents have to be doubled for each. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a hydrazine standard solution must be prepared from Hydrazinium sulfate GR, Cat.No. 1.04603 (see section "Standard solutions").

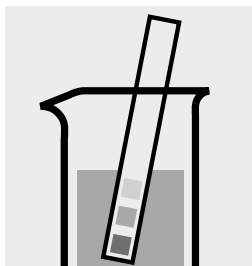
# Hydrogen Peroxide

1.14731

Cell Test

<b>Measuring</b>	2.0 – 20.0 mg/l H <sub>2</sub> O <sub>2</sub>	Round cell
<b>range:</b>	0.25 – 5.00 mg/l H <sub>2</sub> O <sub>2</sub>	50-mm cell
Expression of results also possible in mmol/l.		

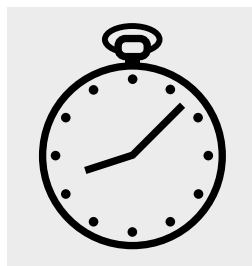
## Measuring range: 2.0 – 20.0 mg/l H<sub>2</sub>O<sub>2</sub>



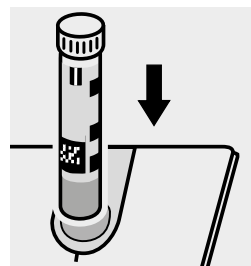
Check the pH of the sample, specified range: pH 0 – 10.  
If required, add dilute sulfuric acid drop by drop to adjust the pH.



Pipette 10 ml of the sample into a reaction cell, close with the screw cap, and mix.

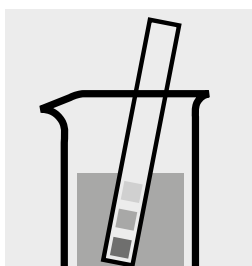


Reaction time:  
2 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Measuring range: 0.25 – 5.00 mg/l H<sub>2</sub>O<sub>2</sub>



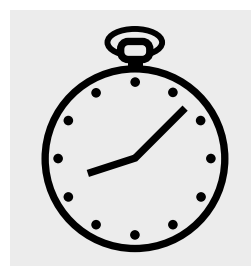
Check the pH of the sample, specified range: pH 0 – 10.  
If required, add dilute sulfuric acid drop by drop to adjust the pH.



Select method no. **128**.



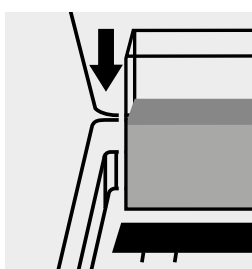
Pipette 10 ml of the sample into a reaction cell, close with the screw cap, and mix.



Reaction time:  
2 minutes



Transfer the solution into a 50-mm cell.



Place the cell into the cell compartment.

### Important:

The contents of the reaction cells may be slightly yellow. However, this does not influence the measurement result.

### Quality assurance:

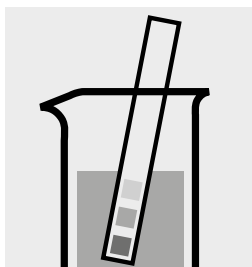
To check the measurement system (test reagents, measurement device, and handling) a hydrogenperoxide standard solution must be prepared from Perhydrol® 30% H<sub>2</sub>O<sub>2</sub> GR, Cat.No. 1.07209 (see section "Standard solutions").

# Hydrogen Peroxide

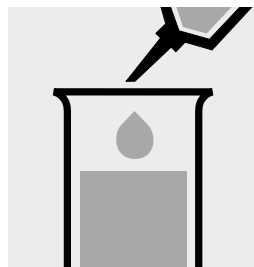
1.18789

Test

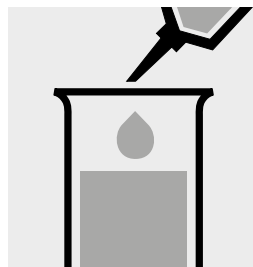
<b>Measuring</b>	0.03 – 6.00 mg/l H <sub>2</sub> O <sub>2</sub>	10-mm cell
<b>range:</b>	0.015 – 3.000 mg/l H <sub>2</sub> O <sub>2</sub>	20-mm cell
Expression of results also possible in mmol/l.		



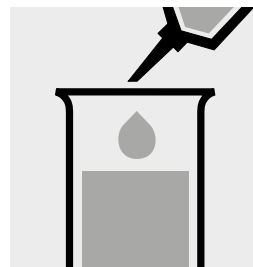
Check the pH of the sample, specified range: pH 4 – 10. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



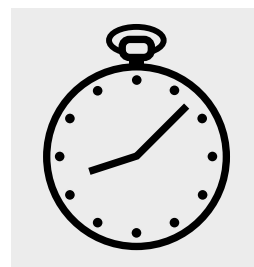
Pipette 0.50 ml of H<sub>2</sub>O<sub>2</sub>-1 into a test tube.



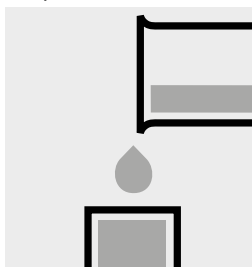
Add 8.0 ml of the sample with pipette and mix.



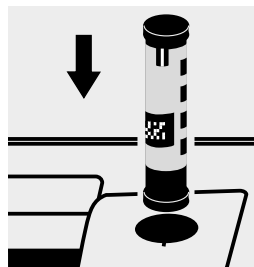
Add 0.50 ml of H<sub>2</sub>O<sub>2</sub>-2 with pipette and mix.



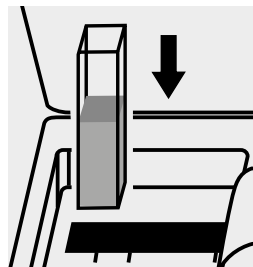
Reaction time: 10 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a hydrogenperoxide standard solution must be prepared from Perhydrol® 30% H<sub>2</sub>O<sub>2</sub> GR, Cat.No. 1.07209 (see section "Standard solutions").

# Hydroxyproline in meat, meat products and sausages

corresponds to German Food and Feed Code §64 LFGB 06.00-8

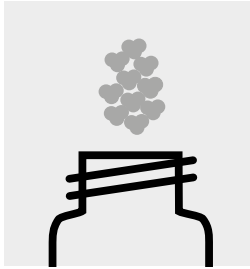
Application

**Measuring range:** 0.000 – 1.000 g/100 g      10-mm cell      Method No. 2538

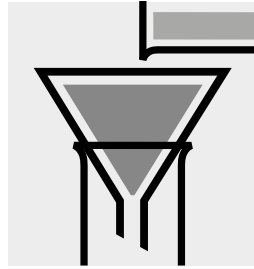
**Attention!** Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended.

This zero value remains valid until the method is exited.

## Preparation: Acid hydrolysis and fat separation



Weigh approx. 2 g of sample, accurately weighed to 1 mg, into a DURAN® glass bottle and process acc. to §64 LFGB 06.00-8, section 7.1 [1].

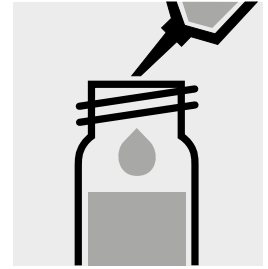


Use the resultant filtrate: **pretreated sample solution**.

## Hydroxyproline determination: Reagent blank



Pipette 0.100 ml of distilled water (Water for analysis EMSURE®, Cat. No. 1.16754, is recommended) into a test tube with screw cap.



Add 5 ml of **oxidizing reagent** and mix.



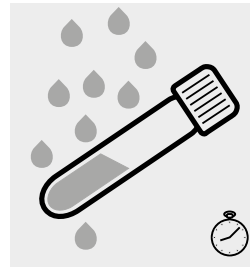
Incubation time: 20 minutes at room temperature



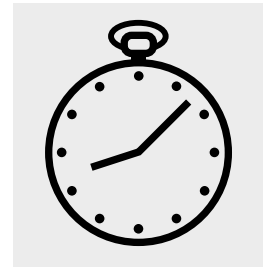
Add 2 ml of **color reagent**, close the test tube with the screw cap, and mix.



Incubate in the water bath at 60 °C for 15 minutes.

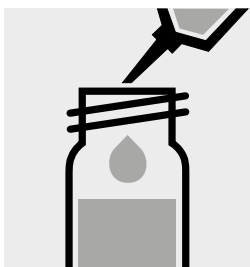


Cool under running water to room temperature within 3 minutes.

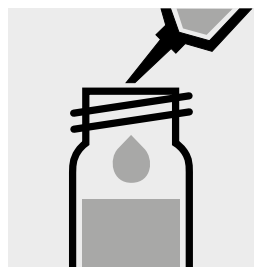


Incubation time: 30 minutes at room temperature: **reagent blank**

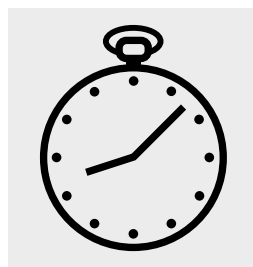
## Hydroxyproline determination: Measurement sample



Pipette 0.100 ml of pretreated sample (filtrate) into a test tube with screw cap.



Add 5 ml of **oxidizing reagent** and mix.



Incubation time: 20 minutes at room temperature



Add 2 ml of **color reagent**, close the test tube with the screw cap, and mix.



Incubate in the water bath at 60 °C for 15 minutes.

# Hydroxyproline

## in meat, meat products and sausages

corresponds to German Food and Feed Code §64 LFGB 06.00-8

### Application

#### Measurement:



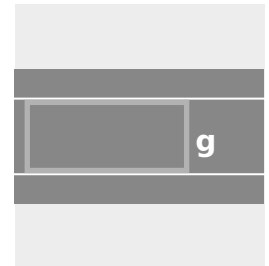
Cool under running water to room temperature within 3 minutes.



Incubation time: 30 minutes at room temperature: **measurement sample**



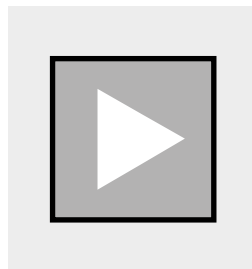
Select method no. **2538**. Perform the zero adjustment and confirm by pressing the <OK> button.



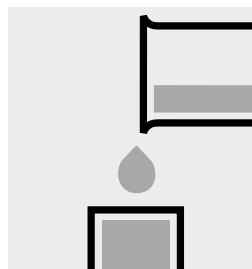
Enter the sample weight in grams.



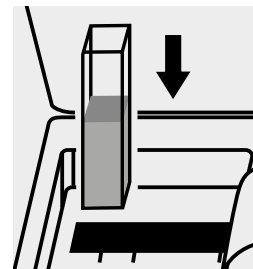
Confirm with <OK>.



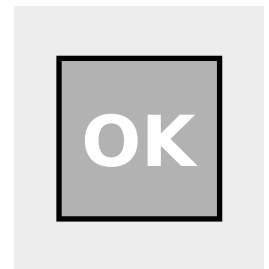
Tap the <Start> button.



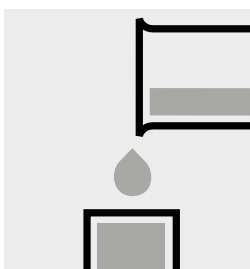
Transfer the solution "**reagent blank**" into the cell.



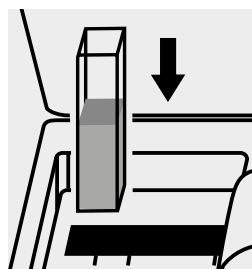
Place the cell into the cell compartment. The blank measurement is performed automatically.



Confirm with <OK>.



Transfer the solution "**measurement sample**" into the cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The result is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

#### Important:

For each new measurement series, the pre-programmed calibration must be checked using standard solutions (see section "Adjustment"). If there are any significant deviations, the method must be recalibrated. Proceed according to the application instructions.

#### Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.



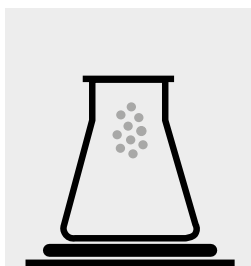
# ICUMSA Color

## Color of sugar solutions

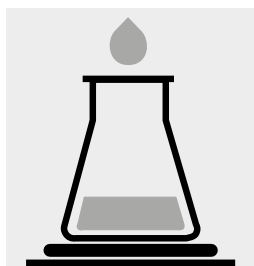
corresponds to **ICUMSA method GS1/3-7 (2011)**

### Application

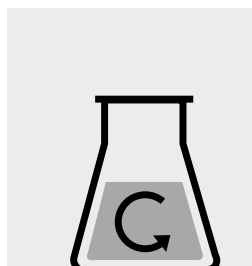
<b>Measuring range:</b>	0 – 50 000 IU <sub>7,0</sub>	10-mm cell	Method No. 2548
	0 – 25 000 IU <sub>7,0</sub>	20-mm cell	Method No. 2548
	0 – 10 000 IU <sub>7,0</sub>	50-mm cell	Method No. 2548
<b>Attention!</b>	Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended. This zero value remains valid until the method is exited.		



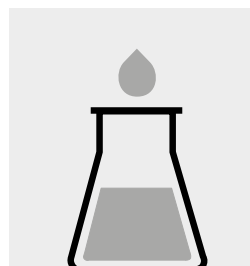
Weigh in **5.0 g of homogenized sample**, accurately weighed to 0.1 g, or **10/30/50 g of homogenized sample**, accurately weighed to 1 g, depending on the anticipated color value.



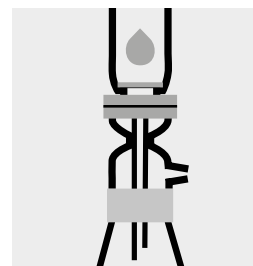
Add **distilled water** (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) until a **total volume of 100 g** is achieved



Dissolve the sample at room temperature.



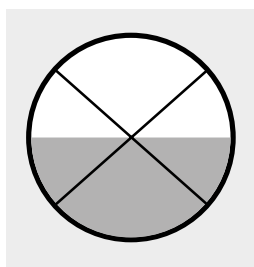
**Adjust the pH of the prepared sample** with sodium hydroxide solution 0.1 mol/l (Cat. No. 1.09141) or, respectively, hydrochloric acid 0.1 mol/l (Cat. No. 1.09060) to  $7.0 \pm 0.1$ .



Vacuum-filter the **adjusted solution** over a membrane filter into a clean and dry conical flask.



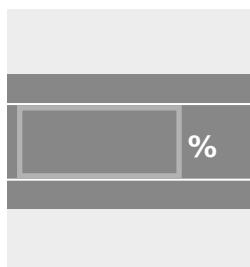
Degas for **3 minutes** in the ultrasonic bath.



Determine the **% RDS value** (refractometric dry substance) of the solution.



Select method no. **2548**. Perform the zero adjustment and confirm by pressing the <OK> button.



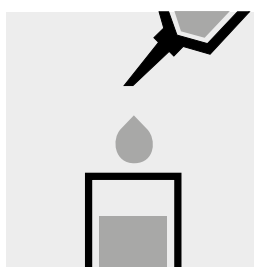
Enter the RDS value in %.



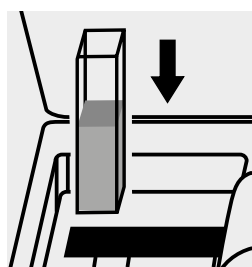
Confirm with <OK>.



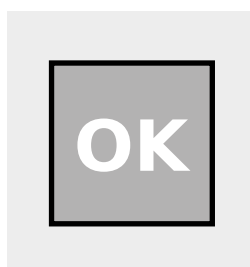
Tap the <Start> button.



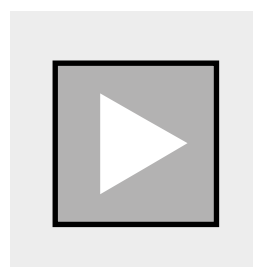
Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The IU<sub>7,0</sub> value is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

#### Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

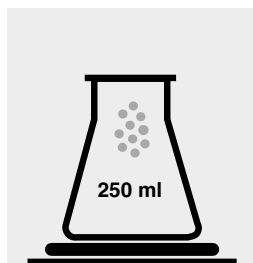
# ICUMSA Color

## Color of sugar solutions at pH 7.0

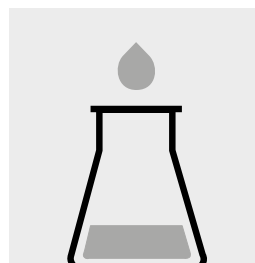
corresponds to ICUMSA method GS2/3-9 (2005)

Application

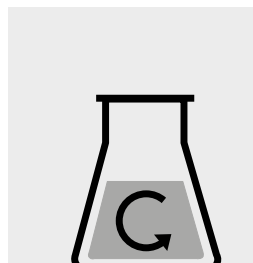
<b>Measuring range:</b> 0 – 600 IU <sub>7.0</sub>	50-mm cell	Method No. 2549
<b>Attention!</b>	Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from buffer solution, is recommended. This zero value remains valid until the method is exited.	



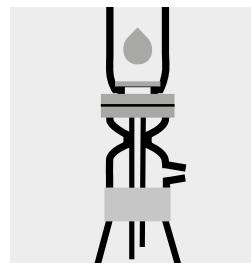
Weigh  $50.0 \pm 0.1$  g of homogenized sample into a 250-ml conical flask.



Add  $50.0 \pm 0.1$  g of buffer solution.



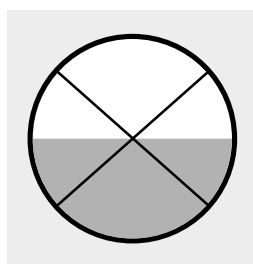
Dissolve the sample at room temperature.



Vacuum-filter the pre-treated solution over a membrane filter into a clean and dry conical flask.



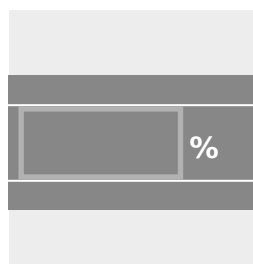
Degas for 3 minutes in the ultrasonic bath.



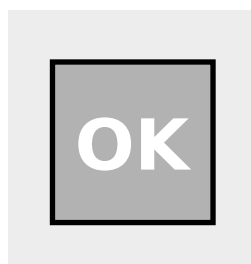
Determine the % RDS value (refractometric dry substance) of the solution.



Select method no. 2549. Perform the zero adjustment and confirm by pressing the <OK> button.



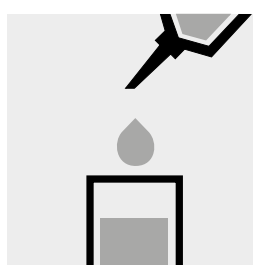
Enter the RDS value in %.



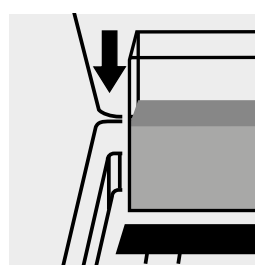
Confirm with <OK>.



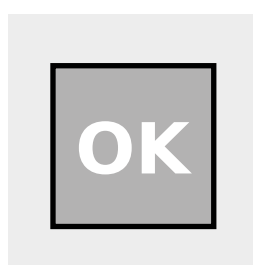
Tap the <Start> button.



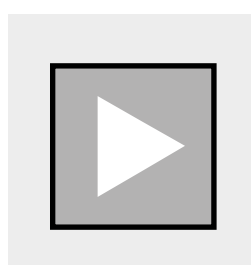
Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The IU<sub>7.0</sub> value is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

### Important:

The exact procedure and the composition and preparation of the buffer solution used are given in the corresponding application, which also includes further information on the method employed. This application can be downloaded from the website.

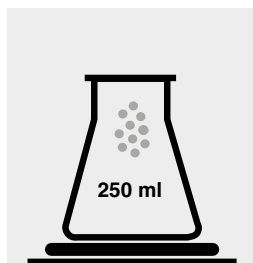
# ICUMSA Color

## Color of sugar solutions of white sugar

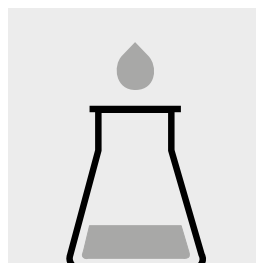
corresponds to ICUMSA method GS2/3-10 (2011)

Application

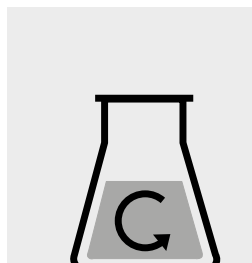
<b>Measuring range:</b> 0 – 50 IU <sub>7,0</sub>	50-mm cell	Method No. 2550
<b>Attention!</b>	Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended. This zero value remains valid until the method is exited.	



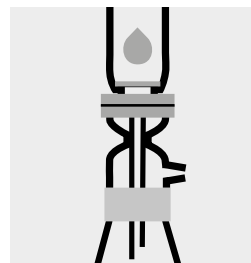
Weigh  $50.0 \pm 0.1$  g of homogenized sample into a 250-ml conical flask.



Add  $50.0 \pm 0.1$  g of distilled water (Water for analysis EMSURE®, Cat. No. 1.16754, is recommended).



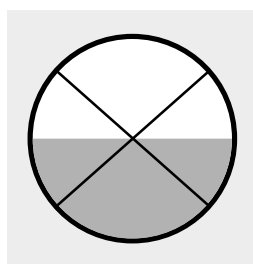
Dissolve the sample at room temperature.



Vacuum-filter the pre-treated solution over a membrane filter into a clean and dry conical flask.



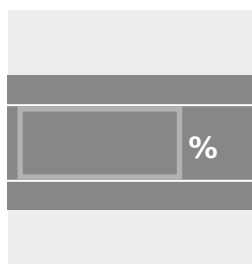
Degas for 3 minutes in the ultrasonic bath.



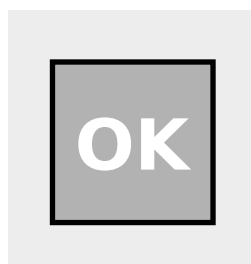
Determine the % RDS value (refractometric dry substance) of the solution.



Select method no. 2550. Perform the zero adjustment and confirm by pressing the <OK> button.



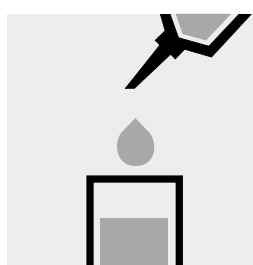
Enter the RDS value in %.



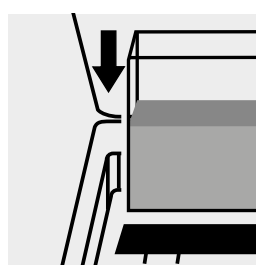
Confirm with <OK>.



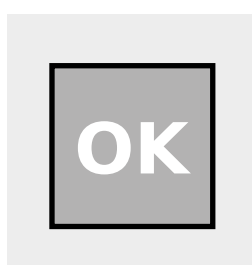
Tap the <Start> button.



Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The IU<sub>7,0</sub> value is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

### Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

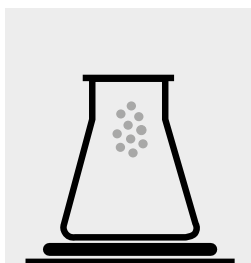
# ICUMSA Color

## Color of sugar solutions at pH 7.0

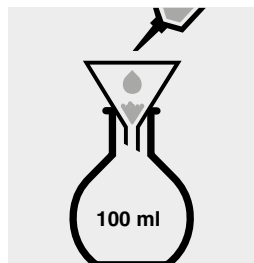
corresponds to **ICUMSA method GS9/1/2/3-8 (2011) (MOPS buffer method)**

### Application

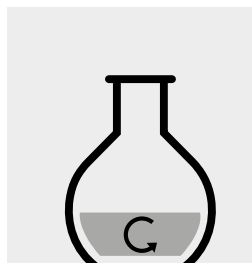
<b>Measuring range:</b>	0 – 20 000 IU <sub>7.0</sub>	10-mm cell	Method No. 2551
	0 – 10 000 IU <sub>7.0</sub>	20-mm cell	Method No. 2551
	0 – 4 000 IU <sub>7.0</sub>	50-mm cell	Method No. 2551
<b>Attention!</b>	Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from reference solution, is recommended. This zero value remains valid until the method is exited.		



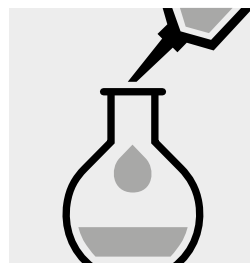
Weigh in **5.0/10.0/20.0 g of homogenized sample**, accurately weighed to 0.1 g, depending on the anticipated color value.



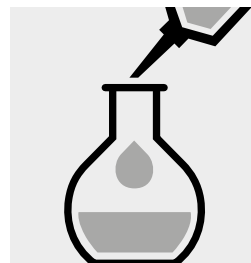
Transfer the sample to a 100-ml volumetric flask by rinsing with **80 ml of distilled water** (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended).



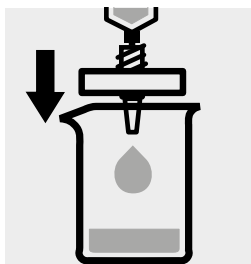
Dissolve the sample at room temperature.



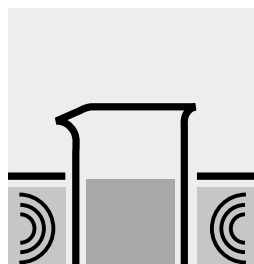
Add **10.0 ml of MOPS buffer**.



Make up the contents of the volumetric flask to the mark with **distilled water** (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) and mix.



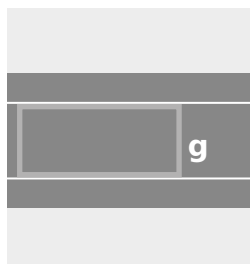
Filter **10 - 20 ml of the pretreated solution** over a membrane filter into a clean and dry beaker.



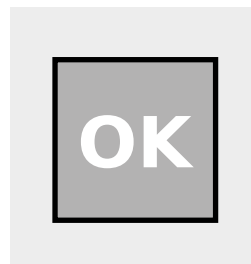
Degas for **3 minutes** in the ultrasonic bath.



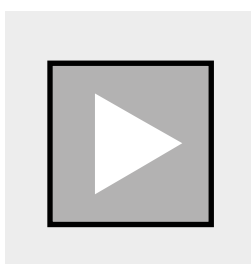
Select method no. **2551**. Perform the zero adjustment and confirm by pressing the **<OK>** button.



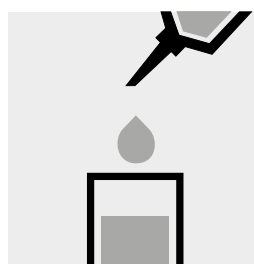
Enter the sample weight in grams.



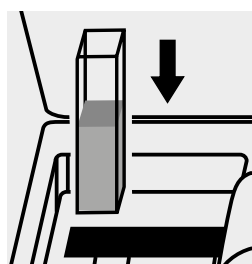
Confirm with **<OK>**.



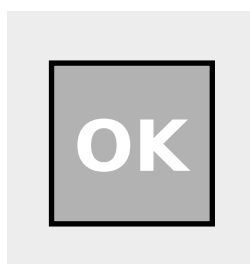
Tap the **<Start>** button.



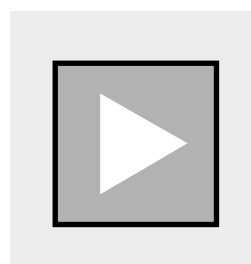
Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with **<OK>**. The IU<sub>7.0</sub> value is shown in the display.



Tap the **<Start>** button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

#### Important:

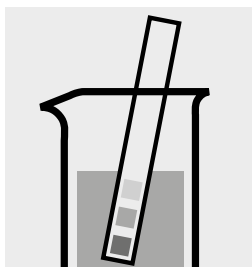
The exact procedure and the composition and preparation of the buffer and reference solution used are given in the corresponding application, which also includes further information on the method employed. This application can be downloaded from the website.

# Iodine

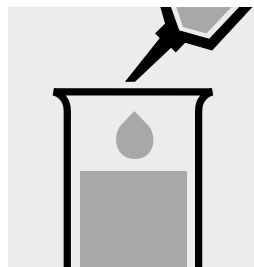
1.00606

Test

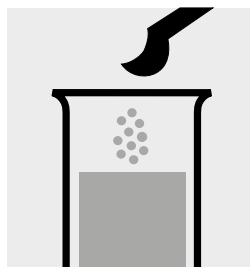
<b>Measuring</b>	0.20 – 10.00 mg/l I <sub>2</sub>	10-mm cell
<b>range:</b>	0.10 – 5.00 mg/l I <sub>2</sub>	20-mm cell
	0.050 – 2.000 mg/l I <sub>2</sub>	50-mm cell
Expression of results also possible in mmol/l.		



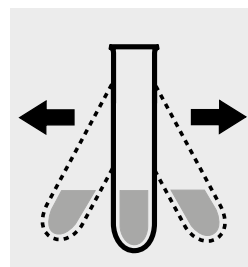
Check the pH of the sample, specified range: pH 4 – 8. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 10 ml of the sample into a test tube.



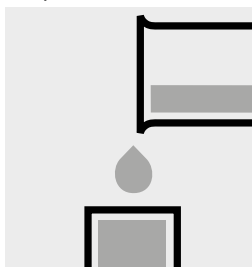
Add 1 level blue micro-spoon of I<sub>2</sub>-1.



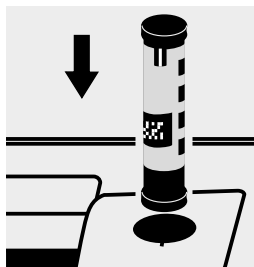
Shake vigorously to dissolve the solid substance.



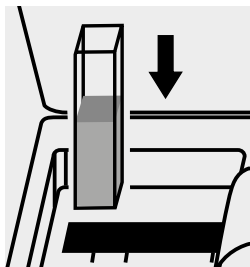
Reaction time: 1 minute



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

Very high iodine concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

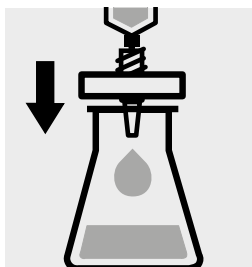
## Note:

Iodine can also be determined with Spectroquant® Chlorine Test, Cat. No. 1.00598 (see corresponding application notes on [www.sigmaaldrich.com](http://www.sigmaaldrich.com)).

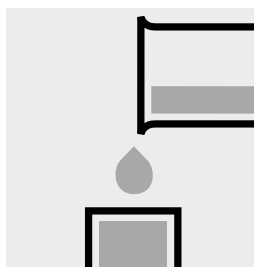
# Iodine Color Number

analogous to **DIN 6162A**

<b>Measuring range:</b>	0.05 – 3.00	340 nm	10-mm cell	Method No. 33
	0.03 – 1.50	340 nm	20-mm cell	Method No. 33
	0.010 – 0.600	340 nm	50-mm cell	Method No. 33



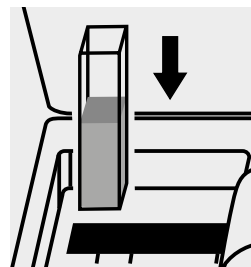
Filter turbid samples.



Transfer the solution into a corresponding cell.



Select method no. **33**.

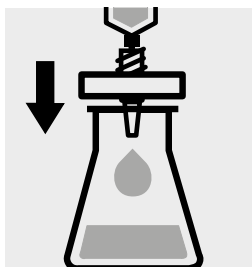


Place the cell into the cell compartment. The measurement is performed automatically.

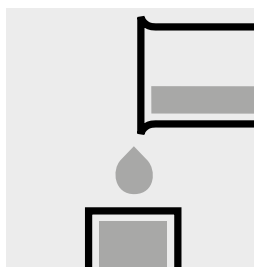
# Iodine Color Number

analogous to **DIN 6162A**

<b>Measuring range:</b>	1.0 – 50.0	445 nm	10-mm cell	Method No. 21
	0.5 – 25.0	445 nm	20-mm cell	Method No. 21
	0.2 – 10.0	445 nm	50-mm cell	Method No. 21



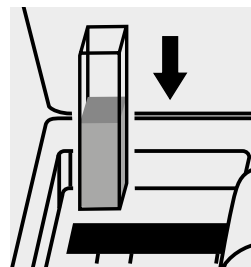
Filter turbid samples.



Transfer the solution into a corresponding cell.



Select method no. 21.



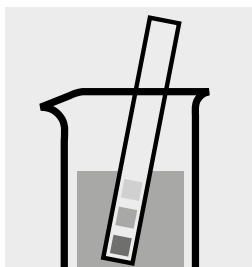
Place the cell into the cell compartment.  
The measurement is performed automatically.

# Iron

1.14549

Cell Test

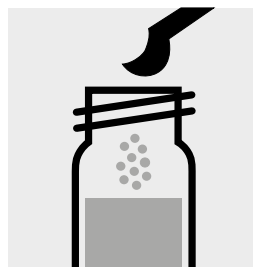
<b>Measuring</b>	0.05 – 4.00 mg/l Fe
<b>range:</b>	Expression of results also possible in mmol/l.



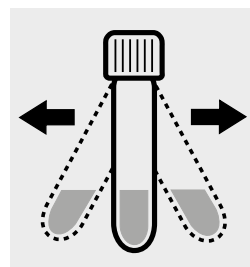
Check the pH of the sample, specified range: pH 1 – 10. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



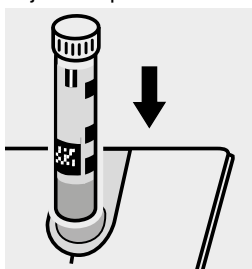
Add 1 level blue microspoon of **Fe-1K**, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 3 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Important:

For the determination of **total iron** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687 and thermoreactor is necessary.

Result can be expressed as sum of iron ( $\Sigma$  Fe).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 90, Cat.No. 1.18700 or the Standard solutions for photometric applications, Cat.Nos. 1.33018, 1.33019 and 1.33020.

Ready-to-use iron standard solution Certipur®, Cat.No. 1.19781, concentration 1000 mg/l Fe, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 90) is highly recommended.



# Iron

1.14896

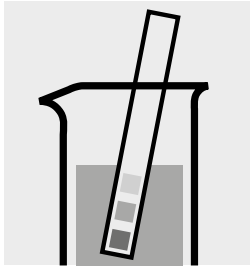
## Determination of iron(II) and iron(III)

Cell Test

**Measuring** 1.0 – 50.0 mg/l Fe

**range:** Expression of results also possible in mmol/l.

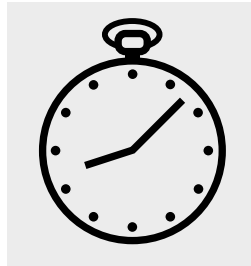
### Determination of iron (II)



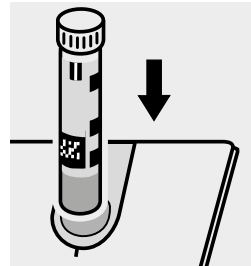
Check the pH of the sample, specified range: pH 3 – 8. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.

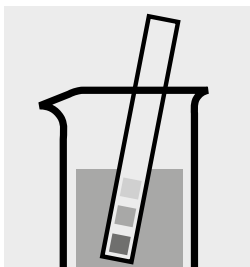


Reaction time: 5 minutes

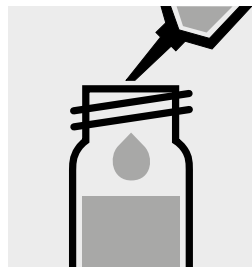


Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

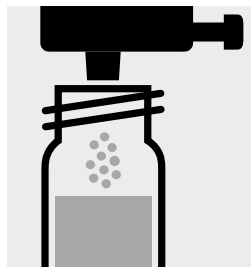
### Determination of iron (II + III)



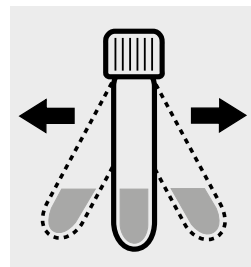
Check the pH of the sample, specified range: pH 3 – 8. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



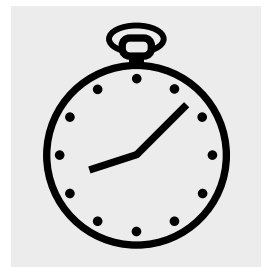
Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



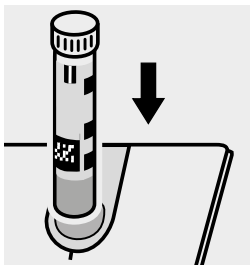
Add 1 dose of **Fe-1K** using the blue dose-metering cap, close the reaction cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 5 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Important:

For the determination of **total iron** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687, and thermoreactor is necessary.

Result can be expressed as sum of iron ( $\Sigma$  Fe).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use iron standard solution Certipur®, Cat.No. 1.19781, concentration 1000 mg/l Fe(III), can be used after diluting accordingly.

# Iron

1.14896

## Differentiation between iron(II) and iron(III)

Cell Test

**Measuring range:** 1.0 – 50.0 mg/l Fe

If the aim is to differentiate between iron(II) and iron(III), after selecting the method it is possible to set the method-specific "Differentiation" mode.

**Note:** If no differentiation is to be measured, the "Differentiation" mode must be deactivated again.



Select method no. **106**.



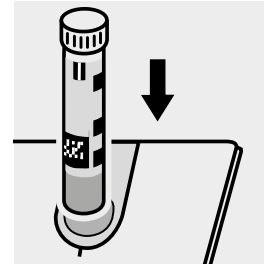
Tap the <Settings> button. Select "Differentiation" and activate.



Confirm with <OK>.

Perform determination of **iron(II + III)** (see analytical procedure "Determination of iron(II + III)" with 1.14896). = **cell A**

After the reaction time has expired:



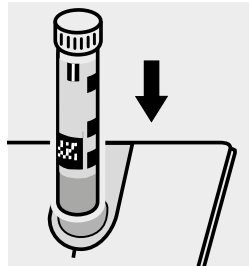
Place the **cell A** into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically.



Confirm with <OK>.

Perform determination of **iron(II)** (see analytical procedure "Determination of iron(II)" with 1.14896). = **cell B**

After the reaction time has expired:



Place the **cell B** into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically.



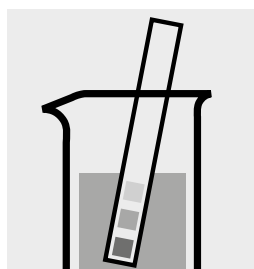
Confirm with <OK>. The results A (Fe(II+III)), B (Fe(II)), and C (Fe(III)) are shown in the display in mg/l.

# Iron

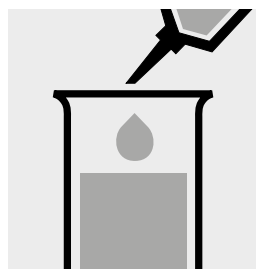
1.14761

Test

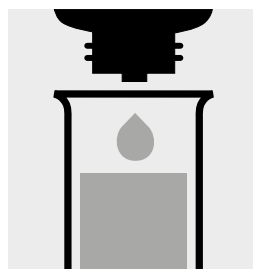
<b>Measuring range:</b>	0.05 – 5.00	mg/l Fe	10-mm cell
	0.03 – 2.50	mg/l Fe	20-mm cell
	0.005 – 1.000	mg/l Fe	50-mm cell
Expression of results also possible in mmol/l.			



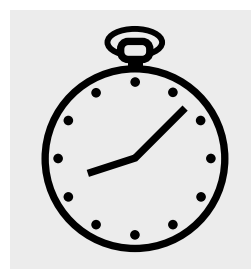
Check the pH of the sample, specified range: pH 1 – 10.  
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



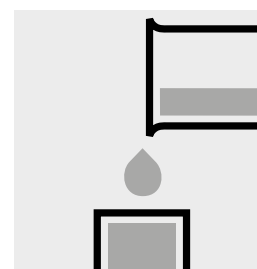
Pipette 5.0 ml of the sample into a test tube.



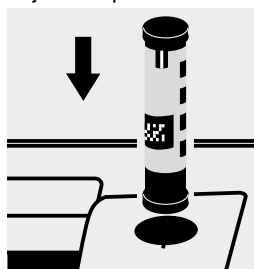
Add 3 drops of Fe-1 and mix.



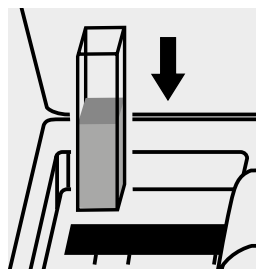
Reaction time: 3 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

For the determination of **total iron** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687 and thermoreactor is necessary.

Result can be expressed as sum of iron ( $\Sigma$  Fe).

To measure in the 50-mm cell, the sample volume and the volume of the reagents have to be doubled for each.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 90, Cat.No. 1.18700 or the Standard solutions for photometric applications, Cat.Nos. 1.33014, 1.33018, 1.33019 and 1.33020.

Ready-to-use iron standard solution Certipur®, Cat.No. 1.19781, concentration 1000 mg/l Fe, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 90) is highly recommended.

# Iron

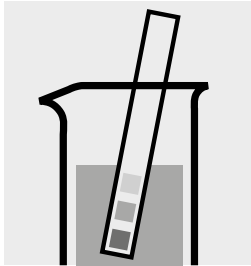
1.00796

## Determination of iron(II) and iron(III)

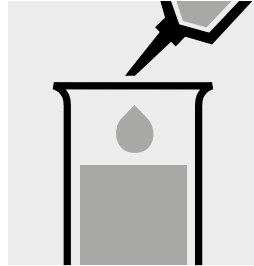
Test

<b>Measuring</b>	0.10 – 5.00 mg/l Fe	10-mm cell
<b>range:</b>	0.05 – 2.50 mg/l Fe	20-mm cell
	0.010 – 1.000 mg/l Fe	50-mm cell
Expression of results also possible in mmol/l.		

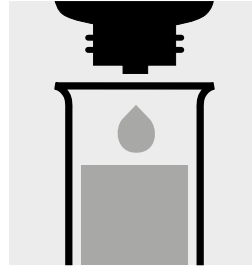
### Determination of iron(II)



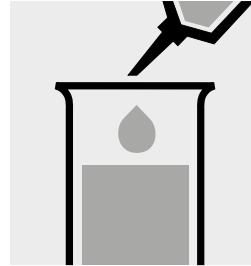
Check the pH of the sample, specified range: pH 2 – 8.  
If required, add dilute sodium hydroxide solution or nitric acid drop by drop to adjust the pH.



Pipette 8.0 ml of the sample into a test tube.



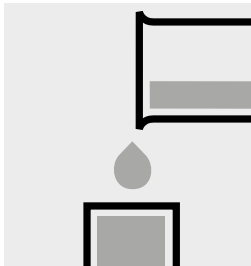
Add 1 drop of **Fe-1** and mix.



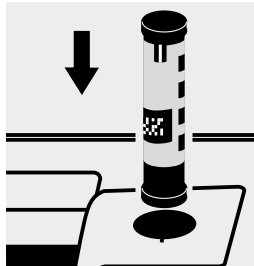
Add 0.50 ml of **Fe-2** with pipette and mix.



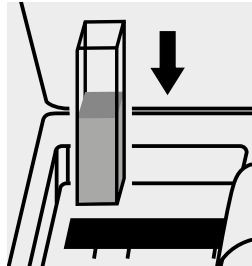
Reaction time: 5 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

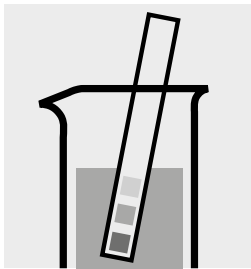
# Iron

1.00796

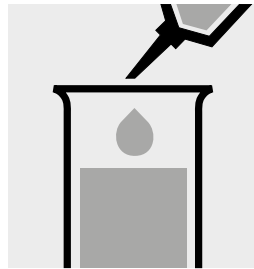
## Determination of iron(II) and iron(III)

Test

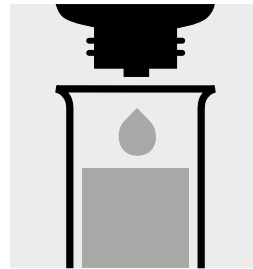
### Determination of iron(II + III)



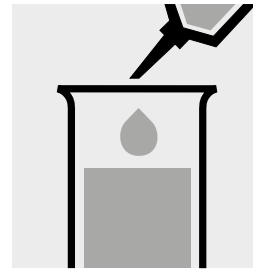
Check the pH of the sample, specified range: pH 2 – 8.  
If required, add dilute sodium hydroxide solution or nitric acid drop by drop to adjust the pH.



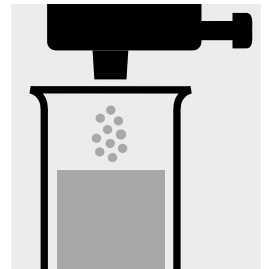
Pipette 8.0 ml of the sample into a test tube.



Add 1 drop of **Fe-1** and mix.



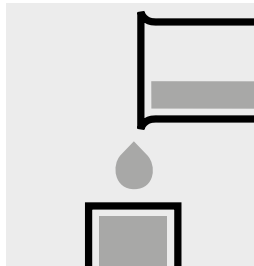
Add 0.50 ml of **Fe-2** with pipette and mix.



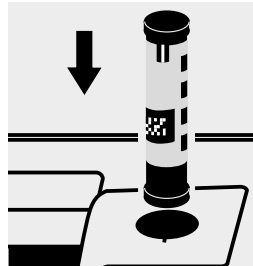
Add 1 dose of **Fe-3** using the blue dose-metering cap and dissolve the solid substance.



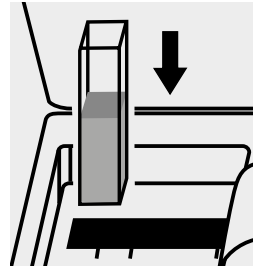
Reaction time:  
10 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

#### Important:

For the determination of **total iron** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687 and thermoreactor is necessary.

#### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 90, Cat.No. 1.18700 or the Standard solutions for photometric applications, Cat.Nos. 1.33014, 1.33018, 1.33019 and 1.33020.

Ready-to-use iron standard solution Certipur®, Cat.No. 1.19781, concentration 1000 mg/l Fe(III), can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 90) is highly recommended.

# Iron

1.00796

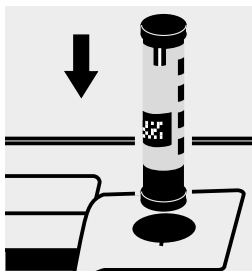
## Differentiation between iron(II) and iron(III)

Test

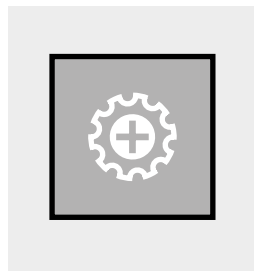
<b>Measuring</b>	0.10 – 5.00	mg/l Fe	10-mm cell
<b>range:</b>	0.05 – 2.50	mg/l Fe	20-mm cell
	0.010 – 1.000	mg/l Fe	50-mm cell

If the aim is to differentiate between iron(II) and iron(III), after selecting the method it is possible to set the method-specific "Differentiation" mode.

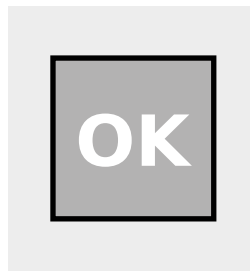
**Note:** If no differentiation is to be measured, the "Differentiation" mode must be deactivated again.



Select method with AutoSelector.



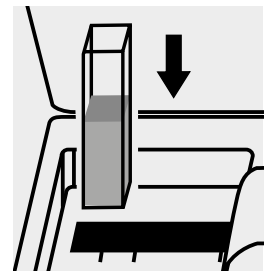
Tap the <Settings> button. Select "Differentiation" and activate.



Confirm with <OK>.

Perform determination of **iron(II + III)** (see analytical procedure "Determination of iron(II + III)" with 1.00796). = **cell A**

After the reaction time has expired:



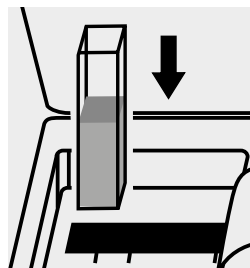
Place the **cell A** into the cell compartment. The measurement is performed automatically.



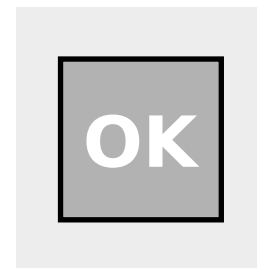
Confirm with <OK>.

Perform determination of **iron(II)** (see analytical procedure "Determination of iron(II)" with 1.00796). = **cell B**

After the reaction time has expired:



Place the **cell B** into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The results A (Fe(II+III)), B (Fe(II)), and C (Fe(III)) are shown in the display in mg/l.

# Lead

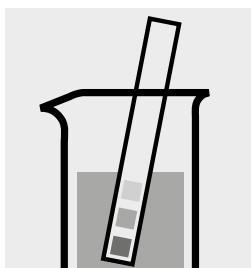
1.14833

Cell Test

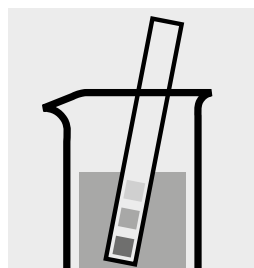
**Measuring** 0.10 – 5.00 mg/l Pb

**range:** Expression of results also possible in mmol/l.

## Samples of total hardness 0–10 °d



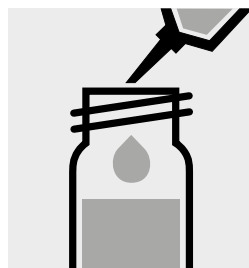
Check the total hardness of the sample.



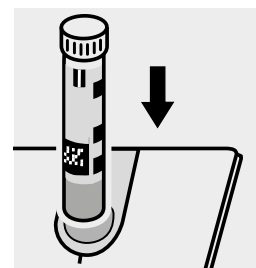
Check the pH of the sample, specified range: pH 3–6.  
If required, add dilute ammonia solution or nitric acid drop by drop to adjust the pH.



Add 5 drops of **Pb-1K** into a reaction cell and mix.

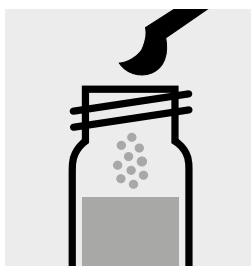


Add 5.0 ml of the sample with pipette, close the cell with the screw cap, and mix.

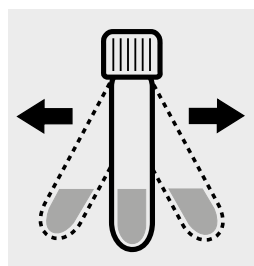


Place the cell into the cell compartment. Align the mark on the cell with that on the photometer = **Result A**

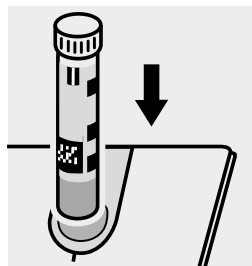
## Samples of total hardness >10 °d



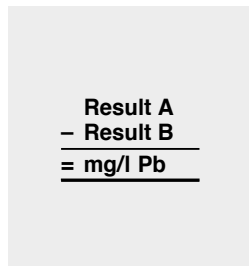
Add 1 level grey micro-spoon of **Pb-2K** to the already measured cell, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer = **Result B**



$$\begin{array}{r} \text{Result A} \\ - \text{Result B} \\ \hline = \text{mg/l Pb} \end{array}$$

### Important:

For the determination of **total lead** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687, and thermoreactor is necessary.

Result can be expressed as sum of lead ( $\Sigma$  Pb).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 100, Cat.No. 1.18701.

Ready-to-use lead standard solution Certipur®, Cat.No. 1.19776, concentration 1000 mg/l Pb, can also be used after diluting accordingly.

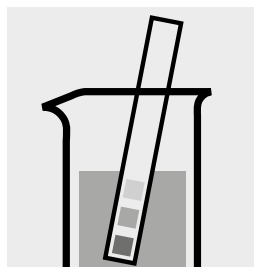
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 100) is highly recommended.

# Lead

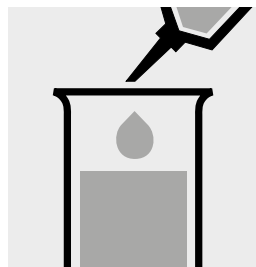
1.09717

Test

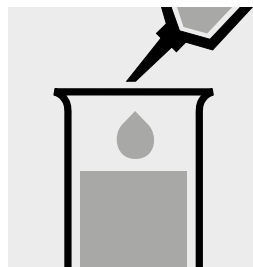
<b>Measuring range:</b>	0.10 – 5.00 mg/l Pb	10-mm cell
	0.05 – 2.50 mg/l Pb	20-mm cell
	0.010 – 1.000 mg/l Pb	50-mm cell
	Expression of results also possible in mmol/l.	



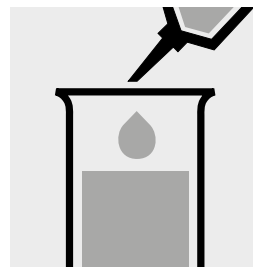
Check the pH of the sample, specified range: pH 3 – 6.  
If required, add dilute ammonia solution or nitric acid drop by drop to adjust the pH.



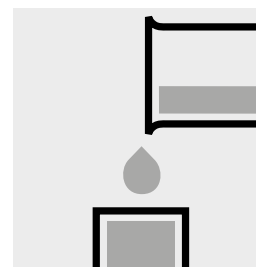
Pipette 0.50 ml of **Pb-1** into a test tube.



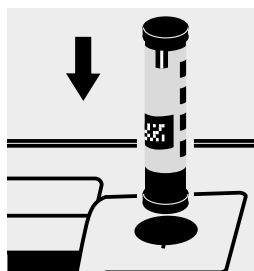
Add 0.50 ml of **Pb-2** with pipette and mix.



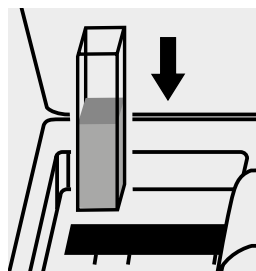
Add 8.0 ml of the sample with pipette and mix.



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

For the determination of **total lead** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687, and thermoreactor is necessary.

Result can be expressed as sum of lead ( $\Sigma$  Pb).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 100, Cat.No. 1.18701 or the Standard solutions for photometric applications, Cat.Nos. 1.33003 and 1.33004.

Ready-to-use lead standard solution Certipur®, Cat.No. 1.19776, concentration 1000 mg/l Pb, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 100) is highly recommended.



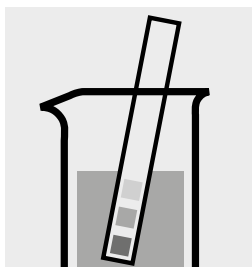
# Magnesium

1.00815

Cell Test

**Measuring** 5.0 – 75.0 mg/l Mg

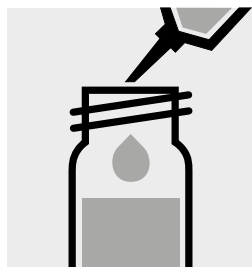
**range:** Expression of results also possible in mmol/l.



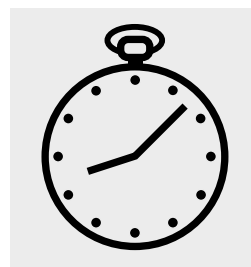
Check the pH of the sample, specified range: pH 3 – 9. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



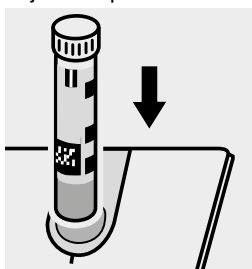
Add 1.0 ml of **Mg-1K** with pipette, close the cell with the screw cap, and mix.



Reaction time: **exactly 3 minutes**



Add 3 drops of **Mg-2K**, close the cell with the screw cap and mix.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

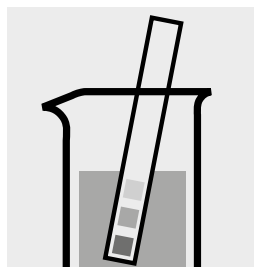
# Manganese

1.00816

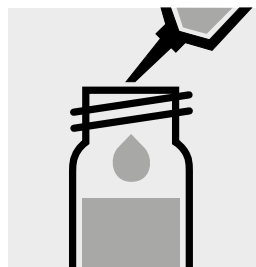
Cell Test

**Measuring** 0.10 – 5.00 mg/l Mn

**range:** Expression of results also possible in mmol/l.



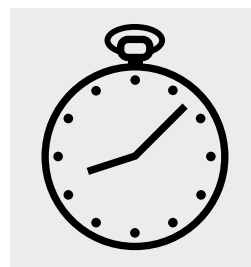
Check the pH of the sample, specified range: pH 2 – 7. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



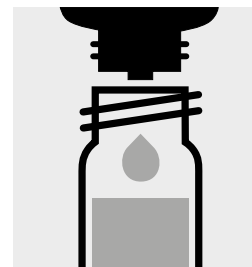
Pipette 7.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



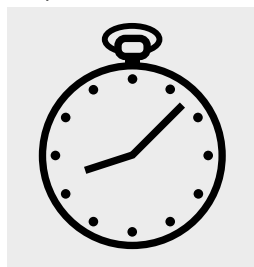
Add 2 drops of **Mn-1K**, close the cell with the screw cap, and mix.



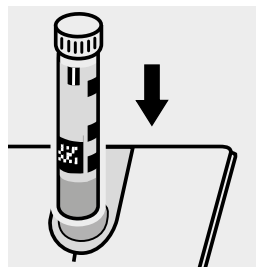
Reaction time:  
2 minutes



Add 3 drops of **Mn-2K**, close the cell with the screw cap, and mix.



Reaction time:  
10 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 90, Cat.No. 1.18700 or the Standard solutions for photometric applications, Cat.Nos. 1.32238 and 1.32239.

Ready-to-use manganese standard solution Certipur®, Cat.No. 1.19789, concentration 1000 mg/l Mn, can also be used after diluting accordingly.

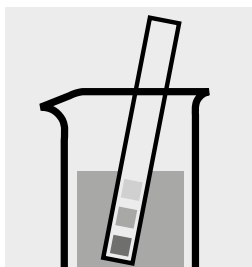
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 90) is highly recommended.

# Manganese

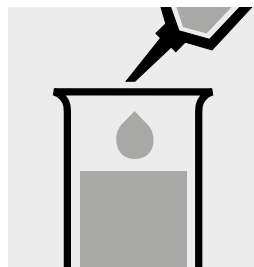
1.14770

Test

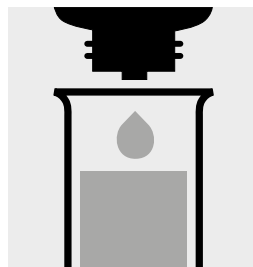
<b>Measuring range:</b>	0.50 – 10.00 mg/l Mn	10-mm cell
	0.25 – 5.00 mg/l Mn	20-mm cell
	0.010 – 2.000 mg/l Mn	50-mm cell
Expression of results also possible in mmol/l.		



Check the pH of the sample, specified range: pH 2 – 7.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a test tube.



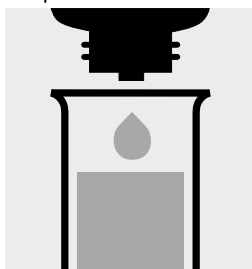
Add 4 drops of **Mn-1** and mix.  
Check the pH, specified pH: approx. 11.5.



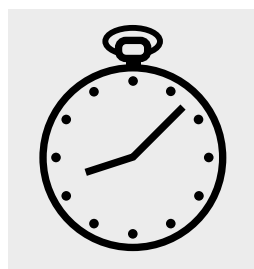
Add 2 drops of **Mn-2** and mix.



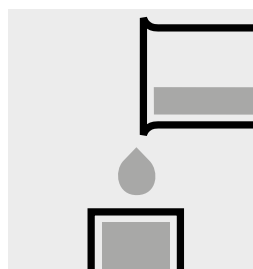
Reaction time:  
2 minutes



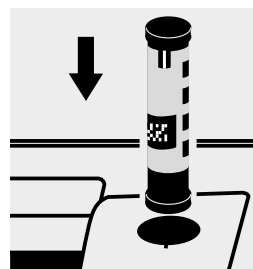
Add 2 drops of **Mn-3** and mix.



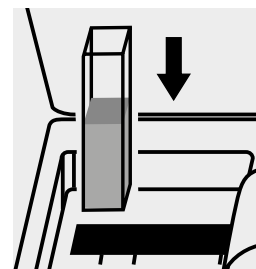
Reaction time:  
10 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

To measure in the 50-mm cell, the sample volume and the volume of the reagents have to be doubled for each. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 90, Cat.No. 1.18700 or the Standard solutions for photometric applications, Cat.Nos. 1.32237, 1.32238 and 1.32239.

Ready-to-use manganese standard solution Certipur®, Cat.No. 1.19789, concentration 1000 mg/l Mn, can also be used after diluting accordingly.

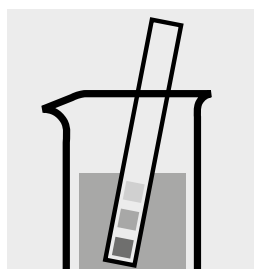
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 90) is highly recommended.

# Manganese

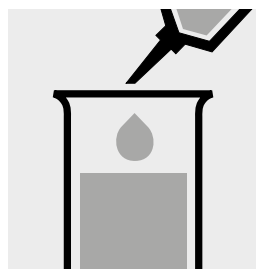
1.01846

Test

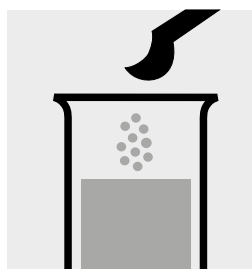
<b>Measuring range:</b>	0.05 – 2.00 mg/l Mn	10-mm cell
	0.03 – 1.00 mg/l Mn	20-mm cell
	0.005 – 0.400 mg/l Mn	50-mm cell
Expression of results also possible in mmol/l.		



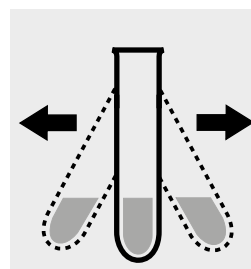
Check the pH of the sample, specified range: pH 3 – 10. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



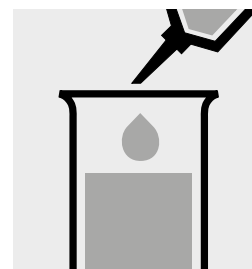
Pipette 8.0 ml of the sample into a test tube.



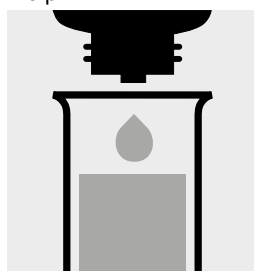
Add 1 level grey micro-spoon of **Mn-1**.



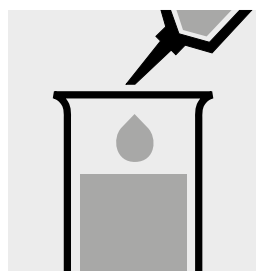
Shake the tube vigorously to dissolve the solid substance.



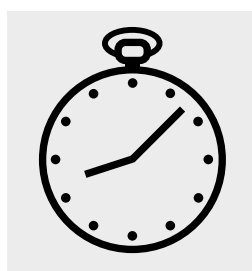
Add 2.0 ml of **Mn-2** with pipette and mix.



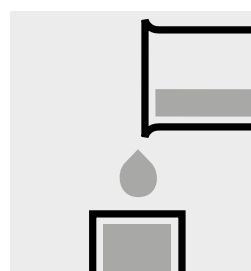
Add **carefully** 3 drops of **Mn-3** and mix.



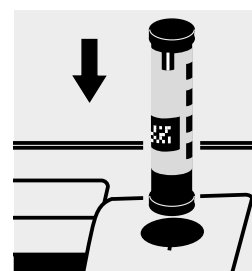
Add **carefully** 0.25 ml of **Mn-4** with pipette and mix **carefully** (Foams! Wear eye protection!).



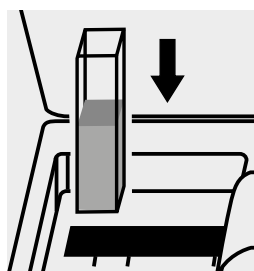
Reaction time: 10 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

When using the 50-mm cell, perform the measurement against a separately prepared blank (preparation as per measurement sample, but with distilled water instead of sample).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 90, Cat.No. 1.18700 or the Standard solutions for photometric applications, Cat.Nos. 1.32237, 1.32238 and 1.32239.

Ready-to-use manganese standard solution Certipur®, Cat.No. 1.19789, concentration 1000 mg/l Mn, can also be used after diluting accordingly.

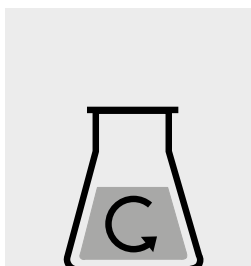
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 90) is highly recommended.

# McFarland

## Determination of microbial cell concentration in suspensions

### Application

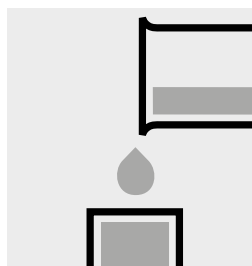
<b>Measuring range:</b>	0.0 – 10.0 McFarland	10-mm cell	Method No. 2513
	0 – 3000 CFU ( $\times 10^6/\text{ml}$ ) based on <i>E. coli</i>	10-mm cell	Method No. 2513
<b>Attention!</b>	Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended. This zero value remains valid until the method is exited.		



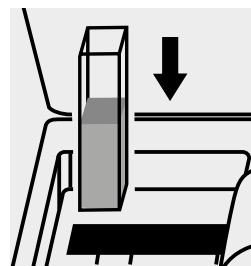
Homogenize the sample **carefully**: measurement sample.



Select method no. **2513**. Perform the zero adjustment and confirm by pressing the <OK> button.



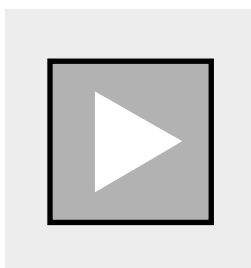
Transfer the **measurement sample** into the cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The result is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

#### Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

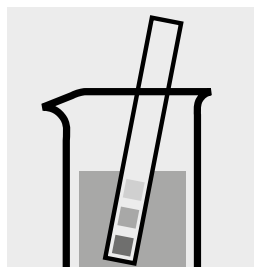
# Mercury in water and wastewater

Application

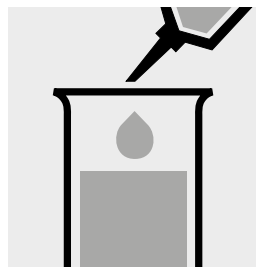
Measuring range: 0.025 – 1.000 mg/l Hg

50-mm cell

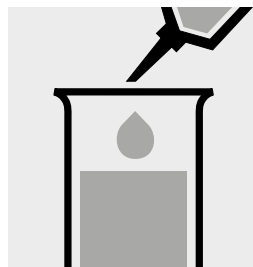
Method No. 135



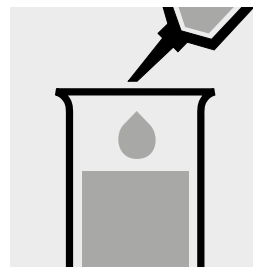
Check the pH of the sample, specified range: pH 3 – 7. If required, add dilute sodium hydroxide solution or acetic acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a test tube.



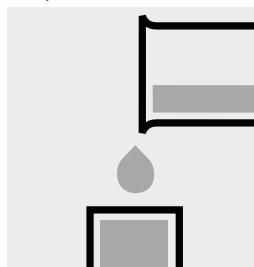
Add 1.0 ml of **reagent 1** with pipette and mix.



Add 1.5 ml of **reagent 2** with pipette and mix.



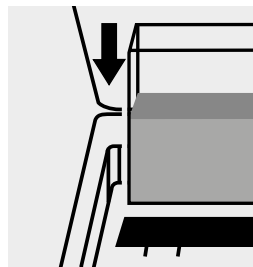
Reaction time: 5 minutes



Transfer the solution into a cell.



Select method no. **135**.



Place the cell into the cell compartment. The measurement is performed automatically.

## Important:

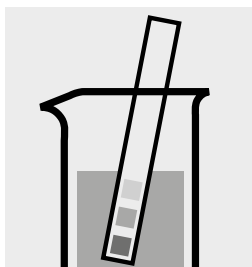
The exact composition and preparation of the reagents 1 and 2 used are given in the corresponding application, which also includes further information on the method employed. This application can be downloaded from the website.

# Molybdenum

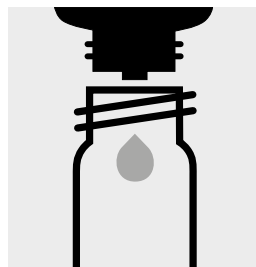
1.00860

Cell Test

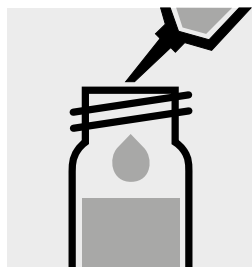
<b>Measuring</b>	0.02 – 1.00 mg/l Mo
<b>range:</b>	0.03 – 1.67 mg/l MoO <sub>4</sub>
	0.04 – 2.15 mg/l Na <sub>2</sub> MoO <sub>4</sub>
	Expression of results also possible in mmol/l.



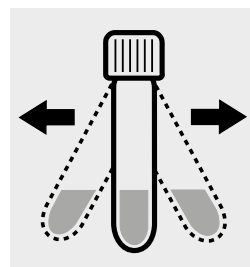
Check the pH of the sample, specified range: pH 1 – 10. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Place 2 drops of **Mo-1K** into a reaction cell and mix.



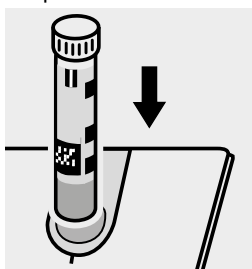
Add 10 ml of the sample with pipette, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 2 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

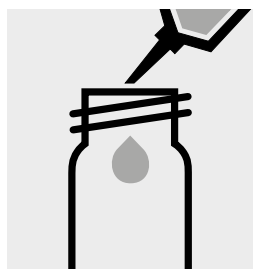
To check the measurement system (test reagents, measurement device, and handling) a ready-to-use molybdenum standard solution Certipur®, Cat.No. 1.70227, concentration 1000 mg/l Mo, can be used after diluting accordingly.

# Molybdenum

1.19252

Test

<b>Measuring</b>	0.5 – 45.0 mg/l Mo	20-mm cell
<b>range:</b>	0.8 – 75.0 mg/l MoO <sub>4</sub>	20-mm cell
	1.1 – 96.6 mg/l Na <sub>2</sub> MoO <sub>4</sub>	20-mm cell
Expression of results also possible in mmol/l.		



Pipette 10 ml of the sample into an empty round cell (Empty cells, Cat.No. 1.14724).



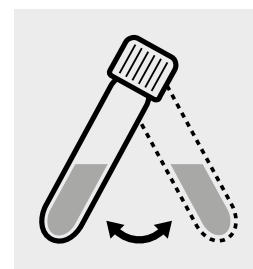
Add 1 powder pack of **Molybdenum HR1**, close with the screw cap, and dissolve the solid substance.



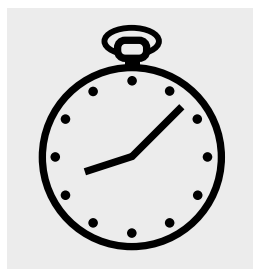
Add 1 powder pack of **Molybdenum HR2**, close with the screw cap, and dissolve the solid substance.



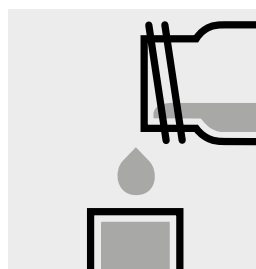
Add 1 powder pack of **Molybdenum HR3** and close with the screw cap.



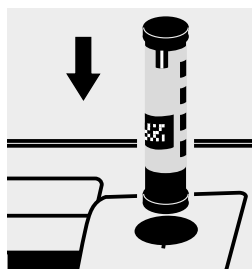
Swirl the cell to dissolve the solid substance.



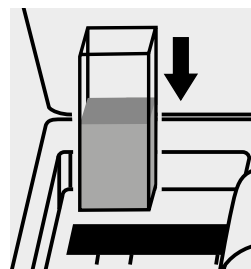
Reaction time: 5 minutes, **measure immediately**.



Transfer the solution into a rectangular cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a ready-to-use molybdenum standard solution Certipur®, Cat.No. 1.70227, concentration 1000 mg/l Mo, can be used after diluting accordingly.

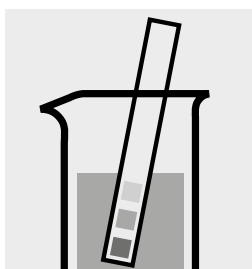


# Monochloramine

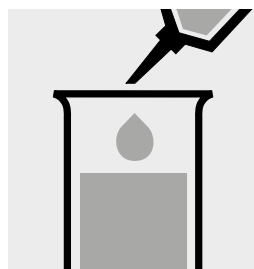
1.01632

Test

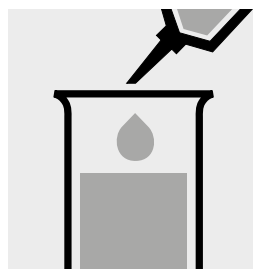
<b>Measuring range:</b>	0.25 – 10.00 mg/l Cl <sub>2</sub>	0.18 – 7.26 mg/l NH <sub>2</sub> Cl	0.05 – 1.98 mg/l NH <sub>2</sub> Cl-N	10-mm cell
	0.13 – 5.00 mg/l Cl <sub>2</sub>	0.09 – 3.63 mg/l NH <sub>2</sub> Cl	0.026 – 0.988 mg/l NH <sub>2</sub> Cl-N	20-mm cell
	0.050 – 2.000 mg/l Cl <sub>2</sub>	0.04 – 1.45 mg/l NH <sub>2</sub> Cl	0.010 – 0.395 mg/l NH <sub>2</sub> Cl-N	50-mm cell
Expression of results also possible in mmol/l.				



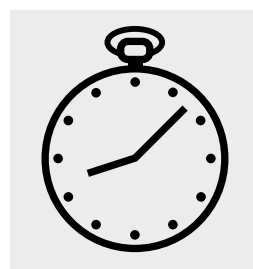
Check the pH of the sample, specified range: pH 4 – 13.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



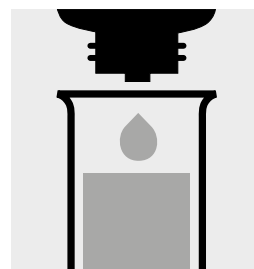
Pipette 10 ml of the sample into a test tube.



Add 0.60 ml of **MCA-1** with pipette and mix.



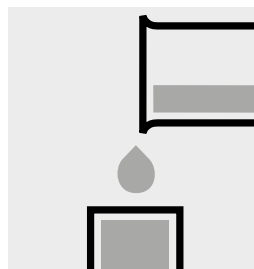
Reaction time: 5 minutes



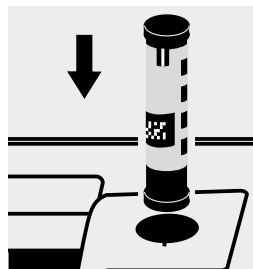
Add 4 drops of **MCA-2** and mix.



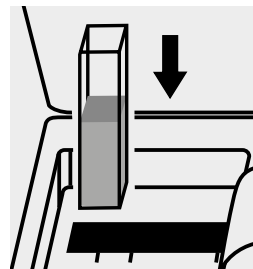
Reaction time: 10 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

Very high monochloramine concentrations in the sample produce turquoise-colored solutions (measurement solution should be yellow-green to green) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a standard solution must be prepared (see section "Standard solutions").

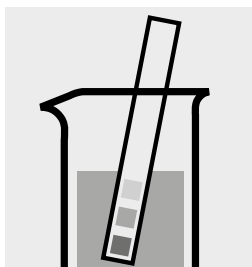
# Nickel

1.14554

Cell Test

**Measuring** 0.10 – 6.00 mg/l Ni

**range:** Expression of results also possible in mmol/l.



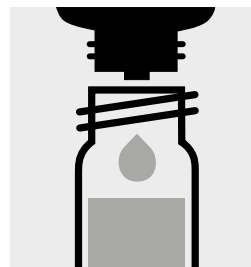
Check the pH of the sample, specified range: pH 3–8. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



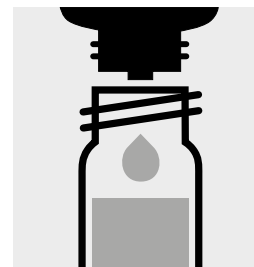
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Reaction time:  
1 minute



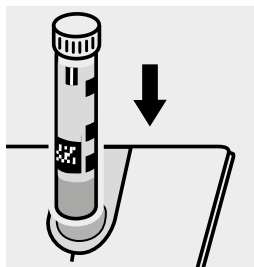
Add 2 drops of **Ni-1K**, close with the screw cap, and mix.



Add 2 drops of **Ni-2K**, close the cell with the screw cap, and mix.



Reaction time:  
2 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Important:

For the determination of **total nickel** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687 and thermoreactor is necessary.

Result can be expressed as sum of nickel ( $\Sigma$  Ni).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 100, Cat.No. 1.18701.

A nickel standard solution Titrisol®, Cat.No. 1.09989, can also be used after diluting accordingly.

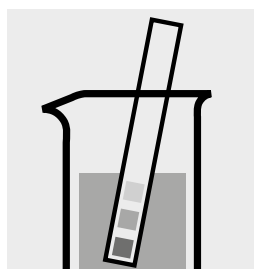
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 100) is highly recommended.

# Nickel

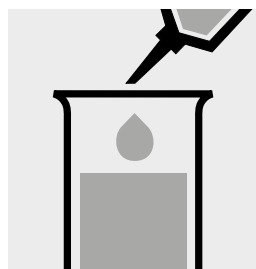
1.14785

Test

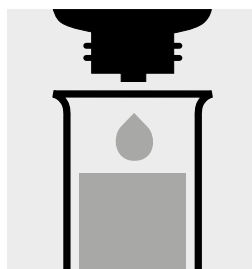
<b>Measuring range:</b>	0.10 – 5.00 mg/l Ni	10-mm cell
	0.05 – 2.50 mg/l Ni	20-mm cell
	0.02 – 1.00 mg/l Ni	50-mm cell
	Expression of results also possible in mmol/l.	



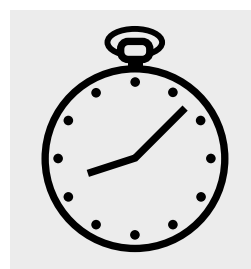
Check the pH of the sample, specified range: pH 3–8.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a test tube.



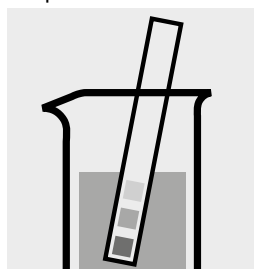
Add 1 drop of **Ni-1** and mix. If the color disappears, continue adding drop by drop until a slight yellow coloration persists.



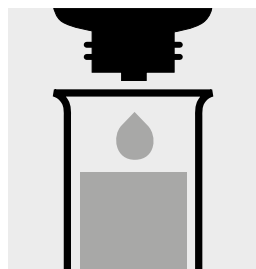
Reaction time:  
1 minute



Add 2 drops of **Ni-2** and mix.



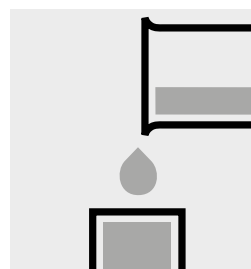
Check the pH, specified range: pH 10–12.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



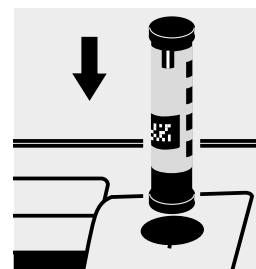
Add 2 drops of **Ni-3** and mix.



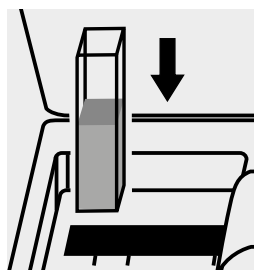
Reaction time:  
2 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

For the determination of **total nickel** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687 and thermoreactor is necessary.

Result can be expressed as sum of nickel ( $\Sigma$  Ni).

To measure in the 50-mm cell, the sample volume and the volume of the reagents have to be doubled for each. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 100, Cat.No. 1.18701.

A nickel standard solution Titrisol®, Cat.No. 1.09989, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 100) is highly recommended.

# Nickel in electroplating baths

## Inherent color

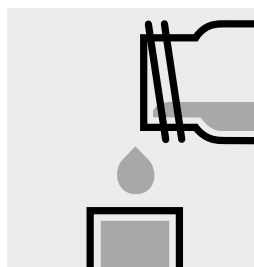
<b>Measuring range:</b>	10 – 120 g/l Ni	10-mm cell	Method No. 57
	5.0 – 60.0 g/l Ni	20-mm cell	Method No. 57
	2.0 – 24.0 g/l Ni	50-mm cell	Method No. 57



Pipette 5.0 ml of the sample into an empty round cell (Empty cells, Cat.No. 1.14724).



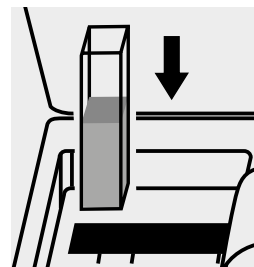
Add 5.0 ml of **sulfuric acid 40 %**, close the cell with the screw cap, and mix.



Transfer the solution into a corresponding cell.



Select method no. **57**.



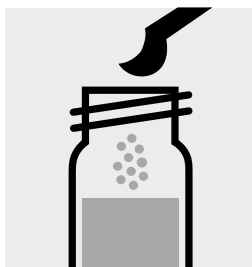
Place the cell into the cell compartment. The measurement is performed automatically.

# Nitrate

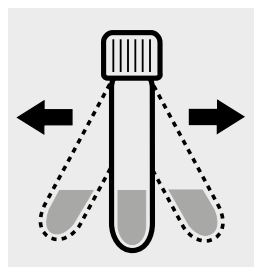
1.14542

Cell Test

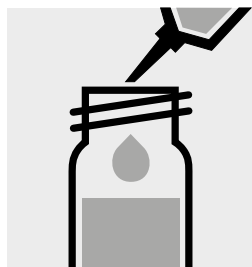
<b>Measuring</b>	0.5 – 18.0 mg/l NO <sub>3</sub> -N
<b>range:</b>	2.2 – 79.7 mg/l NO <sub>3</sub>
	Expression of results also possible in mmol/l.



Add 1 level microspoon of **NO<sub>3</sub>-1K** into a reaction cell and close with the screw cap.



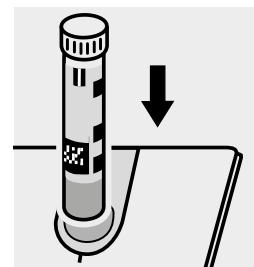
**Shake** the cell **vigorously for 1 minute** to dissolve the solid substance.



Add very slowly 1.5 ml of the sample with pipette, close the cell with the screw cap, and mix **briefly**.  
**Caution, cell becomes hot!**



Reaction time:  
10 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20, Cat.No. 1.14675, or the Standard solutions for photometric applications, Cat.Nos. 1.25037, 1.25038, 1.32241, and 1.32242.

Ready-to-use nitrate standard solution Certipur®, Cat.No. 1.19811, concentration 1000 mg/l NO<sub>3</sub><sup>-</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 20) is highly recommended.

# Nitrate

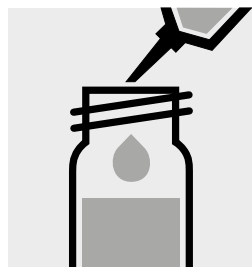
1.14563

Cell Test

<b>Measuring</b>	0.5 – 25.0 mg/l NO <sub>3</sub> -N
<b>range:</b>	2.2 – 110.7 mg/l NO <sub>3</sub>
	Expression of results also possible in mmol/l.



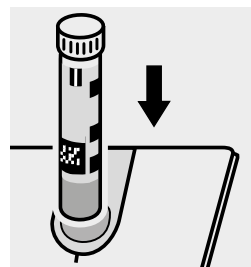
Pipette 1.0 ml of the sample into a reaction cell, **do not mix**.



Add 1.0 ml of **NO<sub>3</sub>-1K** with pipette, close the cell with the screw cap, and mix. **Caution, cell becomes hot!**



Reaction time:  
10 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20, Cat.No. 1.14675, or the Standard solutions for photometric applications, Cat.Nos. 1.25037, 1.25038, 1.32241, and 1.32242.

Ready-to-use nitrate standard solution Certipur®, Cat.No. 1.19811, concentration 1000 mg/l NO<sub>3</sub><sup>-</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 20) is highly recommended.

# Nitrate

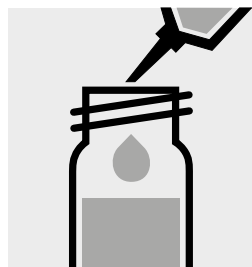
1.14764

Cell Test

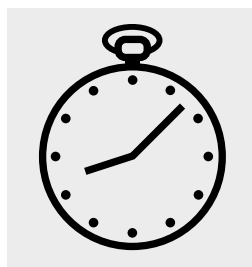
<b>Measuring</b>	1.0 – 50.0 mg/l NO <sub>3</sub> -N
<b>range:</b>	4 – 221 mg/l NO <sub>3</sub>
	Expression of results also possible in mmol/l.



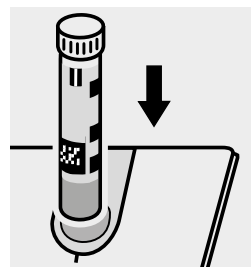
Pipette 0.50 ml of the sample into a reaction cell, **do not mix**.



Add 1.0 ml of **NO<sub>3</sub>-1K** with pipette, close the cell with the screw cap, and mix. **Caution, cell becomes hot!**



Reaction time:  
10 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommend to use Spectroquant® CombiCheck 80, Cat.No. 1.14738, or the Standard solutions for photometric applications, Cat.Nos. 1.25037, 1.25038, 1.25039, 1.32241, and 1.32242.

Ready-to-use nitrate standard solution Certipur®, Cat.No. 1.19811, concentration 1000 mg/l NO<sub>3</sub>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 80) is highly recommended.

# Nitrate

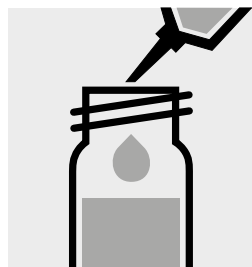
1.00614

Cell Test

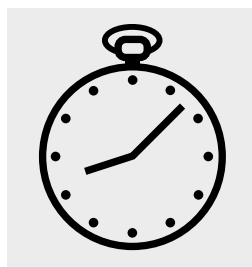
<b>Measuring</b>	23 – 225 mg/l NO <sub>3</sub> -N
<b>range:</b>	102 – 996 mg/l NO <sub>3</sub>
	Expression of results also possible in mmol/l.



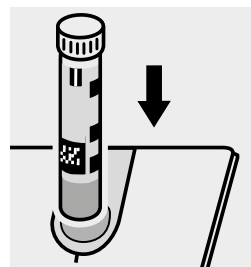
Pipette 1.0 ml of **NO<sub>3</sub>-1K** into a reaction cell, **do not mix**.



Add 0.10 ml of the sample with pipette, close the cell with the screw cap, and mix. **Caution, cell becomes hot!**



Reaction time: 5 minutes, **measure immediately**.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use nitrate standard solution Certipur®, Cat.No. 1.19811, concentration 1000 mg/l NO<sub>3</sub><sup>-</sup>, can be used after diluting accordingly as well as the Standard solutions for photometric applications, Cat.Nos. 1.25039 and 1.25040.

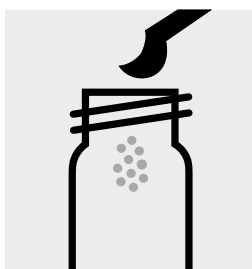


# Nitrate

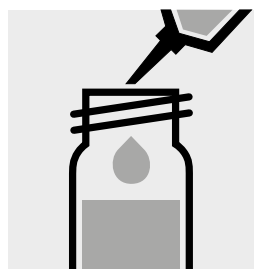
1.14773

Test

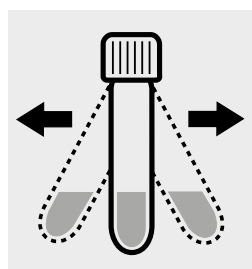
<b>Measuring</b>	0.5 – 20.0 mg/l NO <sub>3</sub> -N	2.2 – 88.5 mg/l NO <sub>3</sub>	10-mm cell
<b>range:</b>	0.20 – 10.00 mg/l NO <sub>3</sub> -N	0.89 – 44.27 mg/l NO <sub>3</sub>	20-mm cell
Expression of results also possible in mmol/l.			



Place 1 microspoon of **NO<sub>3</sub>-1** into a dry empty round cell (Empty cells, Cat.No. 1.14724).



Add 5.0 ml of **NO<sub>3</sub>-2** with pipette into the cell. Close the cell with the screw cap.



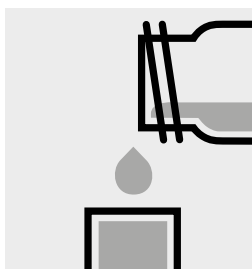
**Shake vigorously for 1 minute** to dissolve the solid substance.



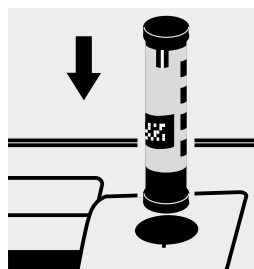
Add very slowly 1.5 ml of the sample with pipette, close the cell with the screw cap, and mix **briefly**. **Caution, cell becomes hot!**



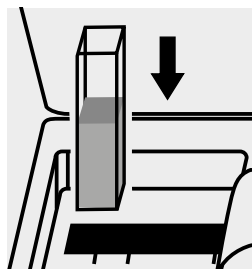
Reaction time:  
10 minutes



Transfer the solution into a corresponding rectangular cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Note:

Empty cells with screw caps, Cat.No. 1.14724 are recommended for the preparation. These cells can be sealed with the screw caps, thus enabling a hazard-free mixing of the sample.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10 and 20, Cat.Nos. 1.14676 and 1.14675, or the Standard solutions for photometric applications, Cat.Nos. 1.25036, 1.25037, 1.25038, 1.32240, 1.32241, and 1.32242.

Ready-to-use nitrate standard solution Certipur®, Cat.No. 1.19811, concentration 1000 mg/l NO<sub>3</sub>, can also be used after diluting accordingly.

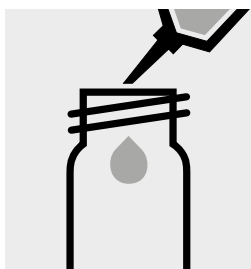
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck) is highly recommended.

# Nitrate

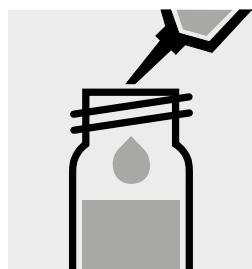
# 1.09713

## Test

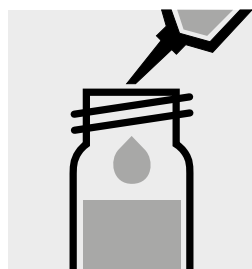
<b>Measuring range:</b>	1.0 – 25.0 mg/l NO <sub>3</sub> -N	4.4 – 110.7 mg/l NO <sub>3</sub>	10-mm cell
	0.5 – 12.5 mg/l NO <sub>3</sub> -N	2.2 – 55.3 mg/l NO <sub>3</sub>	20-mm cell
	0.10 – 5.00 mg/l NO <sub>3</sub> -N	0.4 – 22.1 mg/l NO <sub>3</sub>	50-mm cell
Expression of results also possible in mmol/l.			



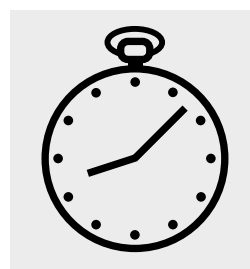
Pipette 4.0 ml of **NO<sub>3</sub>-1** into a dry empty round cell (Empty cells, Cat. No. 1.14724).



Add 0.50 ml of the sample with pipette, **do not mix**.



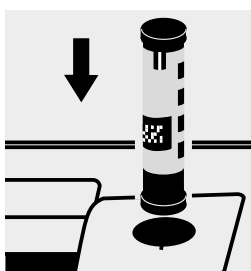
Add 0.50 ml of **NO<sub>3</sub>-2** with pipette, close the cell with the screw cap, and mix. **Caution, cell becomes hot!**



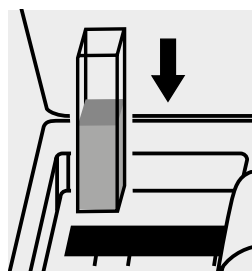
Reaction time: 10 minutes



Transfer the solution into a corresponding rectangular cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

### Important:

To measure in the 50-mm cell, the sample volume and the volume of the reagents have to be doubled for each. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

### Note:

Empty cells with screw caps, Cat.No. 1.14724 are recommended for the preparation. These cells can be sealed with the screw caps, thus enabling a hazard-free mixing of the sample.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10 and 20, Cat.Nos. 1.14676 and 1.14675, or the Standard solutions for photometric applications, Cat.Nos. 1.25036, 1.25037, 1.25038, 1.32240, 1.32241, and 1.32242.

Ready-to-use nitrate standard solution Certipur®, Cat.No. 1.19811, concentration 1000 mg/l NO<sub>3</sub>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck) is highly recommended.

# Nitrate

in seawater

1.14556

Cell Test

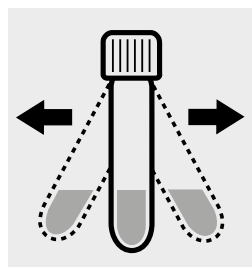
<b>Measuring</b>	0.10 – 3.00 mg/l NO <sub>3</sub> -N
<b>range:</b>	0.4 – 13.3 mg/l NO <sub>3</sub>
Expression of results also possible in mmol/l.	



Pipette 2.0 ml of the sample into a reaction cell, **do not mix**.



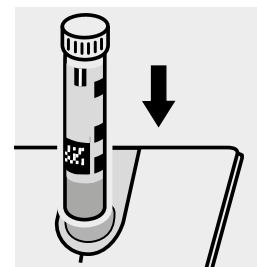
Add 1 level blue micro-spoon of **NO<sub>3</sub>-1K**, **immediately** close the cell tightly with the screw cap. **Caution, foams strongly (eye protection, protective gloves)!**



Shake the cell **vigorously for 5 seconds** to dissolve the solid substance.



Reaction time:  
30 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 1.14676, or the Standard solutions for photometric applications, Cat.Nos. 1.25036, 1.25037, 1.32240, and 1.32241.

Ready-to-use nitrate standard solution Certipur®, Cat.No. 1.19811, concentration 1000 mg/l NO<sub>3</sub><sup>-</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

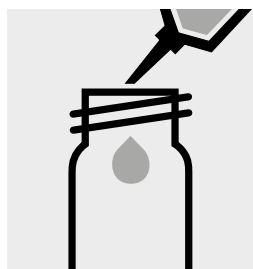
# Nitrate

in seawater

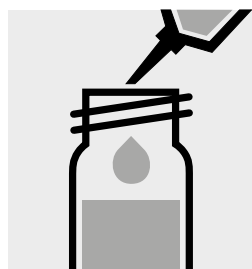
1.14942

Test

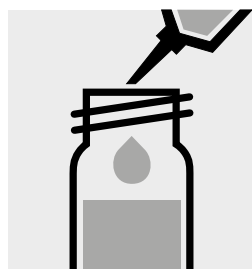
<b>Measuring</b>	0.2 – 17.0 mg/l NO <sub>3</sub> -N	0.9 – 75.3 mg/l NO <sub>3</sub>	10-mm cell
<b>range:</b>	Expression of results also possible in mmol/l.		



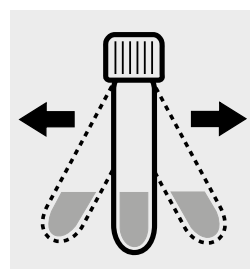
Pipette 5.0 ml of **NO<sub>3</sub>-1** into a dry empty round cell (Empty cells, Cat. No. 1.14724).



Add 1.0 ml of the sample with pipette. **Caution, cell becomes hot!**



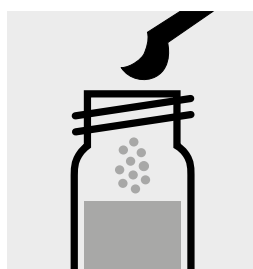
**Immediately** add 1.5 ml of **NO<sub>3</sub>-2** with pipette.



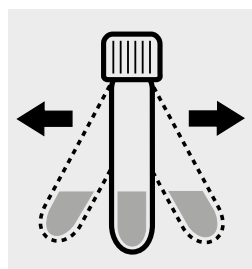
Close cell tightly and shake **vigorously**.



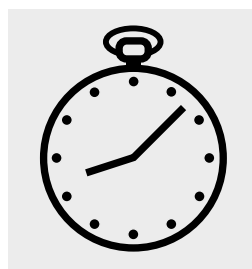
Reaction time: 15 minutes



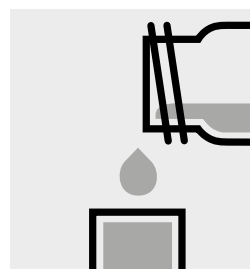
Add 2 level grey microspoons of **NO<sub>3</sub>-3**.



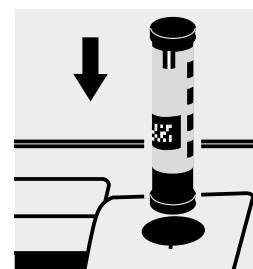
Close cell tightly and shake **vigorously** until the reagent is completely dissolved.



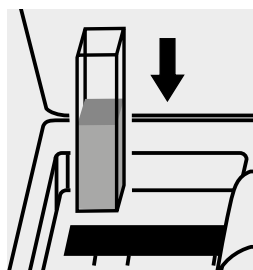
Reaction time: 60 minutes



Transfer the solution into a rectangular cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

Empty cells with screw caps, Cat.No. 1.14724 are recommended for the preparation. These cells can be sealed with the screw caps, thus enabling a hazard-free mixing of the sample.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20, Cat.No. 1.14675, or the Standard solutions for photometric applications, Cat.Nos. 1.25036, 1.25037, 1.25038, 1.32240, 1.32241, and 1.32242.

Ready-to-use nitrate standard solution Certipur®, Cat.No. 1.19811, concentration 1000 mg/l NO<sub>3</sub>, can also be used after diluting accordingly.

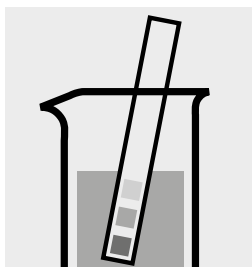
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 20) is highly recommended.

# Nitrate

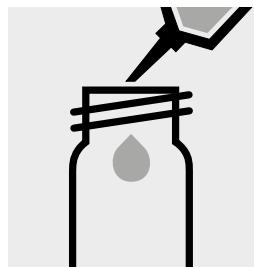
1.01842

Test

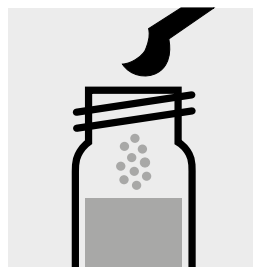
<b>Measuring range:</b>	0.3 – 30.0 mg/l NO <sub>3</sub> -N	1.3 – 132.8 mg/l NO <sub>3</sub>	50-mm cell
	Expression of results also possible in mmol/l.		



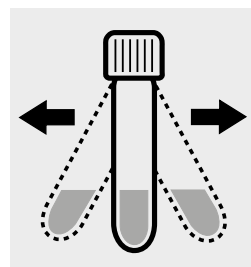
Check the pH of the sample, specified range: pH 3 – 9. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Pipette 10 ml of the sample into a test tube (Flat-bottomed tubes, Cat.No. 1.14902).



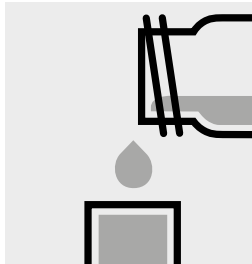
Add 1 level blue microspoon of NO<sub>3</sub>-1, **immediately** close tightly with the screw cap.



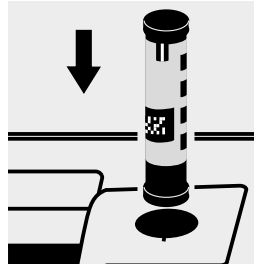
**Shake** the tube **vigorously for 1 minute** to dissolve the solid substance.



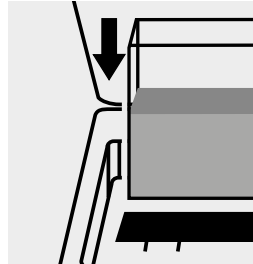
Reaction time: 5 minutes, **measure immediately**.



Transfer the solution (when possible without sediment) into a corresponding rectangular cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Quality assurance:

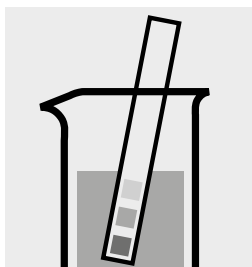
To check the measurement system (test reagents, measurement device, and handling) a ready-to-use nitrate standard solution Certipur®, Cat.No. 1.19811, concentration 1000 mg/l NO<sub>3</sub>, can be used after diluting accordingly as well as the Standard solutions for photometric applications, Cat.Nos. 1.32241 and 1.32242.

# Nitrite

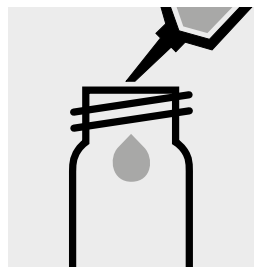
1.14547

Cell Test

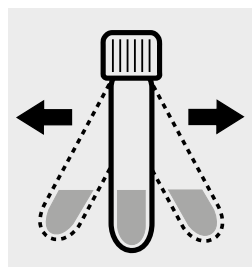
<b>Measuring</b>	0.010 – 0.700 mg/l NO <sub>2</sub> -N
<b>range:</b>	0.03 – 2.30 mg/l NO <sub>2</sub>
	Expression of results also possible in mmol/l.



Check the pH of the sample, specified range: pH 2 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



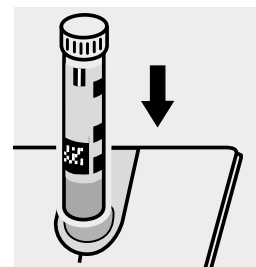
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time:  
10 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

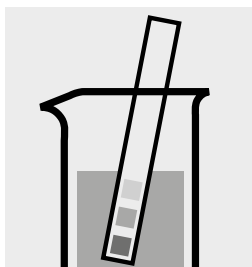
To check the measurement system (test reagents, measurement device, and handling) ready-to-use nitrite standard solution Certipur®, Cat.No. 1.19899, concentration 1000 mg/l NO<sub>2</sub><sup>-</sup>, can be used after diluting accordingly as well as the Standard solution for photometric applications, Cat.No. 1.25041.

# Nitrite

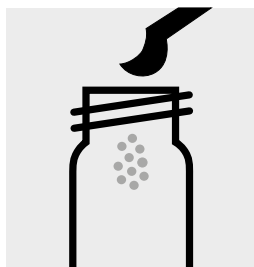
1.00609

Cell Test

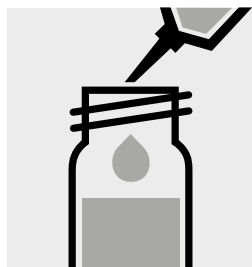
<b>Measuring</b>	1.0 – 90.0 mg/l NO <sub>2</sub> -N
<b>range:</b>	3 – 296 mg/l NO <sub>2</sub>
Expression of results also possible in mmol/l.	



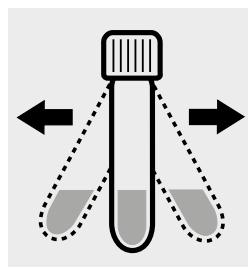
Check the pH of the sample, specified range: pH 1 – 12. If required, add dilute sulfuric acid drop by drop to adjust the pH.



Add 2 level blue microspoons of **NO<sub>2</sub>-1K** into a reaction cell.



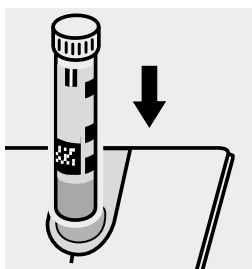
Add 8.0 ml of the sample with pipette and close with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 20 minutes, **measure immediately**. Do not shake or swirl the cell before the measurement.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

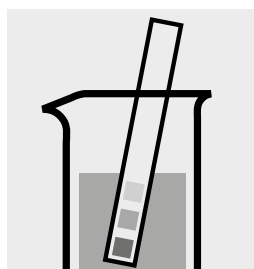
To check the measurement system (test reagents, measurement device, and handling) ready-to-use nitrite standard solution Certipur®, Cat.No. 1.19899, concentration 1000 mg/l NO<sub>2</sub><sup>-</sup>, can be used after diluting accordingly as well as the Standard solution for photometric applications, Cat.No. 1.25042.

# Nitrite

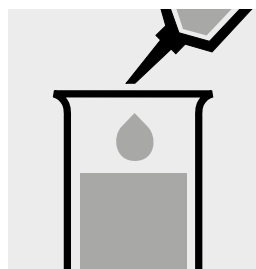
1.14776

Test

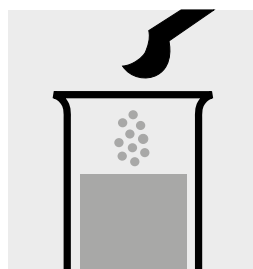
<b>Measuring</b>	0.02 – 1.00 mg/l NO <sub>2</sub> -N	0.07 – 3.28 mg/l NO <sub>2</sub>	10-mm cell
<b>range:</b>	0.010 – 0.500 mg/l NO <sub>2</sub> -N	0.03 – 1.64 mg/l NO <sub>2</sub>	20-mm cell
	0.002 – 0.200 mg/l NO <sub>2</sub> -N	0.007 – 0.657 mg/l NO <sub>2</sub>	50-mm cell
Expression of results also possible in mmol/l.			



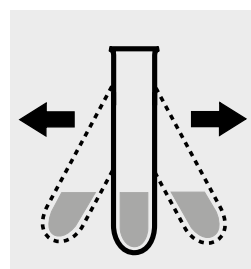
Check the pH of the sample, specified range: pH 2 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a test tube.



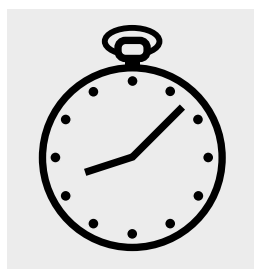
Add 1 level blue micro-spoon of NO<sub>2</sub>-1.



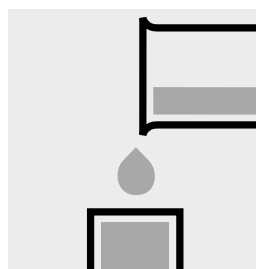
**Shake vigorously for 1 minute** to dissolve the solid substance.



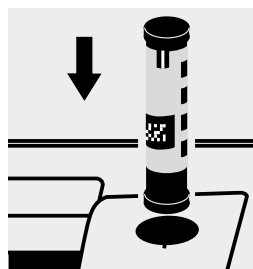
Check the pH, specified range: pH 2.0 – 2.5. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



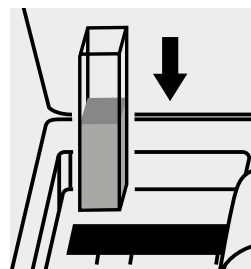
Reaction time:  
10 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

To measure in the 50-mm cell, the sample volume and the volume of the reagents have to be doubled for each. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use nitrite standard solution Certipur®, Cat.No. 1.19899, concentration 1000 mg/l NO<sub>2</sub><sup>-</sup>, can be used after diluting accordingly as well as the Standard solution for photometric applications, Cat.No. 1.25041.



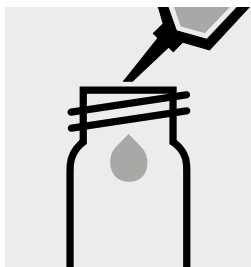
# Nitrogen (total)

1.14537

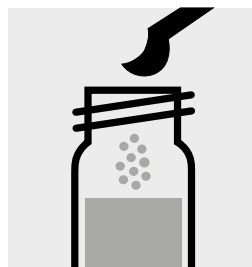
Cell Test

**Measuring** 0.5 – 15.0 mg/l N

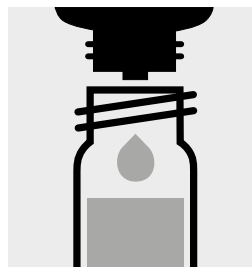
**range:** Expression of results also possible in mmol/l.



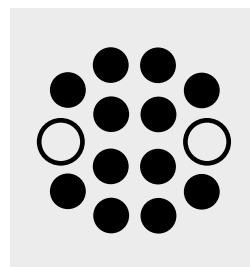
Pipette 10 ml of the sample into an empty round cell (Empty cells, Cat.No. 1.14724).



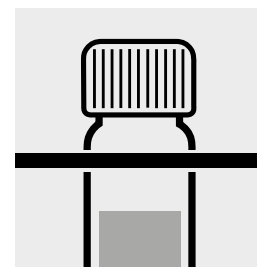
Add 1 level blue microspoon of **N-1K**.



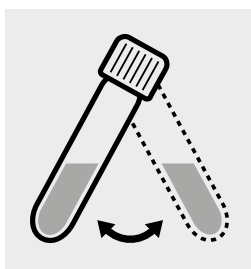
Add 6 drops of **N-2K**, close the cell with the screw cap, and mix.



Heat the cell in the thermoreactor at 120 °C for 1 hour.



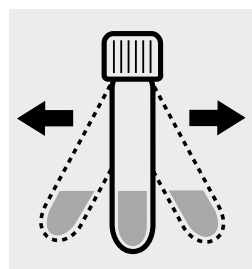
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature:  
**pretreated sample.**



Swirl the cell after 10 minutes.



Add 1 level microspoon of **N-3K** into a **reaction cell**, close the cell with the screw cap.



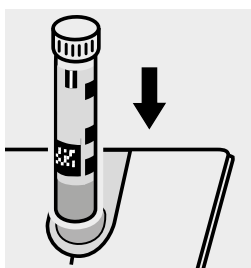
**Shake** the cell **vigorously for 1 minute** to dissolve the solid substance.



Add very slowly 1.5 ml of the **pretreated sample** with pipette, close the cell with the screw cap, and mix **briefly**.  
**Caution, cell becomes hot!**



Reaction time:  
10 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 50, Cat.No. 1.14695, or the Standard solutions for photometric applications, Cat.Nos. 1.25043 and 1.25044.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 50) is highly recommended.

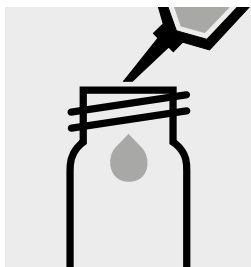
# Nitrogen (total)

1.00613

Cell Test

**Measuring** 0.5 – 15.0 mg/l N

**range:** Expression of results also possible in mmol/l.



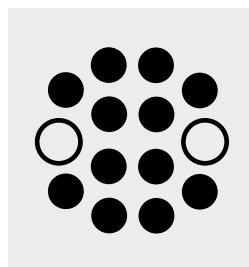
Pipette 10 ml of the sample into an empty round cell (Empty cells, Cat.No. 1.14724).



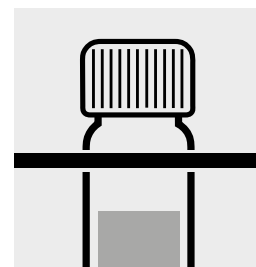
Add 1 level blue micro-spoon of **N-1K**.



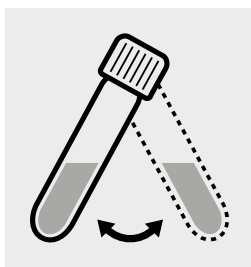
Add 6 drops of **N-2K**, close the cell with the screw cap, and mix.



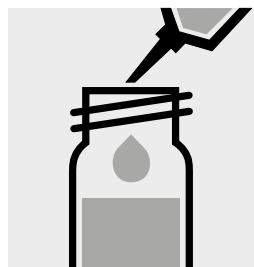
Heat the cell in the thermoreactor at 120 °C for 1 hour.



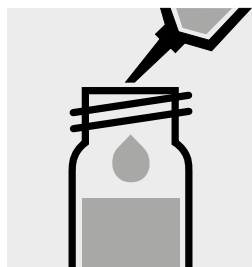
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature: **pretreated sample**.



Swirl the cell after 10 minutes.



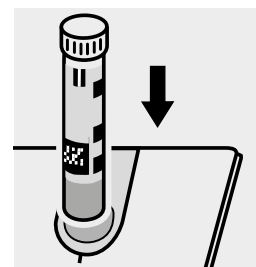
Pipette 1.0 ml of the **pretreated sample** into a reaction cell, **do not mix!**



Add 1.0 ml of **N-3K** with pipette, close the cell with the screw cap, and mix. **Caution, cell becomes hot!**



Reaction time: 10 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 50, Cat.No. 1.14695, or the Standard solutions for photometric applications, Cat.Nos. 1.25043 and 1.25044.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 50) is highly recommended.

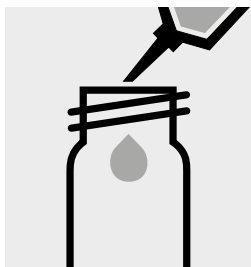
# Nitrogen (total)

1.14763

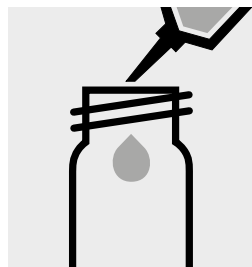
Cell Test

**Measuring** 10 – 150 mg/l N

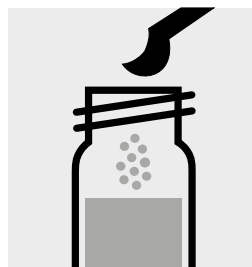
**range:** Expression of results also possible in mmol/l.



Pipette 1.0 ml of the sample into an empty round cell (Empty cells, Cat.No. 1.14724).



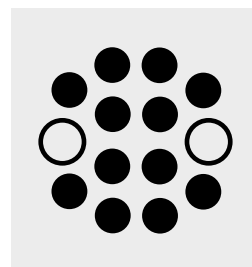
Add 9.0 ml of distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) with pipette.



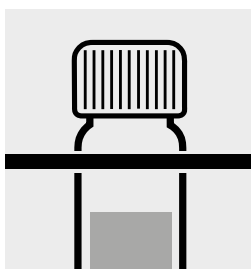
Add 1 level blue micro-spoon of **N-1K**.



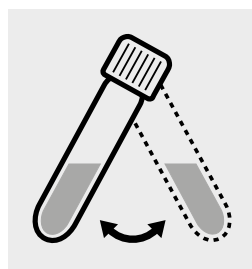
Add 6 drops of **N-2K**, close the cell with the screw cap, and mix.



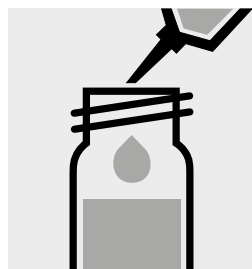
Heat the cell in the thermoreactor at 120 °C for 1 hour.



Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature: **pretreated sample**.



Swirl the cell after 10 minutes.



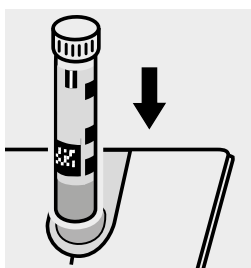
Pipette 1.0 ml of the **pretreated sample** into a reaction cell, **do not mix!**



Add 1.0 ml of **N-3K** with pipette, close the cell with the screw cap, and mix. **Caution, cell becomes hot!**



Reaction time: 10 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 70, Cat.No. 1.14689, or the Standard solutions for photometric applications, Cat.Nos. 1.25044 and 1.25045.

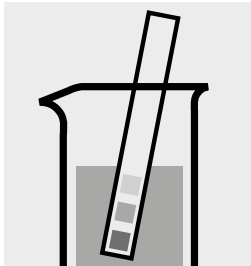
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 70) is highly recommended.

# Oxygen

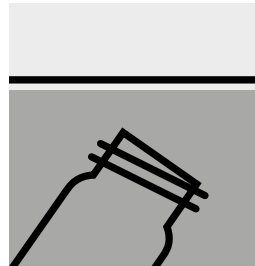
1.14694

Cell Test

<b>Measuring</b>	0.5 – 12.0 mg/l O <sub>2</sub>
<b>range:</b>	Expression of results also possible in mmol/l.



Check the pH of the sample, specified range: pH 6 – 8. If required, add dilute sodium hydroxide solution or nitric acid drop by drop to adjust the pH.



Fill watersample into a reaction cell to overflowing and make sure, that no air bubbles are present.



Place the filled cell in a test-tube rack.



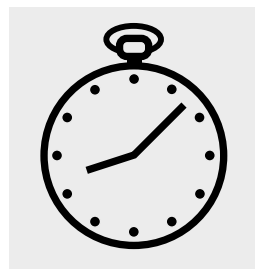
Add with microspoon 1 glass bead.



Add 5 drops of O<sub>2</sub>-1K.



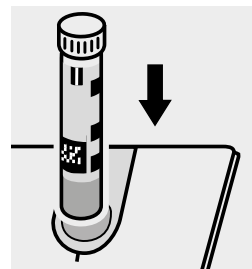
Add 5 drops of O<sub>2</sub>-2K, close the cell with the screw cap, and shake for 10 seconds.



Reaction time:  
1 minute



Add 10 drops of O<sub>2</sub>-3K, close the cell with the screw cap, mix, and clean from outside.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

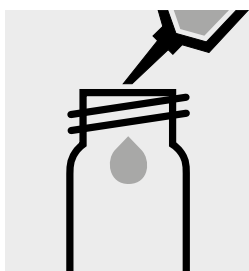
To check the measurement system (test reagents, measurement device, and handling) a oxygen standard solution must be prepared (application see the website).

# Oxygen Scavengers

1.19251

Test

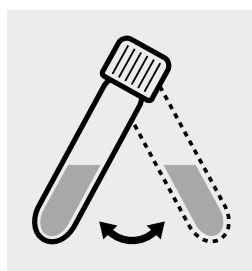
<b>Measuring</b>	0.020 – 0.500 mg/l DEHA*	20-mm cell
<b>range:</b>	*N,N-diethylenhydroxylamine	
	0.027 – 0.666 mg/l Carbohy*	20-mm cell
	*carbohydrazide	
	0.05 – 1.32 mg/l Hydro*	20-mm cell
	*hydroquinone	
	0.08 – 1.95 mg/l ISA*	20-mm cell
	*isoascorbic acid	
	0.09 – 2.17 mg/l MEKO*	20-mm cell
	*methylethylketoxime	



Pipette 10 ml of the sample into an empty round cell (Empty cells, Cat.No. 1.14724).



Add 1 powder pack of **Oxyscav 1** and close with the screw cap.



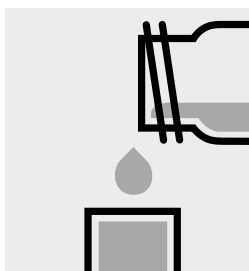
Swirl the cell to dissolve the solid substance.



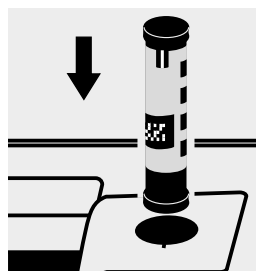
Add 0.20 ml of **Oxyscav 2** with pipette, close with the screw cap, and mix.



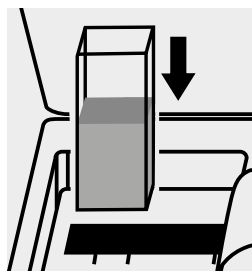
Reaction time: 10 minutes, **protect from light in the process, measure immediately.**



Transfer the solution into a rectangular cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Quality assurance:

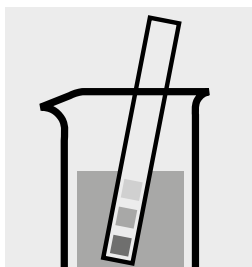
To check the measurement system (test reagents, measurement device, and handling) an oxygen scavengers standard solution must be prepared from N,N-diethylhydroxylamine, Cat.No. 8.18473 (see section "Standard solutions").

# Ozone

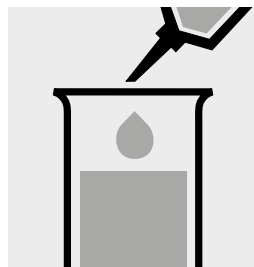
1.00607

Test

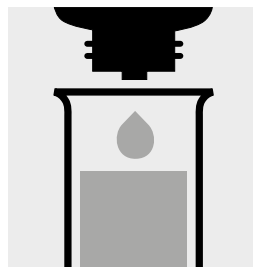
<b>Measuring</b>	0.05 – 4.00 mg/l O <sub>3</sub>	10-mm cell
<b>range:</b>	0.02 – 2.00 mg/l O <sub>3</sub>	20-mm cell
	0.010 – 0.800 mg/l O <sub>3</sub>	50-mm cell
Expression of results also possible in mmol/l.		



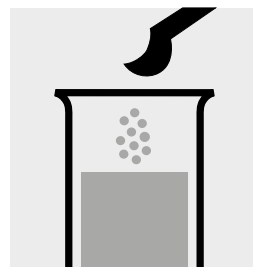
Check the pH of the sample, specified range: pH 4 – 8.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



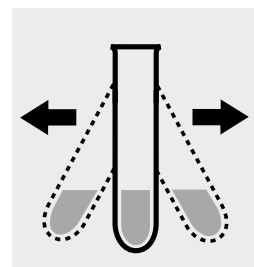
Pipette 10 ml of the sample into a test tube.



Add 2 drops of O<sub>3</sub>-1 and mix.



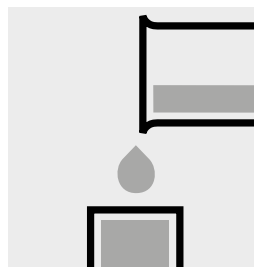
Add 1 level blue micro-spoon of O<sub>3</sub>-2.



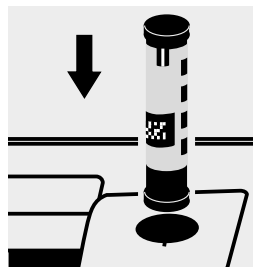
Shake vigorously to dissolve the solid substance.



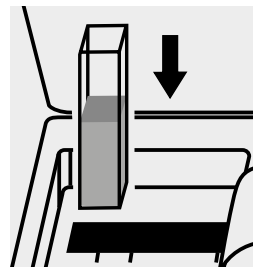
Reaction time:  
1 minute



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

Very high ozone concentrations in the sample produce yellow-colored solutions (measurement solution should be red) and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

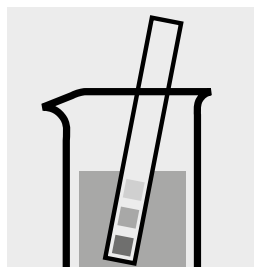
# Palladium in water and wastewater

Application

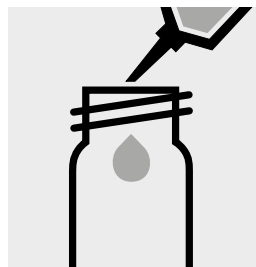
Measuring range: 0.05 – 1.25 mg/l Pd

10-mm cell

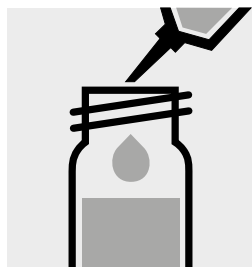
Method No. 133



Check the pH of the sample, specified range: pH 2 – 5. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into an empty round cell (Empty cells, Cat.No. 1.14724).



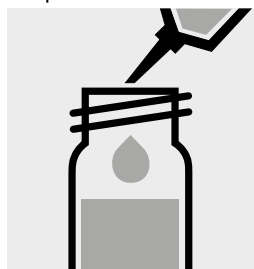
Add 1.0 ml of **reagent 1** with pipette, close the cell with the screw cap, and mix.



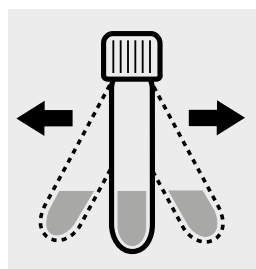
Check the pH of the sample, specified value: pH 3.0. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



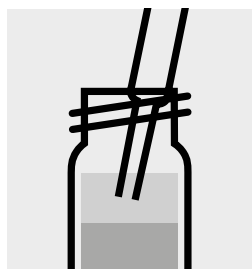
Add 0.20 ml of **reagent 2** with pipette, close the cell with the screw cap, and mix.



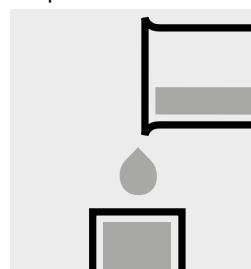
Add 5.0 ml **isoamyl alcohol GR** (Cat.No. 100979) with pipette, close the cell with the screw cap.



Shake the cell vigorously for 1 minute. Leave to stand to allow phases to separate.



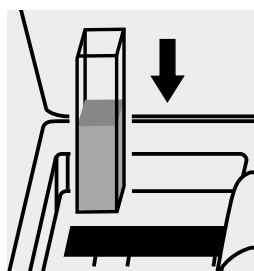
Aspirate the organic-clear upper phase from the tube with pipette and dry over **sodium sulfate anhydrous** (Cat.No. 1.06649).



Transfer the dried solution into a cell.



Select method no. **133**.



Place the cell into the cell compartment. The measurement is performed automatically.

## Note:

Empty cells with screw caps, Cat.No. 1.14724 are recommended for the preparation. These cells can be sealed with the screw caps, thus enabling a hazard-free mixing of the sample.

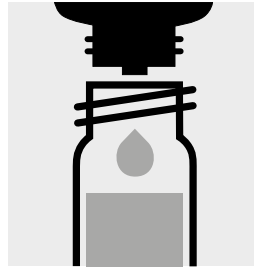
## Important:

The exact composition and preparation of the reagents 1 and 2 used are given in the corresponding application, which also includes further information on the method employed. This application can be downloaded from the website.

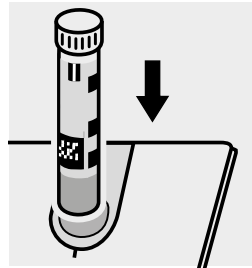
Measuring range: pH 6.4 – 8.8



Pipette 10 ml of the sample into a round cell.



Add 4 drops of **pH-1**, close the cell with the screw cap, and mix.  
**Attention!**  
The reagent bottle must be held **vertically by all means!**



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

**Quality assurance:**

To check the measurement system (test reagents, measurement device, and handling) buffer solution pH 7.00 Certipur®, Cat.No. 1.09407, can be used.



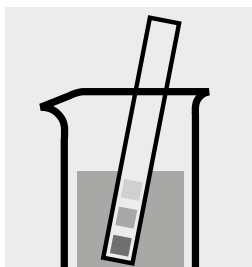
# Phenol

1.14551

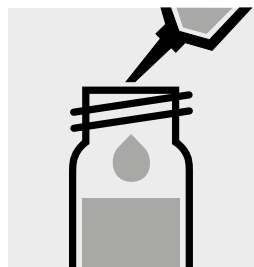
Cell Test

**Measuring** 0.10 – 2.50 mg/l C<sub>6</sub>H<sub>5</sub>OH

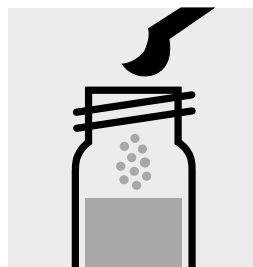
**range:** Expression of results also possible in mmol/l.



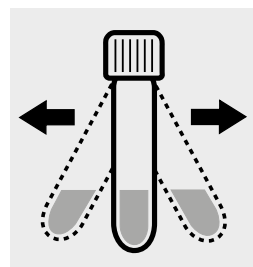
Check the pH of the sample, specified range: pH 2 – 11. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 10 ml of the sample into a reaction cell, close with the screw cap, and mix.



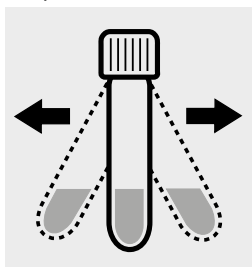
Add 1 level grey microspoon of **Ph-1K**, close the cell with the screw cap.



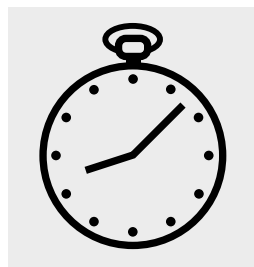
Shake the cell vigorously to dissolve the solid substance.



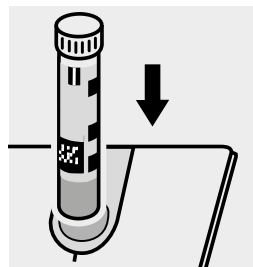
Add 1 level green microspoon of **Ph-2K**, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time:  
1 minute



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Important:

Very high phenol concentrations in the sample result in a weakening of the color and false-low readings are yielded. In such cases the sample must be diluted (plausibility check).

## Quality assurance:

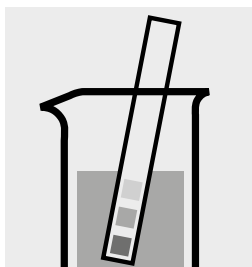
To check the measurement system (test reagents, measurement device, and handling) a phenol standard solution must be prepared from Phenol GR, Cat.No. 1.00206 (see section "Standard solutions").

# Phenol

1.00856

Test

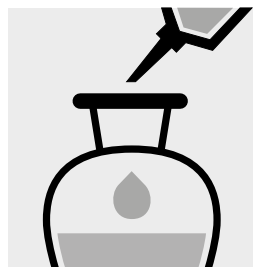
<b>Measuring</b>	0.002 – 0.100 mg/l C <sub>6</sub> H <sub>5</sub> OH	20-mm cell
<b>range:</b>	Expression of results also possible in mmol/l.	
<b>Attention!</b>	The measurement is carried out in a 20-mm rectangular cell against a blank, prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) and the reagents in an analogous manner.	



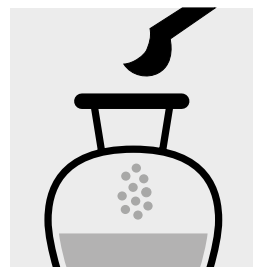
Check the pH of the sample, specified range: pH 2 – 11. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



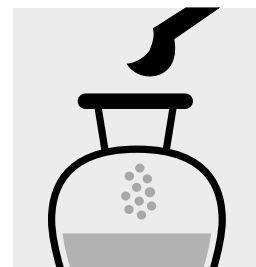
Pipette 200 ml of sample into a separation funnel.



Add 5.0 ml of **Ph-1** with pipette and mix.



Add 1 level green micro-spoon of **Ph-2** and shake to dissolve the solid substance.



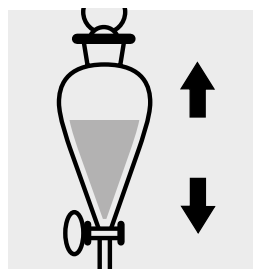
Add 1 level green micro-spoon of **Ph-3** and shake to dissolve the solid substance.



Reaction time: 30 minutes (protected from light)



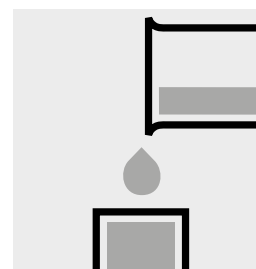
Add 10 ml of chloroform with pipette, close separation funnel.



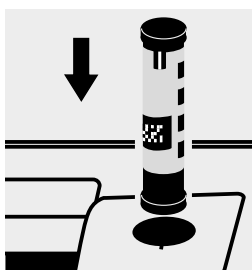
Shake vigorously for 1 minute.



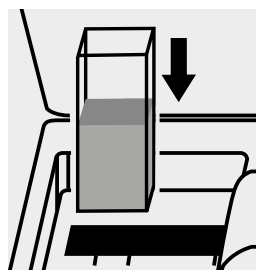
Leave to stand for 5 – 10 minutes to allow the phases to separate.



Transfer the clear **lower** phase into a cell.



Select method with AutoSelector measuring range 0.002 – 0.100 mg/l.



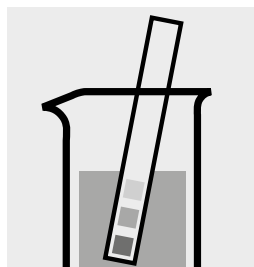
Place the cell into the cell compartment.

# Phenol

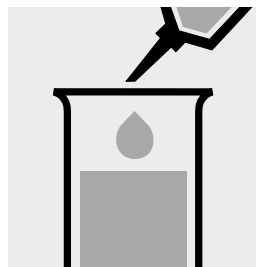
1.00856

Test

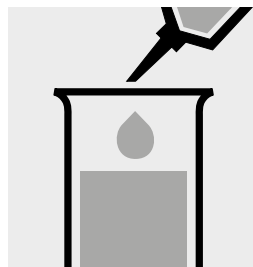
<b>Measuring</b>	0.10 – 5.00 mg/l C <sub>6</sub> H <sub>5</sub> OH	10-mm cell
<b>range:</b>	0.05 – 2.50 mg/l C <sub>6</sub> H <sub>5</sub> OH	20-mm cell
	0.025 – 1.000 mg/l C <sub>6</sub> H <sub>5</sub> OH	50-mm cell
Expression of results also possible in mmol/l.		



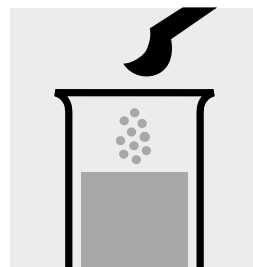
Check the pH of the sample, specified range: pH 2 – 11.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



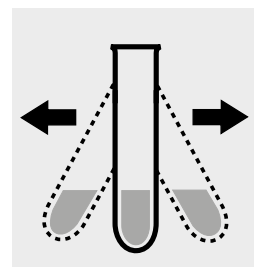
Pipette 10 ml of the sample into a test tube.



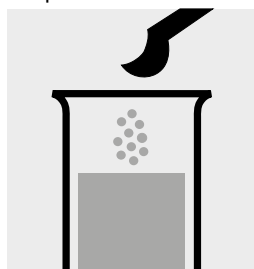
Add 1.0 ml of **Ph-1** with pipette and mix.



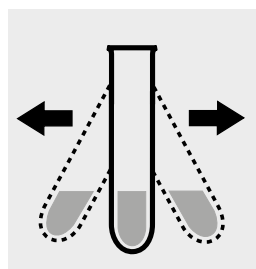
Add 1 level grey micro-spoon of **Ph-2**.



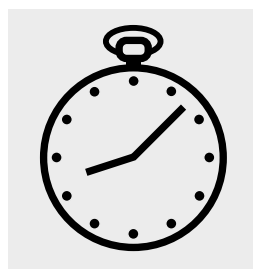
Shake vigorously to dissolve the solid substance.



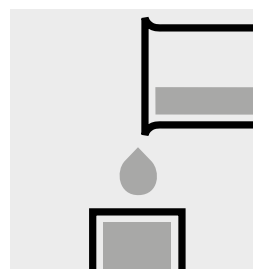
Add 1 level grey micro-spoon of **Ph-3**.



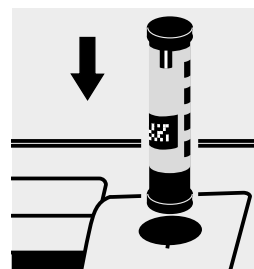
Shake vigorously to dissolve the solid substance.



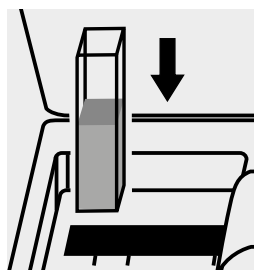
Reaction time: 10 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector measuring range 0.025 – 5.00 mg/l.



Place the cell into the cell compartment.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a phenole standard solution must be prepared from Phenol GR, Cat.No. 1.00206 (see section "Standard solutions").

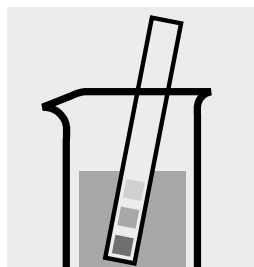
# Phosphate

1.00474

## Determination of orthophosphate

Cell Test

<b>Measuring</b>	0.05 – 5.00 mg/l PO <sub>4</sub> -P
<b>range:</b>	0.2 – 15.3 mg/l PO <sub>4</sub>
	0.11 – 11.46 mg/l P <sub>2</sub> O <sub>5</sub>
	Expression of results also possible in mmol/l.



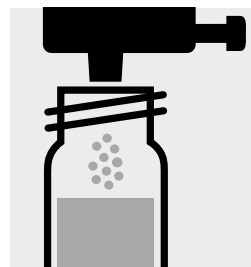
Check the pH of the sample, specified range: pH 0 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



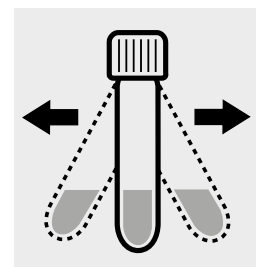
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



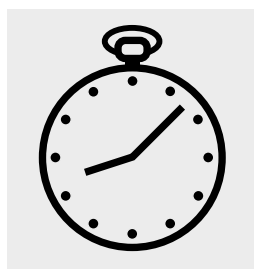
Add 5 drops of **P-1K**, close the cell with the screw cap, and mix.



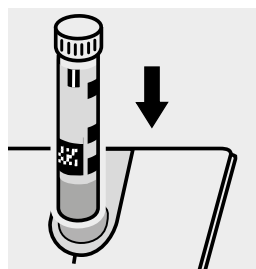
Add 1 dose of **P-2K** using the blue dose-metering cap, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time:  
5 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Important:

For the determination of **total phosphorus = sum of orthophosphate, polyphosphate and organophosphate** either Phosphate Cell Test, Cat. No. 1.14543, 1.14729, and 1.00673 or Phosphate Test, Cat. No. 1.14848 in conjunction with Crack Set 10/10C, Cat. No. 1.14687 resp. 1.14688 can be used.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 1.14676.

Ready-to-use phosphate standard solution Certipur®, Cat.No. 1.19898, concentration 1000 mg/l PO<sub>4</sub><sup>3-</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

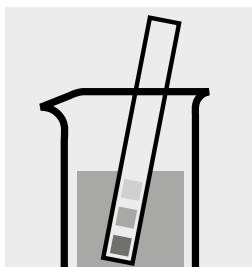
# Phosphate

1.14543

## Determination of orthophosphate

Cell Test

<b>Measuring</b>	0.05 – 5.00 mg/l PO <sub>4</sub> -P
<b>range:</b>	0.2 – 15.3 mg/l PO <sub>4</sub>
	0.11 – 11.46 mg/l P <sub>2</sub> O <sub>5</sub>
	Expression of results also possible in mmol/l.



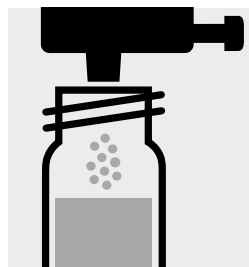
Check the pH of the sample, specified range: pH 0 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



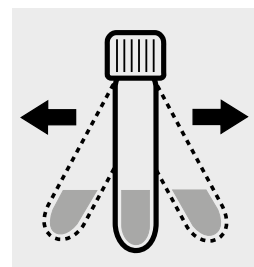
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 5 drops of **P-2K**, close the cell with the screw cap, and mix.



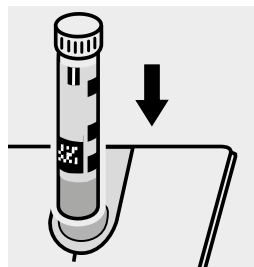
Add 1 dose of **P-3K** using the blue dose-metering cap, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time:  
5 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommend to use Spectroquant® CombiCheck 10, Cat.No. 1.14676.

Ready-to-use phosphate standard solution Certipur®, Cat.No. 1.19898, concentration 1000 mg/l PO<sub>4</sub><sup>3-</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

# Phosphate

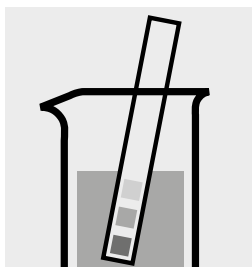
1.14543

Determination of total phosphorus

= sum of orthophosphate, polyphosphate, and organophosphate

Cell Test

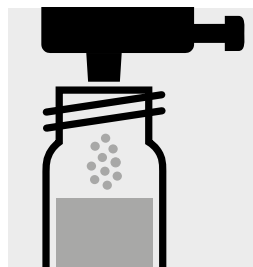
<b>Measuring</b>	0.05 – 5.00 mg/l P
<b>range:</b>	0.2 – 15.3 mg/l PO <sub>4</sub>
	0.11 – 11.46 mg/l P <sub>2</sub> O <sub>5</sub>
	Expression of results also possible in mmol/l.



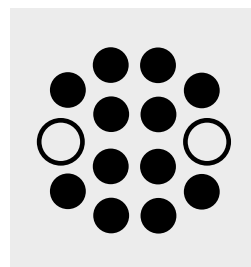
Check the pH of the sample, specified range: pH 0 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



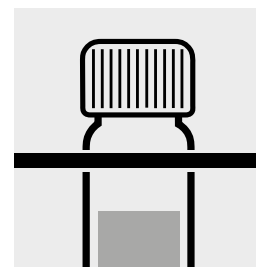
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



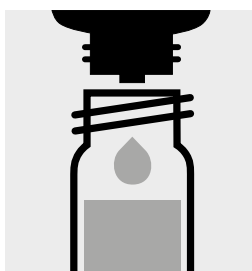
Add 1 dose of **P-1K** using the green dose-metering cap, close the cell with the screw cap.



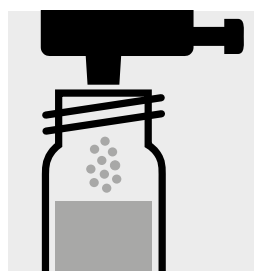
Heat the cell in the thermoreactor at 120 °C for 30 minutes.



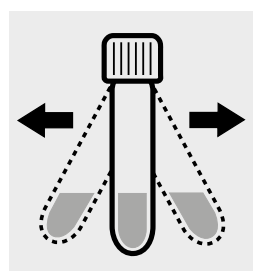
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature.



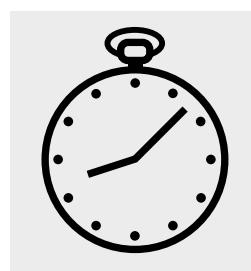
Add 5 drops of **P-2K**, close the cell with the screw cap, and mix.



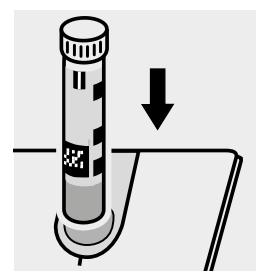
Add 1 dose of **P-3K** using the blue dose-metering cap, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 5 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 1.14676, or the Standard solutions for photometric applications, Cat.Nos. 1.25046 and 1.25047.

Ready-to-use phosphate standard solution Certipur®, Cat.No. 1.19898, concentration 1000 mg/l PO<sub>4</sub><sup>3-</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

# Phosphate

Differentiation between total phosphorus, orthophosphate, and organophosphate

1.14543

Cell Test

<b>Measuring</b>	0.05 – 5.00 mg/l PO <sub>4</sub> -P or P
<b>range:</b>	0.2 – 15.3 mg/l PO <sub>4</sub>
	0.11 – 11.46 mg/l P <sub>2</sub> O <sub>5</sub>

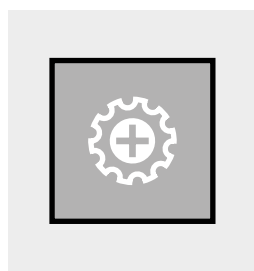
If the aim is to differentiate between orthophosphate (PO<sub>4</sub>-P) and P org\*, after selecting the method it is possible to set the method-specific "Differentiation" mode.

\* P org is the sum of polyphosphate and organophosphate.

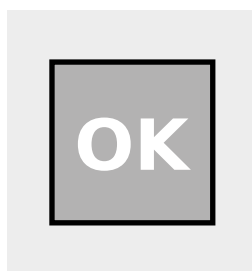
**Note:** If no differentiation is to be measured, the "Differentiation" mode must be deactivated again.



Select method no. 55.



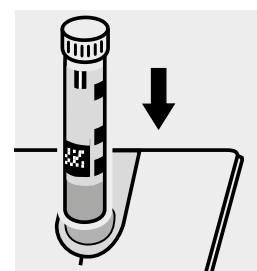
Tap the <Settings> button. Select "Differentiation" and activate.



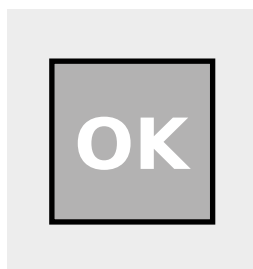
Confirm with <OK>.

Perform determination of **total phosphorus** (see analytical procedure "Determination of total phosphorus" with 1.14543). = **cell Σ P**

After the reaction time has expired:



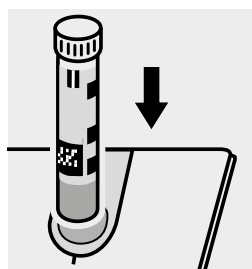
Place the **cell Σ P** into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically.



Confirm with <OK>.

Perform determination of **orthophosphate** (see analytical procedure "Determination of orthophosphate" with 1.14543). = **cell PO<sub>4</sub>-P**

After the reaction time has expired:



Place the **cell PO<sub>4</sub>-P** into the cell compartment. Align the mark on the cell with that on the photometer.

The measurement is performed automatically.



Confirm with <OK>. The results A (Σ P), B (PO<sub>4</sub>-P), and C (P<sub>org</sub>) are shown in the display in mg/l.

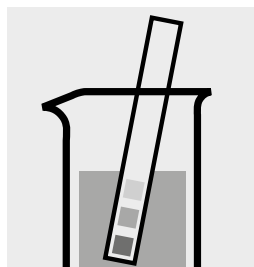
# Phosphate

1.00475

## Determination of orthophosphate

Cell Test

<b>Measuring</b>	0.5 – 25.0 mg/l PO <sub>4</sub> -P
<b>range:</b>	1.5 – 76.7 mg/l PO <sub>4</sub>
	1.1 – 57.3 mg/l P <sub>2</sub> O <sub>5</sub>
	Expression of results also possible in mmol/l.



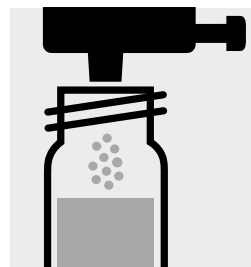
Check the pH of the sample, specified range: pH 0 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



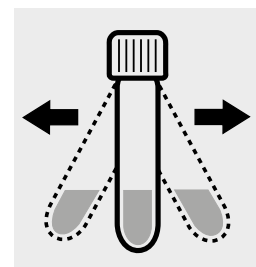
Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



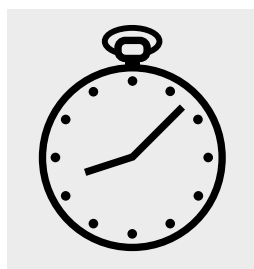
Add 5 drops of **P-1K**, close the cell with the screw cap, and mix.



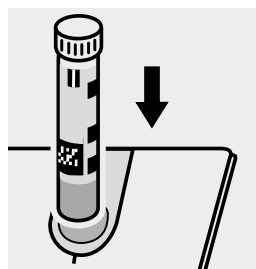
Add 1 dose of **P-2K** using the blue dosing cap, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time:  
5 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Important:

For the determination of **total phosphorus = sum of orthophosphate, polyphosphate and organophosphate** either Phosphate Cell Test, Cat. Nos. 1.14543, 1.14729, and 1.00673 or Phosphate Test, Cat. No. 1.14848 in conjunction with Crack Set 10/10C, Cat. Nos. 1.14687 resp. 1.14688 can be used.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20 and 80, Cat.Nos. 1.14675 and 1.14738.

Ready-to-use phosphate standard solution Certipur®, Cat.No. 1.19898, concentration 1000 mg/l PO<sub>4</sub><sup>3-</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck) is highly recommended.



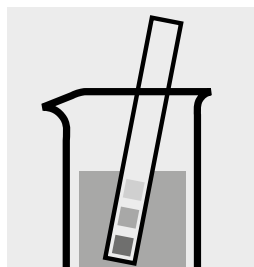
# Phosphate

1.14729

## Determination of orthophosphate

Cell Test

<b>Measuring</b>	0.5 – 25.0 mg/l PO <sub>4</sub> -P
<b>range:</b>	1.5 – 76.7 mg/l PO <sub>4</sub>
	1.1 – 57.3 mg/l P <sub>2</sub> O <sub>5</sub>
	Expression of results also possible in mmol/l.



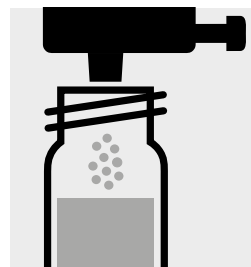
Check the pH of the sample, specified range: pH 0 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



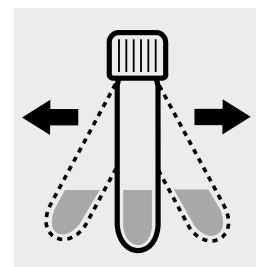
Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



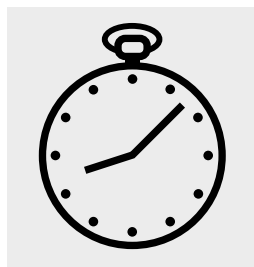
Add 5 drops of **P-2K**, close the cell with the screw cap, and mix.



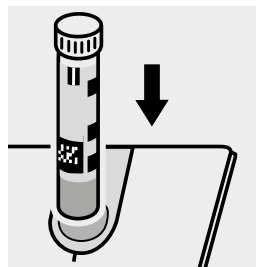
Add 1 dose of **P-3K** using the blue dosing cap, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time:  
5 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20 and 80, Cat.Nos. 1.14675 and 1.14738.

Ready-to-use phosphate standard solution Certipur®, Cat.No. 1.19898, concentration 1000 mg/l PO<sub>4</sub><sup>3-</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck) is highly recommended.

# Phosphate

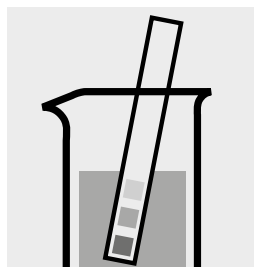
Determination of total phosphorus

= sum of orthophosphate, polyphosphate, and organophosphate

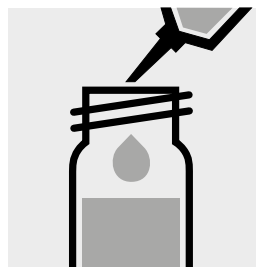
1.14729

Cell Test

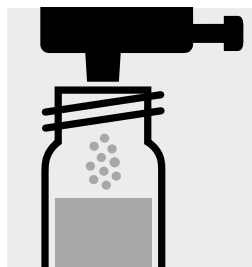
<b>Measuring</b>	0.5 – 25.0 mg/l P
<b>range:</b>	1.5 – 76.7 mg/l PO <sub>4</sub>
	1.1 – 57.3 mg/l P <sub>2</sub> O <sub>5</sub>
	Expression of results also possible in mmol/l.



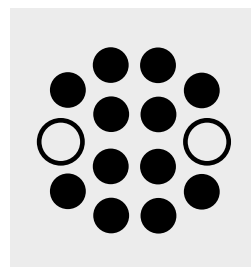
Check the pH of the sample, specified range: pH 0 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



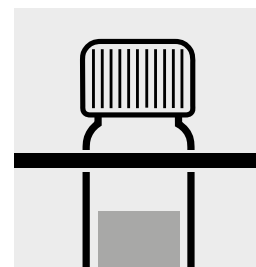
Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



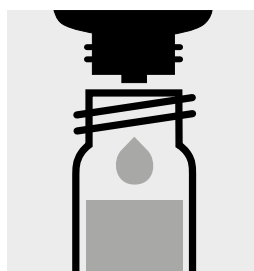
Add 1 dose of **P-1K** using the green dose-metering cap, close the cell with the screw cap.



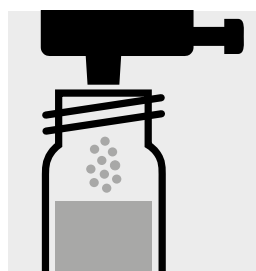
Heat the cell in the thermoreactor at 120 °C for 30 minutes.



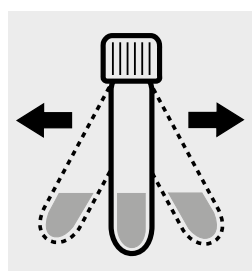
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature.



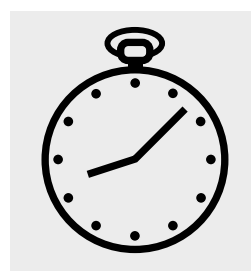
Add 5 drops of **P-2K**, close the cell with the screw cap, and mix.



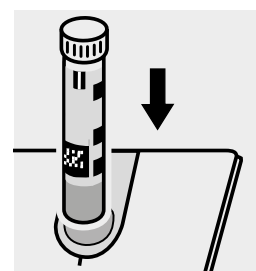
Add 1 dose of **P-3K** using the blue dose-metering cap, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 5 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20 and 80, Cat.Nos. 1.14675 and 1.14738, or as well as the Standard solutions for photometric applications, Cat.Nos. 1.25047 and 1.25048.

Ready-to-use phosphate standard solution Certipur®, Cat.No. 1.19898, concentration 1000 mg/l PO<sub>4</sub><sup>2-</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck) is highly recommended.

# Phosphate

Differentiation between total phosphorus, orthophosphate, and organophosphate

1.14729

Cell Test

<b>Measuring</b>	0.5 – 25.0 mg/l PO <sub>4</sub> -P or P
<b>range:</b>	1.5 – 76.7 mg/l PO <sub>4</sub>
	1.1 – 57.3 mg/l P <sub>2</sub> O <sub>5</sub>

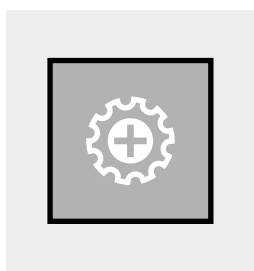
If the aim is to differentiate between orthophosphate (PO<sub>4</sub>-P) and P org\*, after selecting the method it is possible to set the method-specific "Differentiation" mode.

\* P org is the sum of polyphosphate and organophosphate.

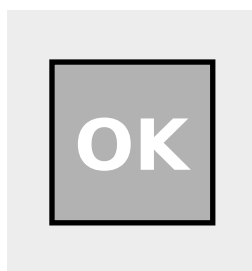
**Note:** If no differentiation is to be measured, the "Differentiation" mode must be deactivated again.



Select method no. **86**.



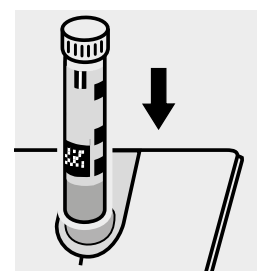
Tap the <Settings> button. Select "Differentiation" and activate.



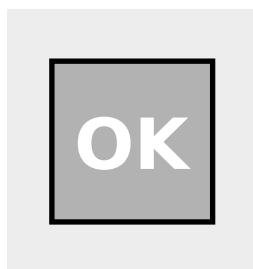
Confirm with <OK>.

Perform determination of **total phosphorus** (see analytical procedure "Determination of total phosphorus" with 1.14729).  
**= cell Σ P**

After the reaction time has expired:



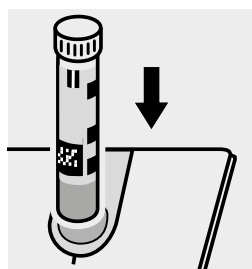
Place the **cell Σ P** into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically.



Confirm with <OK>.

Perform determination of **orthophosphate** (see analytical procedure "Determination of orthophosphate" with 1.14729).  
**= cell PO<sub>4</sub>-P**

After the reaction time has expired:



Place the **cell PO<sub>4</sub>-P** into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically.



Confirm with <OK>. The results A (Σ P), B (PO<sub>4</sub>-P), and C (P<sub>org</sub>) are shown in the display in mg/l.

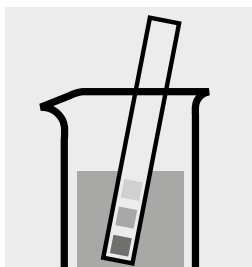
# Phosphate

1.00616

## Determination of orthophosphate

Cell Test

<b>Measuring</b>	3.0 – 100.0 mg/l PO <sub>4</sub> -P
<b>range:</b>	9 – 307 mg/l PO <sub>4</sub>
	7 – 229 mg/l P <sub>2</sub> O <sub>5</sub>
	Expression of results also possible in mmol/l.



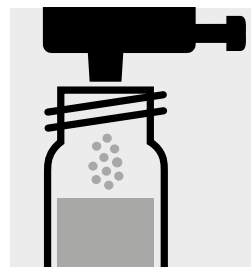
Check the pH of the sample, specified range: pH 0 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



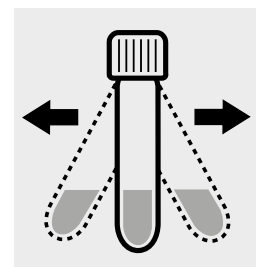
Pipette 0.20 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 5 drops of **PO<sub>4</sub>-1K**, close the cell with the screw cap, and mix.



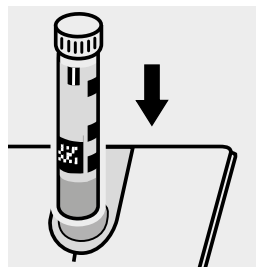
Add 1 dose of **PO<sub>4</sub>-2K** using the blue dose-metering cap, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time:  
5 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Important:

For the determination of **total phosphorus = sum of orthophosphate, polyphosphate and organophosphate** either Phosphate Cell Test, Cat. Nos. 1.14543, 1.14729, and 1.00673 or Phosphate Test, Cat. No. 1.14848 in conjunction with Crack Set 10/10C, Cat. Nos. 1.14687 resp. 1.14688 can be used.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use phosphate standard solution Certipur®, Cat.No. 1.19898, concentration 1000 mg/l PO<sub>4</sub><sup>3-</sup>, can be used after diluting accordingly.

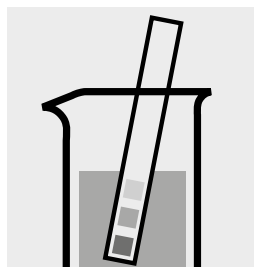
# Phosphate

1.00673

## Determination of orthophosphate

Cell Test

<b>Measuring</b>	3.0 – 100.0 mg/l PO <sub>4</sub> -P
<b>range:</b>	9 – 307 mg/l PO <sub>4</sub>
	7 – 229 mg/l P <sub>2</sub> O <sub>5</sub>
	Expression of results also possible in mmol/l.



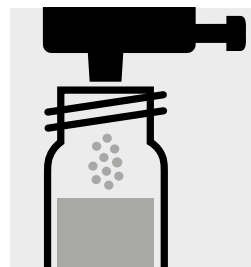
Check the pH of the sample, specified range: pH 0 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



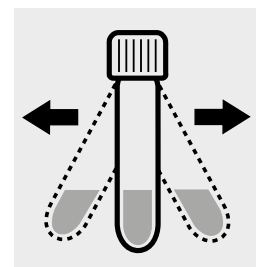
Pipette 0.20 ml of the sample into a reaction cell, close with the screw cap, and mix.



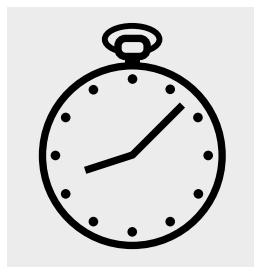
Add 5 drops of **P-2K**, close the cell with the screw cap, and mix.



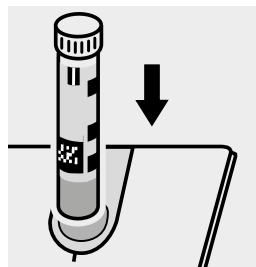
Add 1 dose of **P-3K** using the blue dosing cap, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time:  
5 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use phosphate standard solution Certipur®, Cat.No. 1.19898, concentration 1000 mg/l PO<sub>4</sub><sup>3-</sup>, can be used after diluting accordingly.

# Phosphate

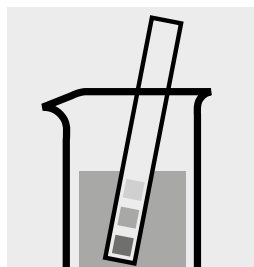
Determination of total phosphorus

= sum of orthophosphate, polyphosphate, and organophosphate

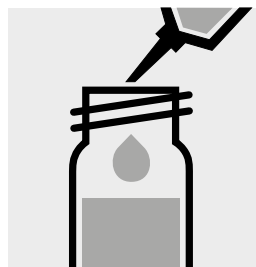
1.00673

Cell Test

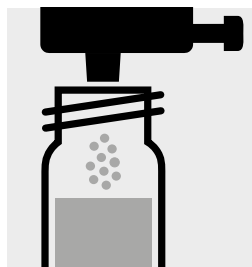
<b>Measuring</b>	3.0 – 100.0 mg/l P
<b>range:</b>	9 – 307 mg/l PO <sub>4</sub>
	7 – 229 mg/l P <sub>2</sub> O <sub>5</sub>
Expression of results also possible in mmol/l.	



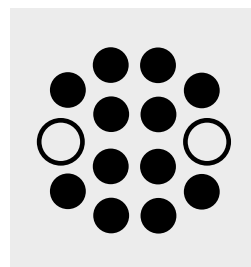
Check the pH of the sample, specified range: pH 0 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



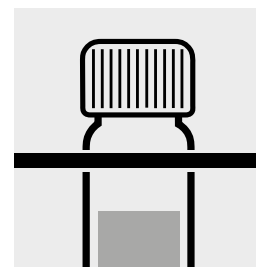
Pipette 0.20 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 1 dose of **P-1K** using the green dose-metering cap, close the cell with the screw cap.



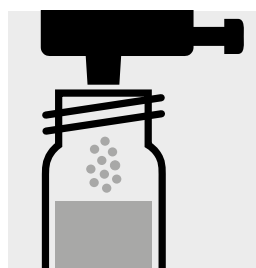
Heat the cell in the thermoreactor at 120 °C for 30 minutes.



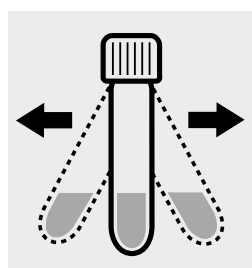
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature.



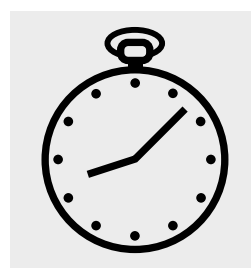
Add 5 drops of **P-2K**, close the cell with the screw cap, and mix.



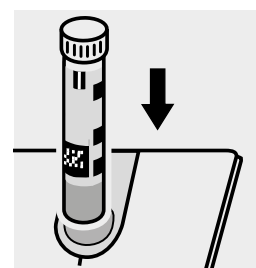
Add 1 dose of **P-3K** using the blue dose-metering cap, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 5 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use phosphate standard solution Certipur®, Cat.No. 1.19898, concentration 1000 mg/l PO<sub>4</sub><sup>3-</sup>, can be used after diluting accordingly as well as the Standard solutions for photometric applications, Cat.Nos. 1.25047, 1.25048, and 1.25049.

# Phosphate

Differentiation between total phosphorus, orthophosphate, and organophosphate

1.00673

Cell Test

<b>Measuring</b>	3.0 – 100.0 mg/l PO <sub>4</sub> -P or P
<b>range:</b>	9 – 307 mg/l PO <sub>4</sub>
	7 – 229 mg/l P <sub>2</sub> O <sub>5</sub>

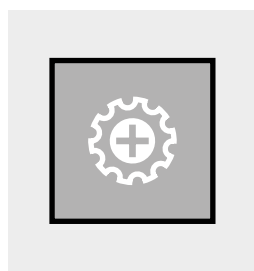
If the aim is to differentiate between orthophosphate (PO<sub>4</sub>-P) and P org\*, after selecting the method it is possible to set the method-specific "Differentiation" mode.

\* P org is the sum of polyphosphate and organophosphate.

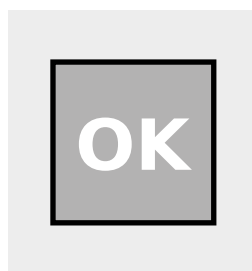
**Note:** If no differentiation is to be measured, the "Differentiation" mode must be deactivated again.



Select method no. **214**.



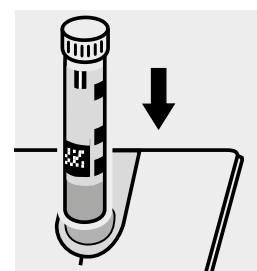
Tap the <Settings> button. Select "Differentiation" and activate.



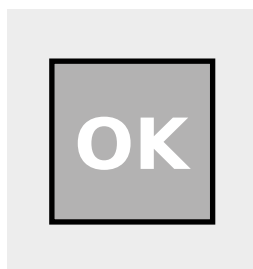
Confirm with <OK>.

Perform determination of **total phosphorus** (see analytical procedure "Determination of total phosphorus" with 1.00673).  
**= cell Σ P**

After the reaction time has expired:



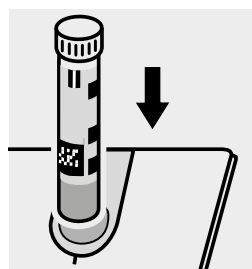
Place the **cell Σ P** into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically.



Confirm with <OK>.

Perform determination of **orthophosphate** (see analytical procedure "Determination of orthophosphate" with 1.00673).  
**= cell PO<sub>4</sub>-P**

After the reaction time has expired:



Place the **cell PO<sub>4</sub>-P** into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically.



Confirm with <OK>. The results A (Σ P), B (PO<sub>4</sub>-P), and C (P<sub>org</sub>) are shown in the display in mg/l.

# Phosphate

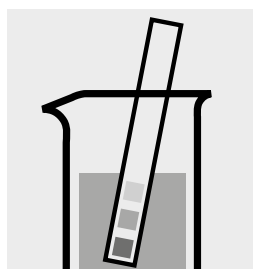
1.14848

## Determination of orthophosphate

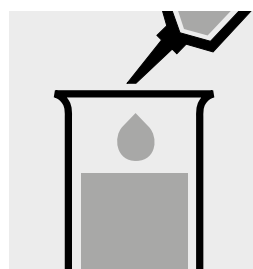
Test

<b>Measuring range:</b>	0.05 – 5.00 mg/l PO <sub>4</sub> -P	0.2 – 15.3 mg/l PO <sub>4</sub>	0.11 – 11.46 mg/l P <sub>2</sub> O <sub>5</sub>	10-mm cell
	0.03 – 2.50 mg/l PO <sub>4</sub> -P	0.09 – 7.67 mg/l PO <sub>4</sub>	0.07 – 5.73 mg/l P <sub>2</sub> O <sub>5</sub>	20-mm cell
	0.005 – 1.000 mg/l PO <sub>4</sub> -P	0.015 – 3.066 mg/l PO <sub>4</sub>	0.011 – 2.291 mg/l P <sub>2</sub> O <sub>5</sub>	50-mm cell

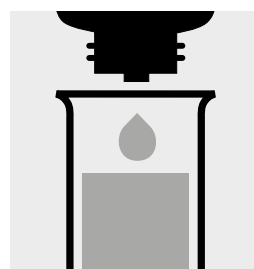
Expression of results also possible in mmol/l.



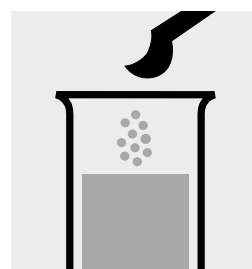
Check the pH of the sample, specified range: pH 0 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



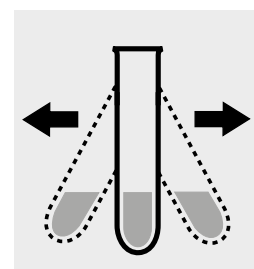
Pipette 5.0 ml of the sample into a test tube.



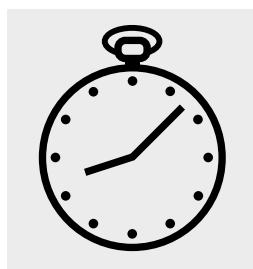
Add 5 drops of PO<sub>4</sub>-1 and mix.



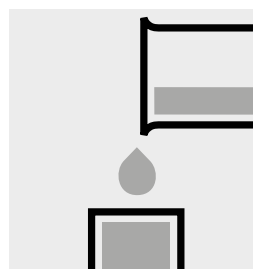
Add 1 level blue micro-spoon of PO<sub>4</sub>-2.



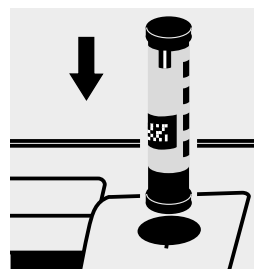
Shake vigorously to dissolve the solid substance.



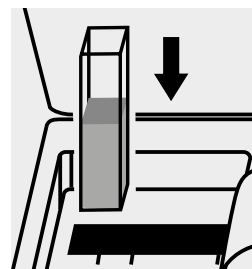
Reaction time: 5 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

### Important:

For measurement in the 50-mm cell, the sample volume and the volume of the reagents have to be doubled for each. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

For the determination of **total phosphorus = sum of orthophosphate, polyphosphate, and organophosphate** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687, and thermoreactor is necessary.

Result can be expressed as sum of phosphorus ( $\Sigma$  P).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 1.14676.

Ready-to-use phosphate standard solution Certipur®, Cat.No. 1.19898, concentration 1000 mg/l PO<sub>4</sub><sup>3-</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.



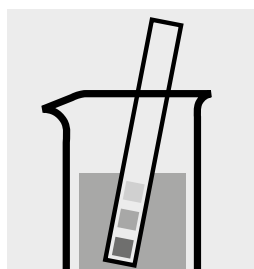
# Phosphate

1.00798

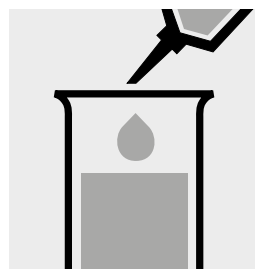
## Determination of orthophosphate

Test

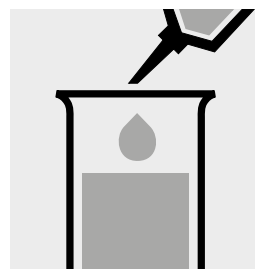
<b>Measuring</b>	1.0 – 100.0 mg/l PO <sub>4</sub> -P	3 – 307 mg/l PO <sub>4</sub>	2 – 229 mg/l P <sub>2</sub> O <sub>5</sub>	10-mm cell
<b>range:</b>	Expression of results also possible in mmol/l.			



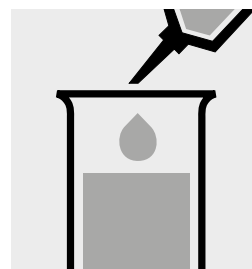
Check the pH of the sample, specified range: pH 0 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



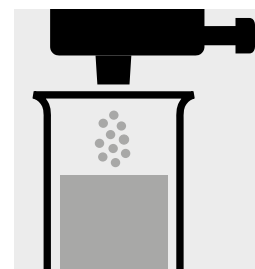
Pipette 8.0 ml of distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) into a test tube.



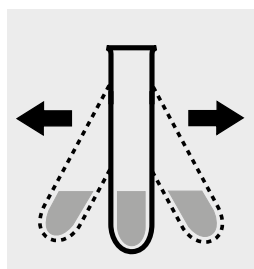
Add 0.50 ml of the sample with pipette and mix.



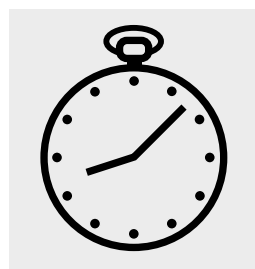
Add 0.50 ml of PO<sub>4</sub>-1 with pipette and mix.



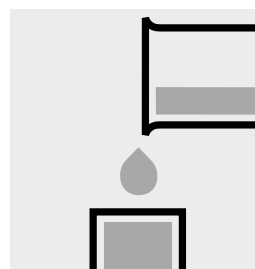
Add 1 dose of PO<sub>4</sub>-2 using the blue dose-metering cap.



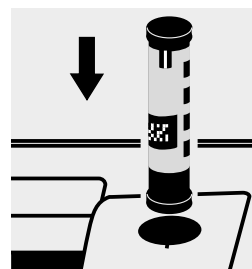
Shake vigorously to dissolve the solid substance.



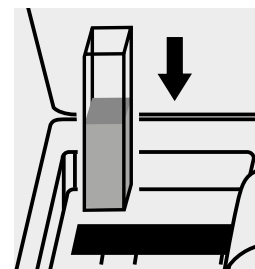
Reaction time: 5 minutes



Transfer the solution into a cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

### Important:

For the determination of **total phosphorus = sum of orthophosphate, polyphosphate and organophosphate** either Phosphate Cell Test, Cat. Nos. 1.14543, 1.14729, and 1.00673 or Phosphate Test, Cat. No. 1.14848 in conjunction with Crack Set 10/10C, Cat. Nos. 1.14687 resp. 1.14688 can be used.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use phosphate standard solution Certipur®, Cat.No. 1.19898, concentration 1000 mg/l PO<sub>4</sub><sup>3-</sup>, can be used after diluting accordingly.

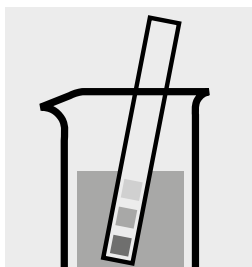
# Phosphate

1.14546

## Determination of orthophosphate

Cell Test

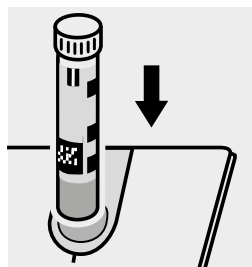
<b>Measuring</b>	0.5 – 25.0 mg/l PO <sub>4</sub> -P
<b>range:</b>	1.5 – 76.7 mg/l PO <sub>4</sub>
	1.1 – 57.3 mg/l P <sub>2</sub> O <sub>5</sub>
	Expression of results also possible in mmol/l.



Check the pH of the sample, specified range: pH 0 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Important:

For the determination of **total phosphorus = sum of orthophosphate, polyphosphate and organophosphate** either Phosphate Cell Test, Cat. Nos. 1.14543, 1.14729, and 1.00673 or Phosphate Test, Cat. No. 1.14848 in conjunction with Crack Set 10/10C, Cat. Nos. 1.14687 resp. 1.14688 can be used.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use phosphate standard solution Certipur®, Cat.No. 1.19898, concentration 1000 mg/l PO<sub>4</sub><sup>3-</sup>, can be used after diluting accordingly.

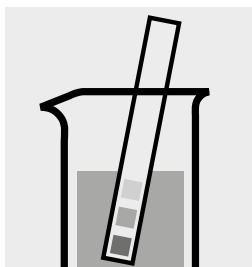
# Phosphate

1.14842

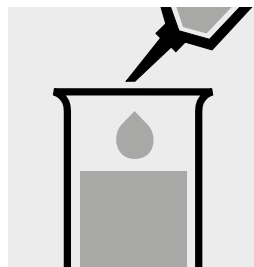
## Determination of orthophosphate

Test

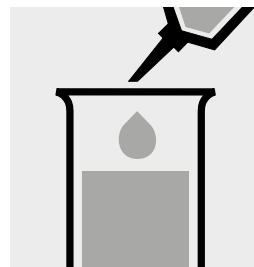
<b>Measuring range:</b>	1.0 – 30.0 mg/l PO <sub>4</sub> -P	3.1 – 92.0 mg/l PO <sub>4</sub>	2.3 – 68.7 mg/l P <sub>2</sub> O <sub>5</sub>	10-mm cell
	0.5 – 15.0 mg/l PO <sub>4</sub> -P	1.5 – 46.0 mg/l PO <sub>4</sub>	1.1 – 34.4 mg/l P <sub>2</sub> O <sub>5</sub>	20-mm cell
Expression of results also possible in mmol/l.				



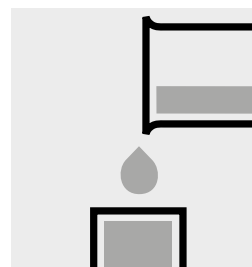
Check the pH of the sample, specified range: pH 0 – 10. If required, add dilute sulfuric acid drop by drop to adjust the pH.



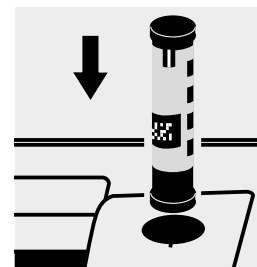
Pipette 5.0 ml of the sample into a test tube.



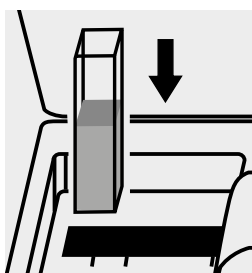
Add 1.2 ml of **PO<sub>4</sub>-1** with pipette and mix.



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

### Important:

For the determination of **total phosphorus = sum of orthophosphate, polyphosphate and organophosphate** either Phosphate Cell Test, Cat. Nos. 1.14543, 1.14729, and 1.00673 or Phosphate Test, Cat. No. 1.14848 in conjunction with Crack Set 10/10C, Cat. Nos. 1.14687 resp. 1.14688 can be used.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use phosphate standard solution Certipur®, Cat.No. 1.19898, concentration 1000 mg/l PO<sub>4</sub><sup>3-</sup>, can be used after diluting accordingly.

# Phosphatide in milk and dairy products

corresponds to German Food and Feed Code §64 LFGB 01.00-41

## Application

**Measuring range:** 0 – 750 mg/100 g P

10-mm cell

Method No. 2535

**Attention!**

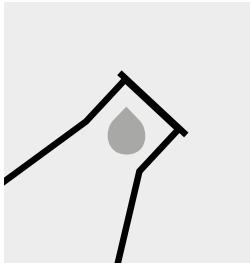
Prior to the measurement of the first sample, the system automatically prompts a zero adjustment

prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended.

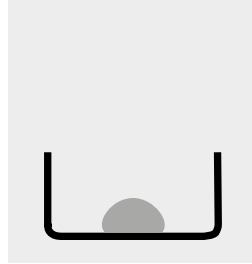
This zero value remains valid until the method is exited.

### Preparation:

Extraction of fat and incineration



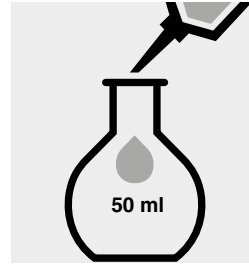
Weigh sample, accurately weighed to 10 mg, into a Mojonnier extraction tube, add **sodium chloride (solution)**, and extract acc. to §64 LFGB 01.00-41 [1].



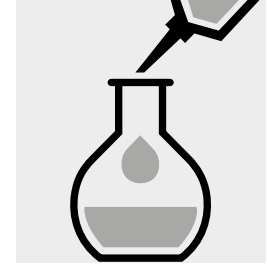
After extracting, incinerate acc. to §64 LFGB 01.00-41 [1].

### Phosphatide determination:

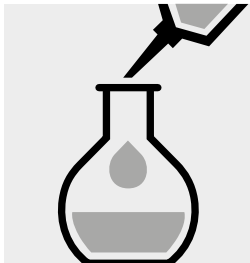
Reagent blank



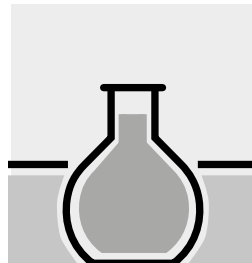
Place 20 ml of **sulfuric acid 0.05 mol/l** into a 50-ml volumetric flask.



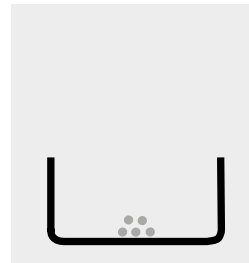
Add 20 ml of **sodium molybdate/ascorbic acid reagent** and mix.



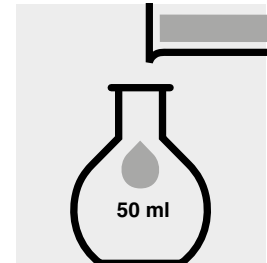
Make up the contents of the volumetric flask to the mark with distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) and mix thoroughly.



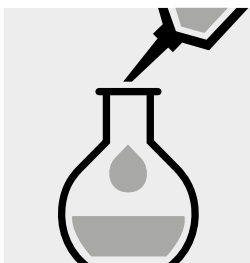
Incubate acc. to §64 LFGB 01.00-41 [1]: **reagent blank**.



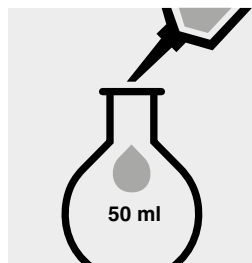
Prepare ash acc. to §64 LFGB 01.00-41 [1].



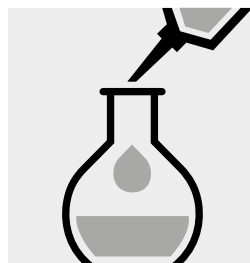
Transfer to a 50-ml volumetric flask using **sulfuric acid 0.05 mol/l**.



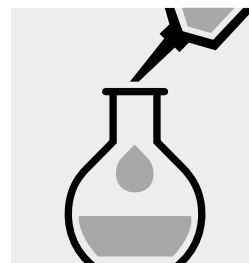
Make up the contents of the volumetric flask to the mark with **sulfuric acid 0.05 mol/l** and mix thoroughly: **solution 1**.



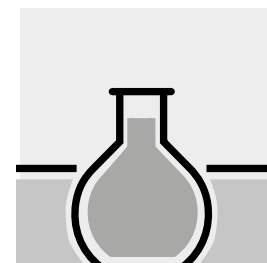
Place 20 ml of **solution 1** into a 50-ml volumetric flask.



Add 20 ml of **sodium molybdate/ascorbic acid reagent** and mix.



Make up the contents of the volumetric flask to the mark with distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) and mix thoroughly.



Incubate acc. to §64 LFGB 01.00-41 [1]: **measurement sample**.

# Phosphatide in milk and dairy products

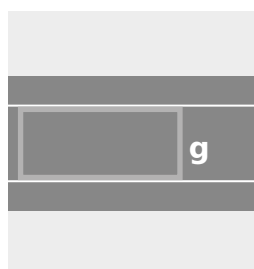
corresponds to German Food and Feed Code §64 LFGB 01.00-41

Application

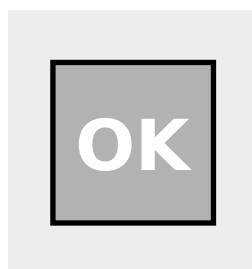
## Measurement:



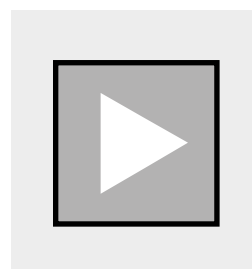
Select method no. **2535**. Perform the zero adjustment and confirm by pressing the <OK> button.



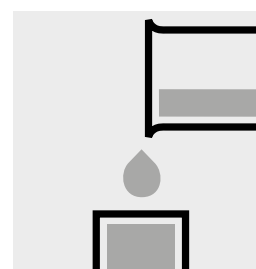
Enter the sample weight in grams.



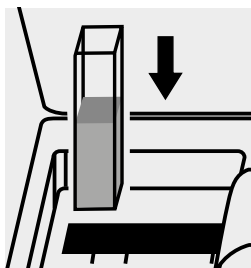
Confirm with <OK>.



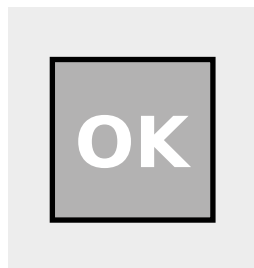
Tap the <Start> button.



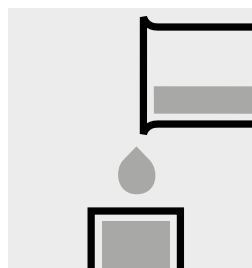
Transfer the solution "**reagent blank**" into the cell.



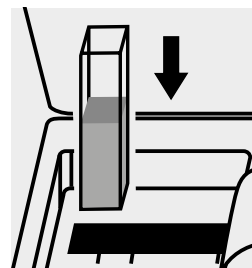
Place the cell into the cell compartment. The blank measurement is performed automatically.



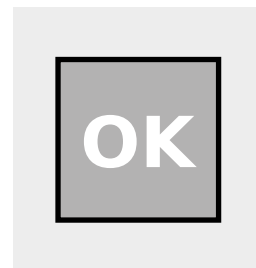
Confirm with <OK>.



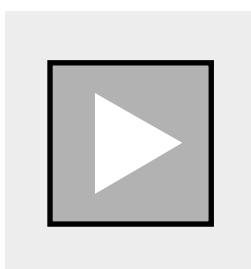
Transfer the solution "**measurement sample**" into the cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The result is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

### Important:

For each new measurement series, the pre-programmed calibration must be checked using standard solutions (see section "Adjustment"). If there are any significant deviations, the method must be recalibrated. Proceed according to the application instructions.

### Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

# Phosphorus (total) in fruit and vegetable juices

corresponds to EN 1136 and German Food and Feed Code §64 LFGB 31.00-6

Application

Measuring range: 0.0 – 300.0 mg/l P

10-mm cell

Method No. 2534

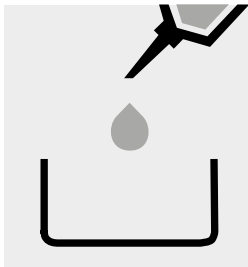
## Attention!

Prior to the measurement of the first sample, the system automatically prompts a zero adjustment

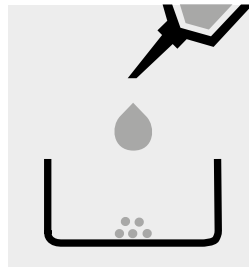
prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended.

This zero value remains valid until the method is exited.

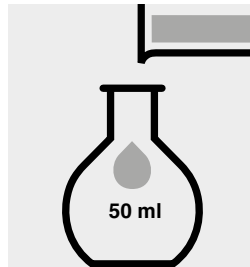
## Preparation:



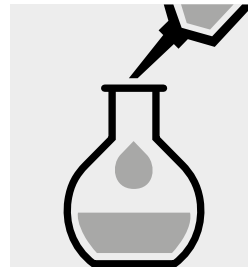
Pipette 25.0 ml of sample into a platinum dish and incinerate acc. to EN 1136 [3].



Dissolve the ash in 2 - 3 ml of **hydrochloric acid 2 mol/l**.

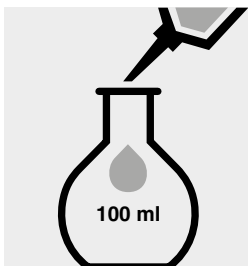


Transfer the solution to a 50-ml volumetric flask.

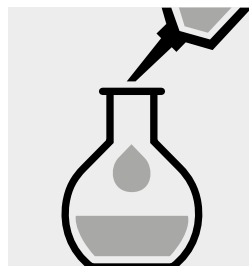


Make up the contents of the volumetric flask to the mark with distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) and mix thoroughly: **pretreated sample solution**.

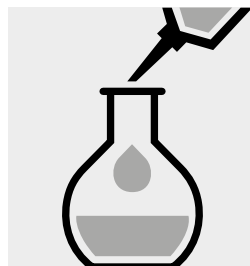
## Phosphorus determination: Reagent blank



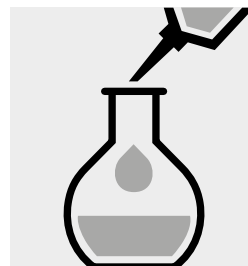
Place 50 ml of distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) into a 100-ml volumetric flask.



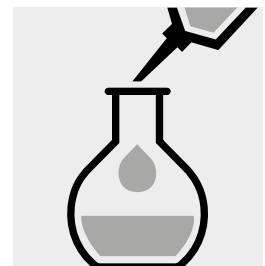
Add 20 ml of **sulfuric acid 1 mol/l**.



Add 2 ml **ammonium heptamolybdate reagent**.

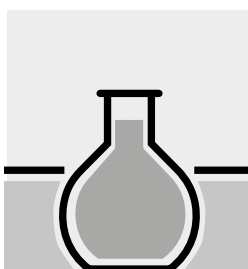


Add 2 ml of **ascorbic acid reagent** and mix.

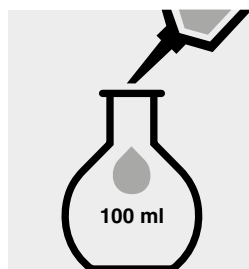


Make up the contents of the volumetric flask to the mark with distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) and mix thoroughly.

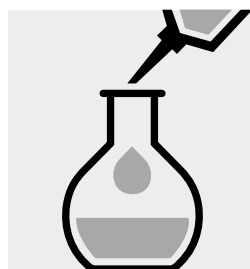
## Phosphorus determination: Measurement sample



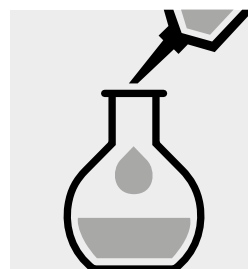
Incubate acc. to EN 1136 [1] or §64 LFGB 31.00-6 [2]: **reagent blank**.



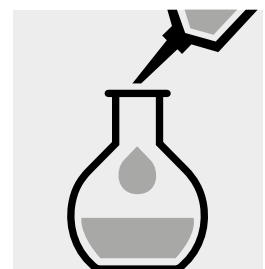
Pipette a suitable volume of the prepared sample solution to the nearest 0.1 ml into a 100-ml volumetric flask.



Add approx. 50 ml distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended).



Add 20 ml of **sulfuric acid 1 mol/l**.



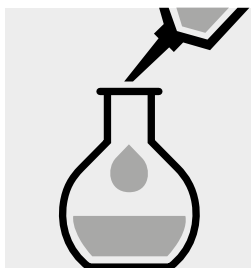
Add 2 ml **ammonium heptamolybdate reagent**.

# Phosphorus (total) in fruit and vegetable juices

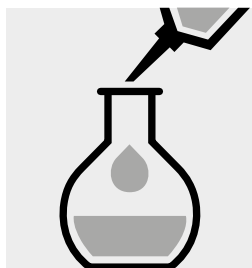
corresponds to EN 1136 and German Food and Feed Code §64 LFGB 31.00-6

Application

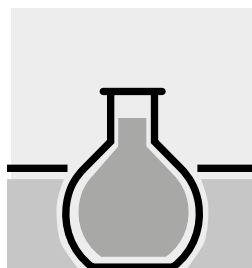
## Measurement:



Add 2 ml of **ascorbic acid reagent** and mix.



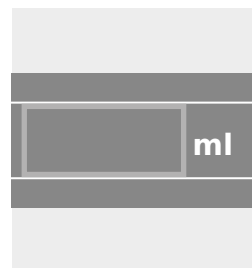
Make up the contents of the volumetric flask to the mark with distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) and mix thoroughly.



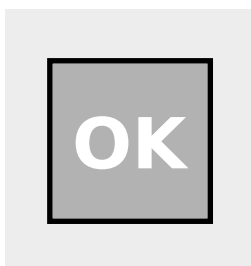
Incubate acc. to EN 1136 [1] or §64 LFGB 31.00-6 [2]: **measurement sample**.



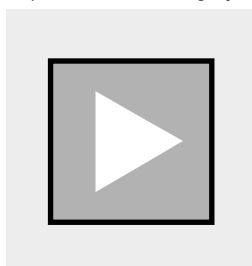
Select method no. **2534**. Perform the zero adjustment and confirm by pressing the <OK> button.



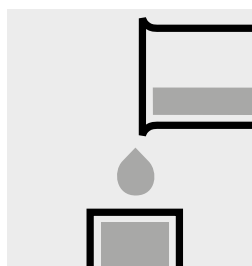
Enter the volumes of the sample solution in milliliters.



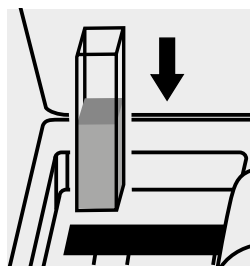
Confirm with <OK>.



Tap the <Start> button.



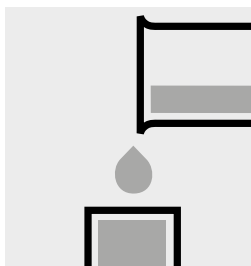
Transfer the solution "**reagent blank**" into the cell.



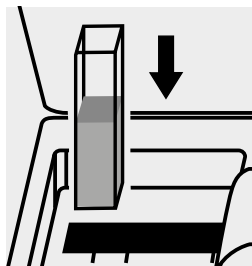
Place the cell into the cell compartment. The blank measurement is performed automatically.



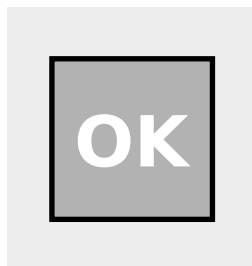
Confirm with <OK>.



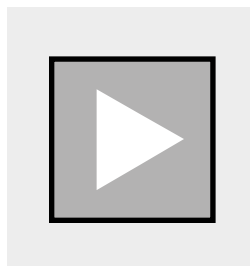
Transfer the solution "**measurement sample**" into the cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The result is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

### Important:

For each new measurement series, the pre-programmed calibration must be checked using standard solutions (see section "Adjustment"). If there are any significant deviations, the method must be recalibrated. Proceed according to the application instructions.

### Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

# Phosphorus (total) in meat and meat products

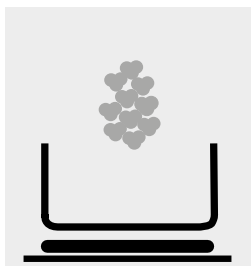
corresponds to German Food and Feed Code §64 LFGB 06.00-9

Application

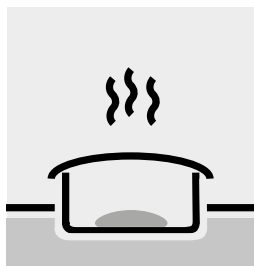
**Measuring range:** 0.000 – 2.500 g/100 g P<sub>2</sub>O<sub>5</sub>      10-mm cell      Method No. 2533

**Attention!** Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended.  
This zero value remains valid until the method is exited.

## Preparation:

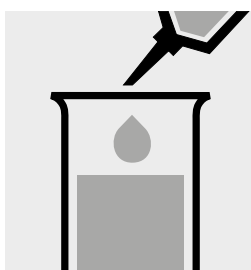


Weigh sample, accurately weighed to 1 mg, into a suitable vessel and perform an incinerate acc. to §64 LFGB 06.00-4 [3].



Hydrolyze the resultant ash acc. to §64 LFGB 06.00-9, section 7.3 [1]: **pretreated sample solution.**

## Phosphorus determination: Reagent blank

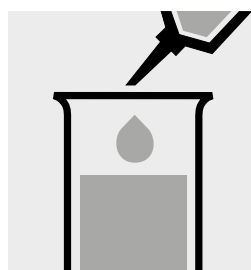


Mix 2 ml distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) with 8 ml of **reagent solution: reagent blank.**



Incubation time: 15 minutes at room temperature

## Phosphorus determination: Measurement sample



Mix 2 ml of pretreated sample with 8 ml of **reagent solution: measurement sample.**



Incubation time: 15 minutes at room temperature



# Phosphorus (total) in meat and meat products

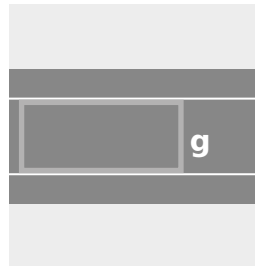
corresponds to German Food and Feed Code §64 LFGB 06.00-9

Application

## Measurement:



Select method no. **2533**. Perform the zero adjustment and confirm by pressing the <OK> button.



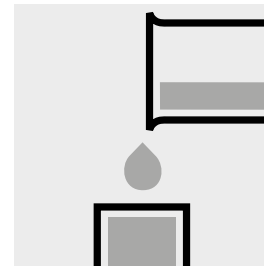
Enter the sample weight in grams.



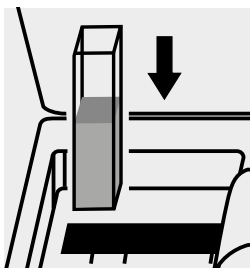
Confirm with <OK>.



Tap the <Start> button.



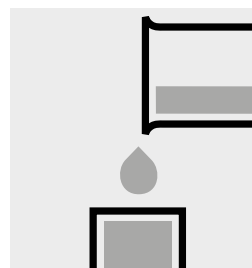
Transfer the solution "**reagent blank**" into the cell.



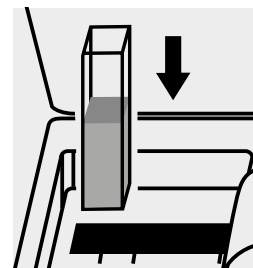
Place the cell into the cell compartment. The blank measurement is performed automatically.



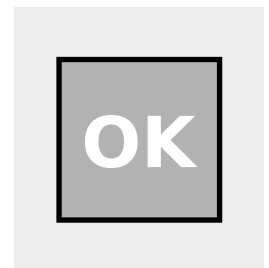
Confirm with <OK>.



Transfer the solution "**measurement sample**" into the cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The result is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

### Important:

For each new measurement series, the pre-programmed calibration must be checked using standard solutions (see section "Adjustment"). If there are any significant deviations, the method must be recalibrated. Proceed according to the application instructions.

### Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

# Phosphorus (total) in milk and dairy products

corresponds to German Food and Feed Code §64 LFGB 01.00-92 [1]

Application

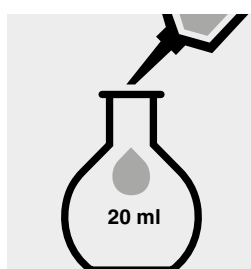
<b>Measuring range:</b> 0 – 2000 mg/100 g P	10-mm cell	Method No. 2532
<b>Attention!</b>	Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended.	
This zero value remains valid until the method is exited.		

## Preparation:

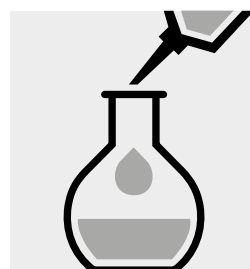


Weigh sample, accurately weighed to 1 mg, into a suitable vessel and perform a wet digestion or incinerate acc. to §64 LFGB 01.00-92 [1].

## Phosphorus determination: Reagent blank



Place 10 ml of **sodium molybdate/ascorbic acid reagent** into a 20-ml volumetric flask.

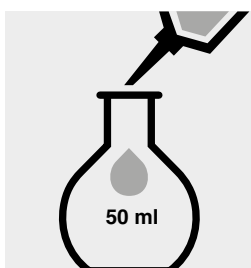


Make up the contents of the volumetric flask to the mark with distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) and mix thoroughly.

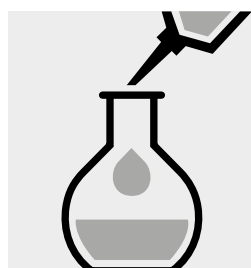


Incubate acc. to §64 LFGB 01.00-92 [1]: **reagent blank**.

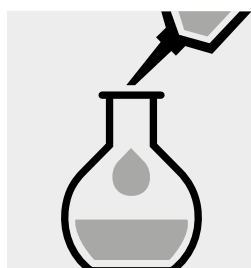
## Phosphorus determination: Measurement sample



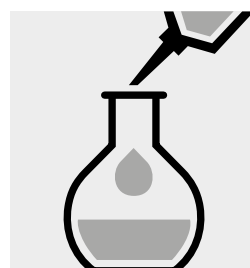
Place 1 ml of pretreated sample into a 50-ml volumetric flask.



Add approx. 20 ml distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended).



Add 25 ml of **sodium molybdate/ascorbic acid reagent** and mix.



Make up the contents of the volumetric flask to the mark with distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) and mix thoroughly.



Incubate acc. to §64 LFGB 01.00-92 [1]: **measurement sample**.

# Phosphorus (total) in milk and dairy products

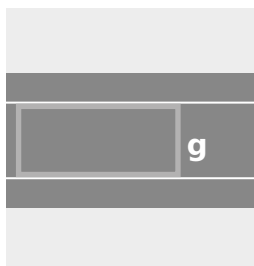
corresponds to German Food and Feed Code §64 LFGB 01.00-92 [1]

Application

## Measurement:



Select method no. **2532**. Perform the zero adjustment and confirm by pressing the <OK> button.



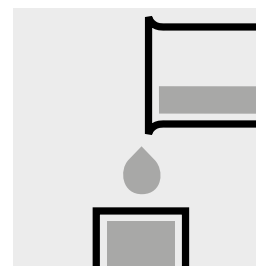
Enter the sample weight in grams.



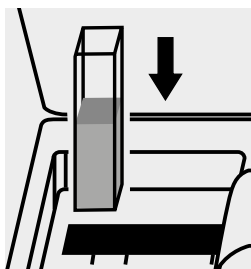
Confirm with <OK>.



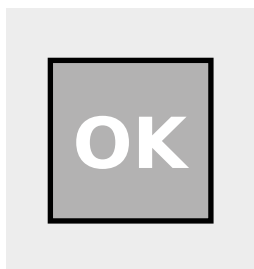
Tap the <Start> button.



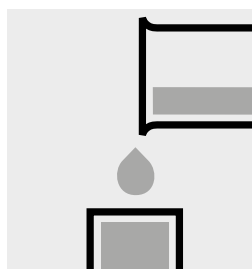
Transfer the solution "**reagent blank**" into the cell.



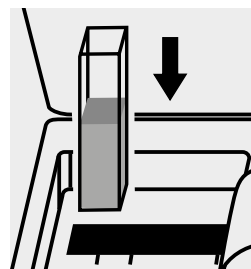
Place the cell into the cell compartment. The blank measurement is performed automatically.



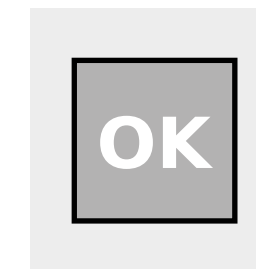
Confirm with <OK>.



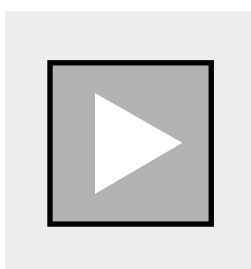
Transfer the solution "**measurement sample**" into the cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The result is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

### Important:

For each new measurement series, the pre-programmed calibration must be checked using standard solutions (see section "Adjustment"). If there are any significant deviations, the method must be recalibrated. Proceed according to the application instructions.

### Important:

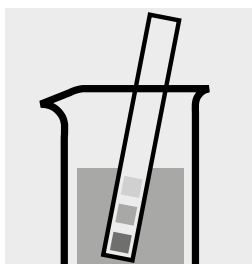
The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

# Platinum in water and wastewater

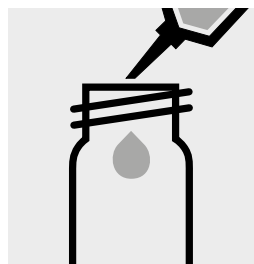
Application

**Measuring range:** 0.10 – 1.25 mg/l Pt      10-mm cell      Method No. 134

**Attention!** The measurement is carried out at 690 nm in a 10-mm rectangular cell against a blank, prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) and the reagents in an analogous manner.



Check the pH of the sample, specified range: pH 2 – 5. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into an empty round cell (Empty cells, Cat.No. 1.14724).



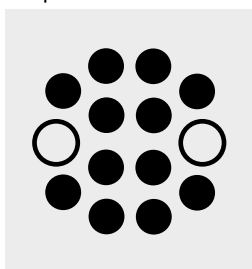
Add 1.0 ml of **reagent 1** with pipette, close the cell with the screw cap, and mix.



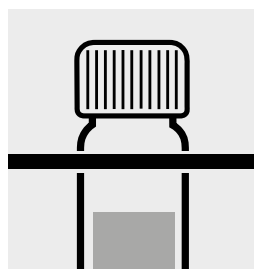
Add 0.50 ml of **reagent 2** with pipette, close the cell with the screw cap, and mix.



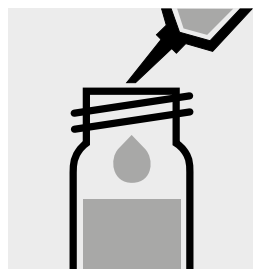
Check the pH of the sample, specified value: pH 6.5. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



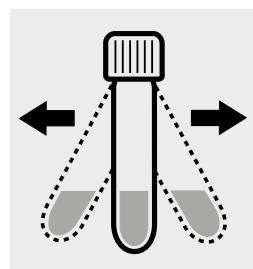
Heat the cell in the thermoreactor at 100 °C for 5 minutes.



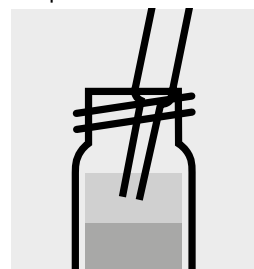
Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature.



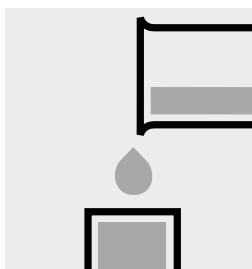
Add 5.0 ml **Isobutyl-methylketone GR** (Cat.No. 1.06146) with pipette, close the cell with the screw cap.



Shake the cell vigorously for 1 minute. Leave to stand to allow phases to separate.



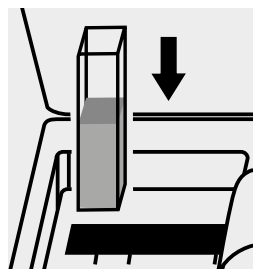
Aspirate the organic-clear upper phase from the tube with pipette and dry over **sodium sulfate anhydrous** (Cat.No. 1.06649).



Transfer the dried solution into a cell.



Select method no. **134**.



Place the cell into the cell compartment. The measurement is performed automatically.

## Note:

Empty cells with screw caps, Cat.No. 1.14724 are recommended for the preparation. These cells can be sealed with the screw caps, thus enabling a hazard-free mixing of the sample.

## Important:

The exact composition and preparation of the reagents 1 and 2 used are given in the corresponding application, which also includes further information on the method employed. This application can be downloaded from the website.

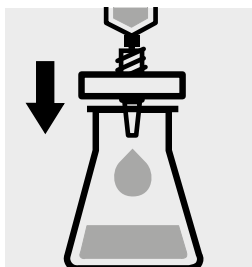
# Potassium

1.14562

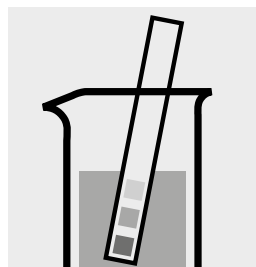
Cell Test

**Measuring** 5.0 – 50.0 mg/l K

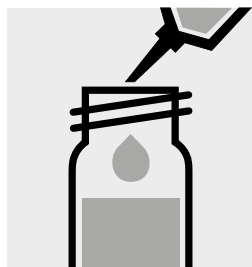
**range:** Expression of results also possible in mmol/l.



Filter turbid samples.



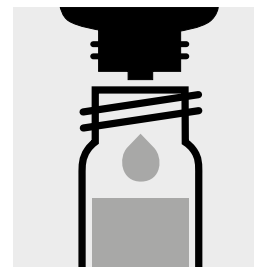
Check the pH of the sample, specified range: pH 3 – 12. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 2.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



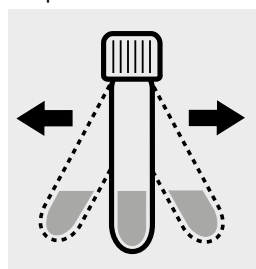
Check the pH, specified range: pH 10.0 – 11.5.



Add 6 drops of **K-1K**, close the cell with the screw cap, and mix.



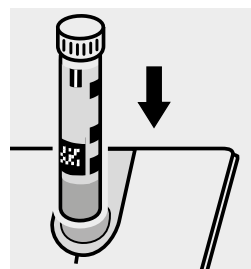
Add 1 level blue micro-spoon of **K-2K**, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time:  
5 minutes



Place the cell **without re-shaking** into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use potassium standard solution Certipur®, Cat.No. 1.70230, concentration 1000 mg/l K, can be used after diluting accordingly.

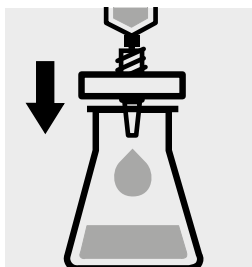
# Potassium

1.00615

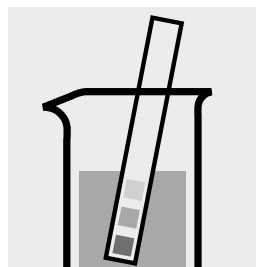
Cell Test

**Measuring** 30 – 300 mg/l K

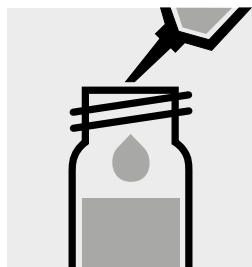
**range:** Expression of results also possible in mmol/l.



Filter turbid samples.



Check the pH of the sample, specified range: pH 3 – 12. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



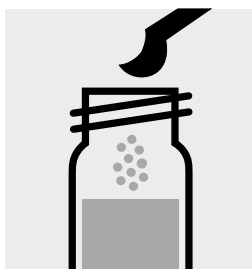
Pipette 0.50 ml of the sample into a reaction cell, close with the screw cap, and mix.



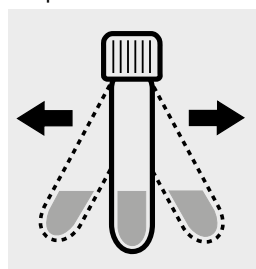
Check the pH, specified range: pH 10.0 – 11.5.



Add 6 drops of **K-1K**, close the cell with the screw cap, and mix.



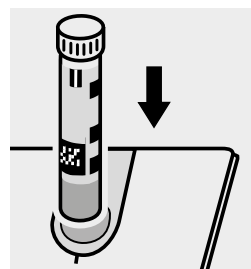
Add 1 level blue micro-spoon of **K-2K**, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time:  
5 minutes



Place the cell **without re-shaking** into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use potassium standard solution Certipur®, Cat.No. 1.70230, concentration 1000 mg/l K, can be used after diluting accordingly.

# Proline in fruit and vegetable juices

corresponds to EN 1141 and German Food and Feed Code §64 LFGB 31.00-7

Application

Measuring range: 0 – 1200 mg/l

10-mm cell

Method No. 2539

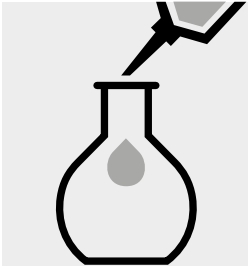
**Attention!**

Prior to the measurement of the first sample, the system automatically prompts a zero adjustment

prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended.

This zero value remains valid until the method is exited.

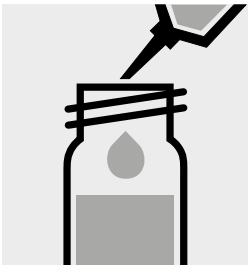
## Preparation:



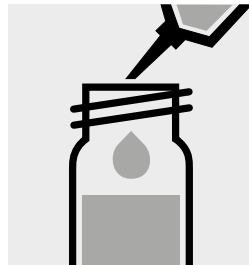
If necessary, dilute the sample with distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended).

**Note the dilution ratio (1 + x).**

## Proline determination: Reagent blank



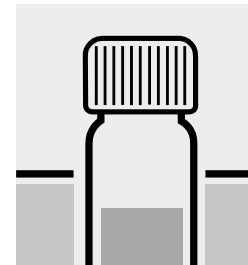
Pipette 1.0 ml of pre-treated sample into a test tube with screw cap.



Add 1.0 ml of **formic acid**.



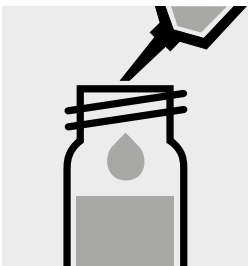
Add 2.0 ml of **ethylene glycol monomethyl ether**, close the test tube with the screw cap, and mix.



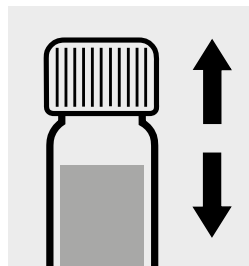
Incubate the test tube in a water bath acc. to EN 1141 [1] or §64 LFGB 31.00-7 [2].



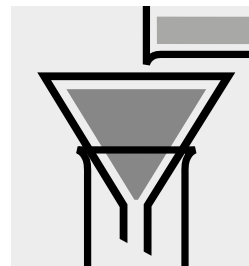
Cool the test tube acc. to EN 1141 [1] or §64 LFGB 31.00-7 [2].



Add 10 ml of **n-butyl acetate** and close the test tube with the screw cap.



Extract the color complex into the organic phase acc. to EN 1141 [1] or §64 LFGB 31.00-7 [2].



Filter the entire mixture over a hydrophobic filter acc. to EN 1141 [1] or §64 LFGB 31.00-7 [2]: **reagent blank**.

# Proline

## in fruit and vegetable juices

corresponds to EN 1141 and German Food and Feed Code §64 LFGB 31.00-7

Application

### Proline determination: Measurement sample



Pipette 1.0 ml of pre-treated sample into a test tube with screw cap.



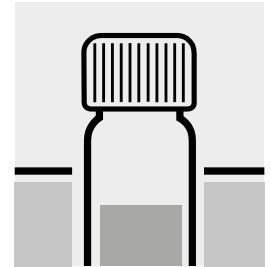
Add 1.0 ml of **formic acid**.



Add 2.0 ml of **ninhydrin solution**, close the test tube with the screw cap, and mix.



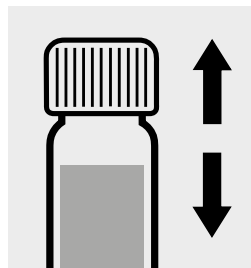
Incubate the test tube in a water bath acc. to EN 1141 [1] or §64 LFGB 31.00-7 [2].



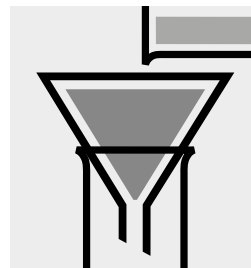
Cool the test tube acc. to EN 1141 [1] or §64 LFGB 31.00-7 [2].



Add 10 ml of **n-butyl acetate** and close the test tube with the screw cap.



Extract the color complex into the organic phase acc. to EN 1141 [1] or §64 LFGB 31.00-7 [2].

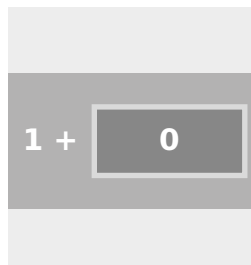


Filter the entire mixture over a hydrophobic filter acc. to EN 1141 [1] or §64 LFGB 31.00-7 [2]: **measurement sample**.

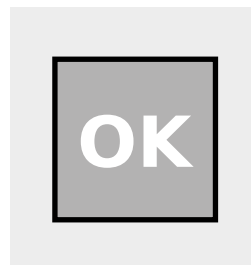
### Measurement:



Select method no. **2539**. Perform the zero adjustment and confirm by pressing the <OK> button.



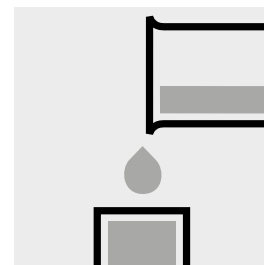
Enter the dilution ratio (1 part of sample + x parts of distilled water).



Confirm with <OK>.



Tap the <Start> button.



Transfer the solution "**reagent blank**" into the cell.

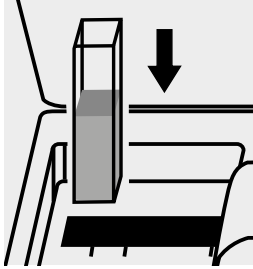


# Proline

## in fruit and vegetable juices

corresponds to EN 1141 and German Food and Feed Code §64 LFGB 31.00-7

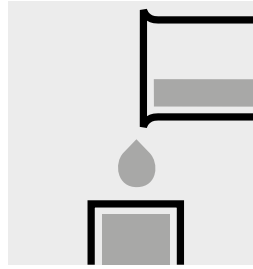
Application



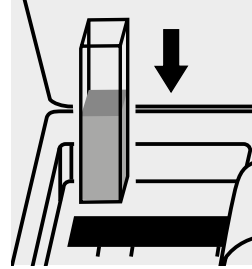
Place the cell into the cell compartment. The blank measurement is performed automatically.



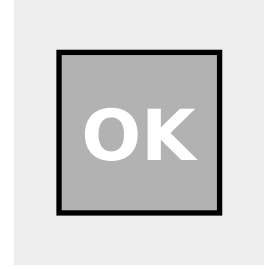
Confirm with <OK>.



Transfer the solution "**measurement sample**" into the cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The result is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

### Important:

For each new measurement series, the pre-programmed calibration must be checked using standard solutions (see section "Adjustment"). If there are any significant deviations, the method must be recalibrated. Proceed according to the application instructions.

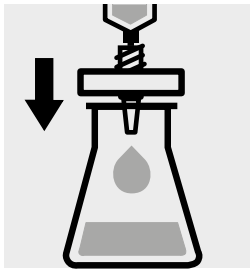
### Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

# Protein (BCA method)

Application

<b>Measuring range:</b>	200 – 1000 µl/ml protein (as bovine serum albumin)	10-mm cell	Method No. 319
<b>Attention!</b>	<b>A separate calibration must be made for each measurement series (see application instructions)!</b>		
	Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended.		
	This zero value remains valid until the method is exited.		

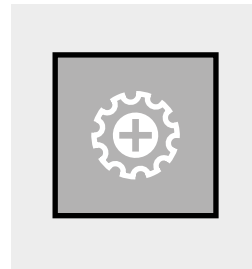


Filter turbid samples.

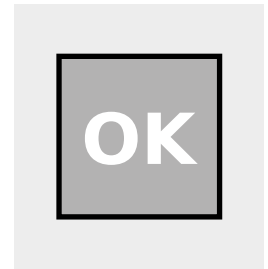


Select method no. **319**. Perform the zero adjustment and confirm by pressing the <OK> button.

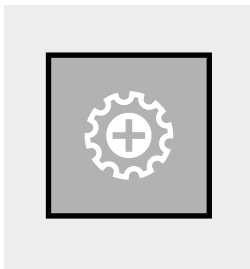
Prepare the measurement solution, the reagent blank solution, and the standard solutions acc. to the package leaflet for "Bicinchonic Acid Protein Assay Kit, Item BCA1 - Procedure A, Steps 1 - 6".



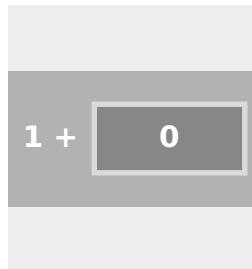
A separate calibration must be made for each measurement series! Tap the <Settings> button. Select "Recalibration" and proceed acc. to the application instructions.



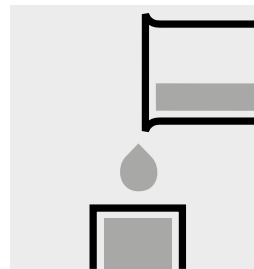
Confirm with <OK>.



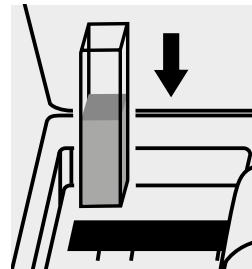
If solutions have been diluted: Tap the <Settings> button. Select "Dilution", and proceed acc. to the application instructions.



Enter the dilution ratio (1 part of sample + x parts of distilled water).



Transfer the **measurement sample** into the cell.



Place the cell into the cell compartment. The measurement is performed automatically.

## Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

# Protein (Biuret method) Low Range

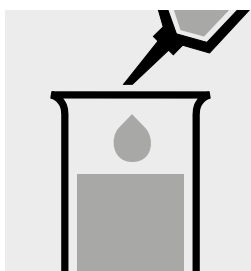
Application

**Measuring range:** 0.5 – 5.0 g/l protein (as bovine serum albumin)      10-mm plastic cell      Method No. 315

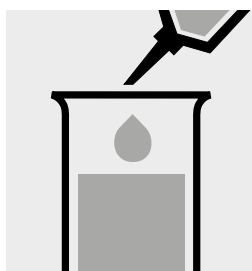
**Attention!** Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended.

This zero value remains valid until the method is exited.

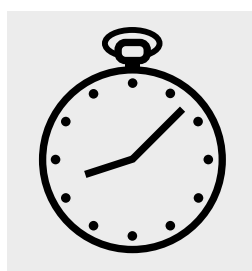
## Reagent blank:



Pipette 0.5 ml of distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) into a plastic vessel.

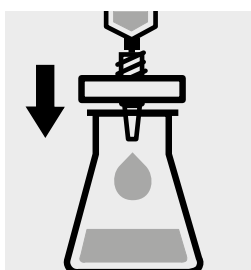


Add 2.0 ml of **Biuret reagent solution** with pipette and mix.

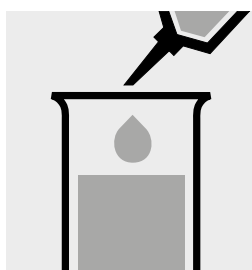


Reaction time:  
30 minutes:  
**reagent blank**

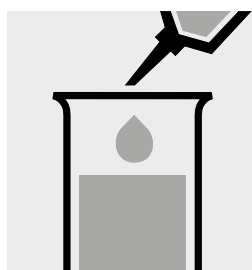
## Measurement sample:



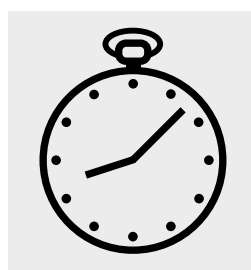
Filter or centrifuge turbid samples.



Pipette 0.5 ml of sample into a plastic vessel.



Add 2.0 ml of **Biuret reagent solution** with pipette and mix.



Reaction time:  
30 minutes:  
**measurement sample**

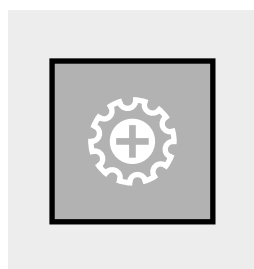
# Protein (Biuret method) Low Range

Application

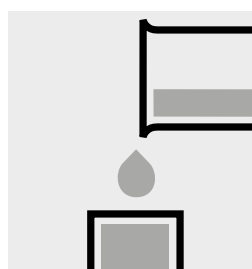
## Measurement:



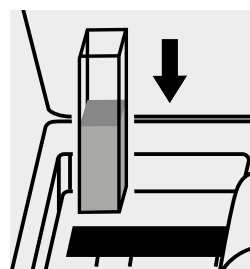
Select method no. **315**. Perform the zero adjustment and confirm by pressing the <OK> button.



Tap the <Settings> button. Select "Reagent blank".



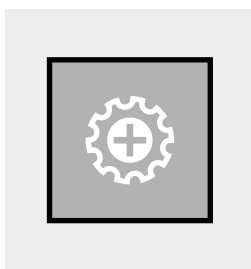
Transfer the solution "**reagent blank**" into the plastic cell.



Place the cell into the cell compartment. The blank measurement is performed automatically.



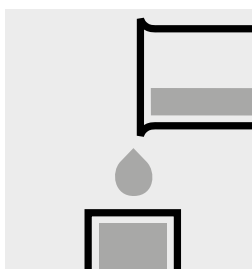
Confirm with <OK>.



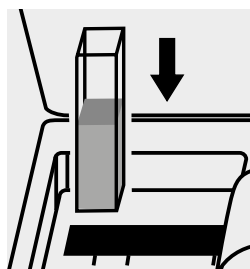
If solutions have been diluted:  
Tap the <Settings> button. Select "Dilution", and proceed acc. to the application instructions.



Enter the dilution ratio (1 part of sample + x parts of distilled water).



Transfer the solution "**measurement sample**" into the plastic cell.



Place the cell into the cell compartment. The measurement is performed automatically.

### Important:

With each new batch of the test kit, the **pre-programmed calibration must be checked using standard solutions** (see section "Calibration"). If there are any significant deviations, the method must be recalibrated. Proceed according to the application instructions.

### Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

# Protein (Biuret method) High Range

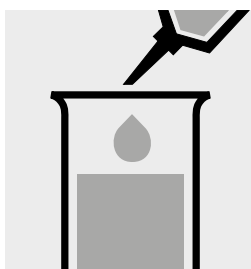
Application

**Measuring range:** 1 – 10 g/l protein (as bovine serum albumin)      10-mm plastic cell      Method No. 316

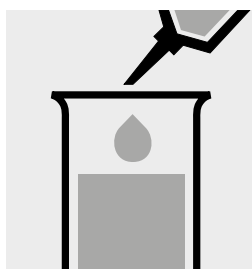
**Attention!** Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended.

This zero value remains valid until the method is exited.

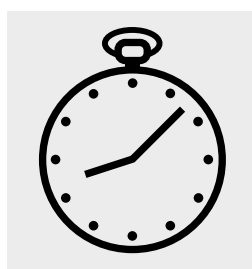
## Reagent blank:



Pipette 1.0 ml of distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) into a plastic vessel.

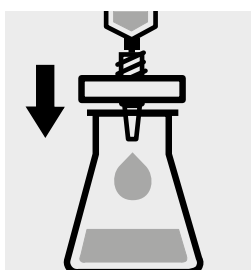


Add 2.0 ml of **Biuret reagent solution** with pipette and mix.

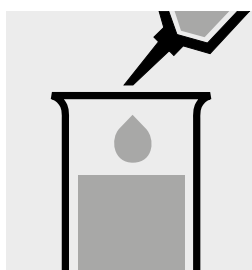


Reaction time:  
30 minutes:  
**reagent blank**

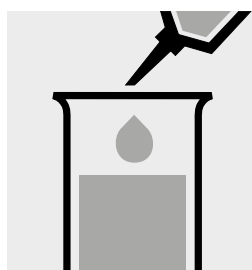
## Measurement sample:



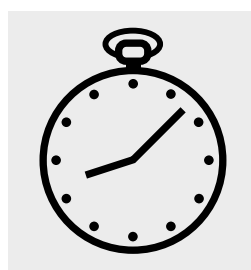
Filter or centrifuge turbid samples.



Pipette 1.0 ml of sample into a plastic vessel.



Add 2.0 ml of **Biuret reagent solution** with pipette and mix.



Reaction time:  
30 minutes:  
**measurement sample**

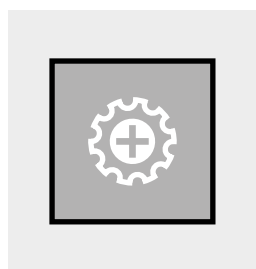
# Protein (Biuret method) High Range

Application

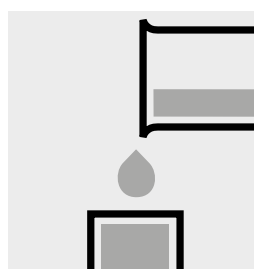
## Measurement:



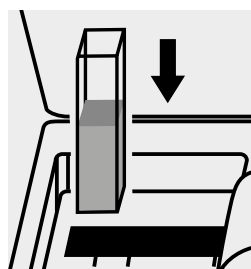
Select method no. **316**. Perform the zero adjustment and confirm by pressing the <OK> button.



Tap the <Settings> button. Select "Reagent blank".



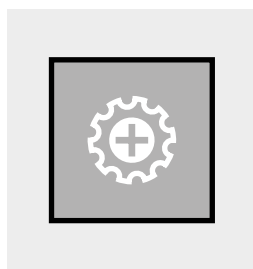
Transfer the solution "**reagent blank**" into the plastic cell.



Place the cell into the cell compartment. The blank measurement is performed automatically.



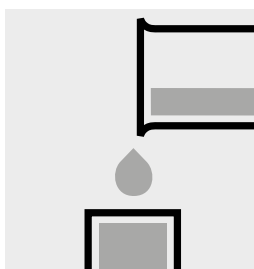
Confirm with <OK>.



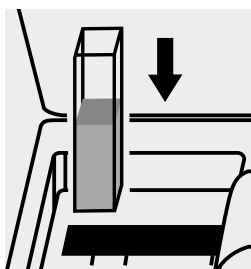
If solutions have been diluted:  
Tap the <Settings> button. Select "Dilution", and proceed acc. to the application instructions.



Enter the dilution ratio (1 part of sample + x parts of distilled water).



Transfer the solution "**measurement sample**" into the plastic cell.



Place the cell into the cell compartment. The measurement is performed automatically.

## Important:

With each new batch of the test kit, the **pre-programmed calibration must be checked using standard solutions** (see section "Calibration"). If there are any significant deviations, the method must be recalibrated. Proceed according to the application instructions.

## Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

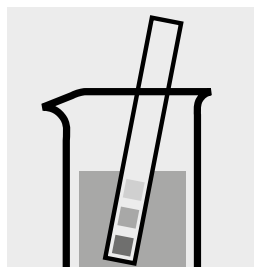
# Residual Hardness

1.14683

Cell Test

<b>Measuring</b>	0.50 – 5.00 mg/l Ca
<b>range:</b>	0.070 – 0.700 °d
	0.087 – 0.874 °e
	0.12 – 1.25 °f

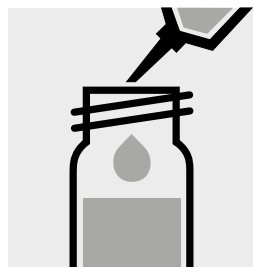
<b>Measuring</b>	0.70 – 7.00 mg/l CaO
<b>range:</b>	1.2 – 12.5 mg/l CaCO <sub>3</sub>
Expression of results also possible in mmol/l.	



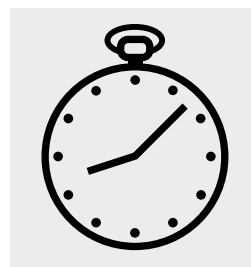
Check the pH of the sample, specified range: pH 5–8. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



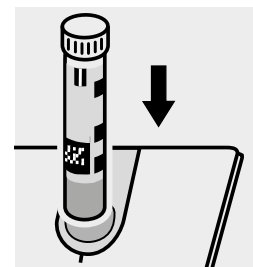
Pipette 4.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 0.20 ml of **RH-1K**, close the cell with the screw cap, and mix.



Reaction time: 10 minutes, **measure immediately**.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use calcium standard solution Certipur®, Cat.No. 1.19778, concentration 1000 mg/l Ca, can be used after diluting accordingly. (Pay attention to pH value!)

# Saybolt Color Measurement

Application

analogous to **ASTM D6045**

**Measuring range:** -15 – 30 Saybolt Color

50-mm cell

Method No. 2563

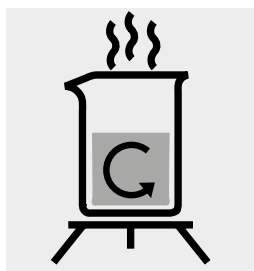
**Attention!**

Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended. This zero value remains valid until the method is exited.

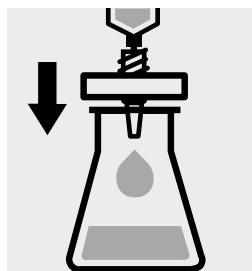
## Preparation:



Contains the sample air or gas bubbles: degassing in ultrasonic bath.



Melt solid samples and homogenize.

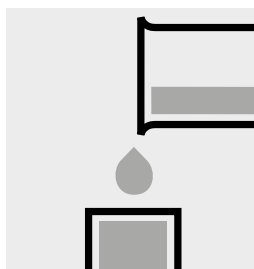


Filter or centrifuge turbid samples.

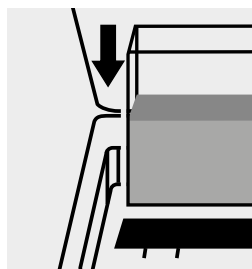
## Determination:



Select method no. **2563**. Perform the zero adjustment and confirm by pressing the <OK> button.



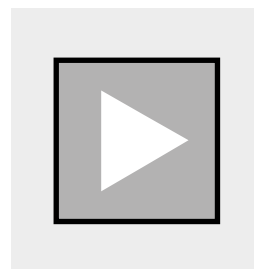
Transfer the solution into a corresponding cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. Saybolt Color is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

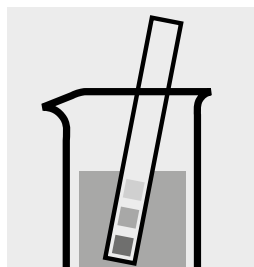


# Silicate (Silicic Acid)

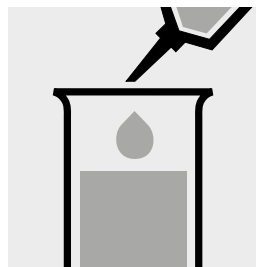
1.14794

Test

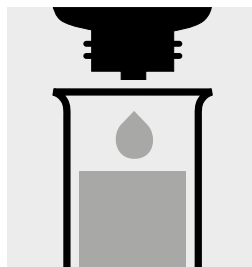
<b>Measuring range:</b>	0.21 – 10.70 mg/l SiO <sub>2</sub>	0.10 – 5.00 mg/l Si	10-mm cell
	0.11 – 5.35 mg/l SiO <sub>2</sub>	0.05 – 2.50 mg/l Si	20-mm cell
	0.011 – 1.600 mg/l SiO <sub>2</sub>	0.005 – 0.750 mg/l Si	50-mm cell
Expression of results also possible in mmol/l.			



Check the pH of the sample, specified range: pH 2–10.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a test tube.



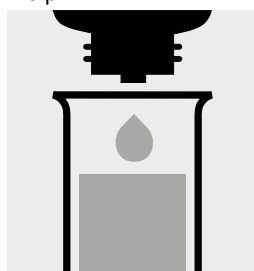
Add 3 drops of **Si-1** and mix.



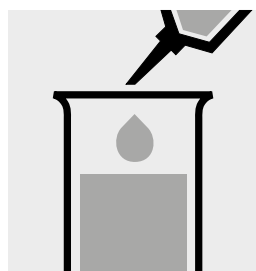
Check the pH, specified range: pH 1.2 – 1.6.



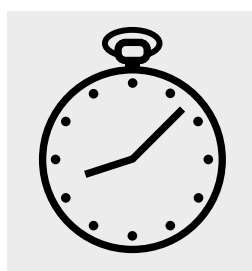
Reaction time: 3 minutes



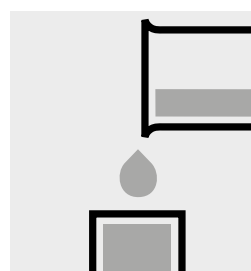
Add 3 drops of **Si-2** and mix.



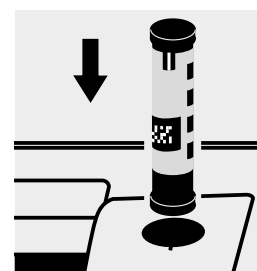
Add 0.50 ml of **Si-3** with pipette and mix.



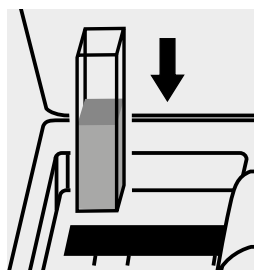
Reaction time: 10 minutes



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

To measure in the 50-mm cell, the sample volume and the volume of the reagents have to be doubled for each. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use silicon standard solution Certipur®, Cat.No. 1.70236, concentration 1000 mg/l Si, can be used after diluting accordingly as well as the Standard solutions for photometric applications, Cat.Nos. 1.32243, 1.32244, and 1.32245. (Attention! Do **not** store standard solutions in glass vessels - see section "Standard solutions"!)

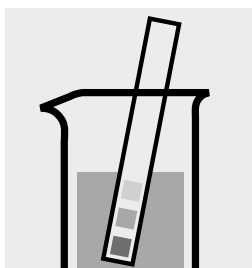
# Silicate (Silicic Acid)

1.00857

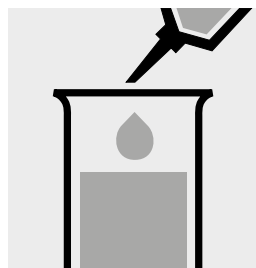
Test

<b>Measuring range:</b>	1.1 – 107.0 mg/l SiO <sub>2</sub>	0.5 – 50.0 mg/l Si	10-mm cell
	11 – 1070 mg/l SiO <sub>2</sub>	5 – 500 mg/l Si	10-mm cell
Expression of results also possible in mmol/l.			

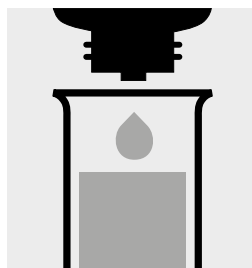
## Measuring range: 1.1 – 107.0 mg/l SiO<sub>2</sub>



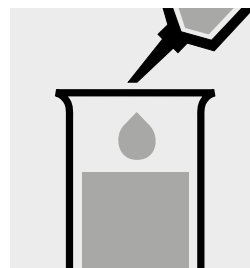
Check the pH of the sample, specified range: pH 2–10.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 4.0 ml of the sample into a test tube.



Add 4 drops of **Si-1** and mix.



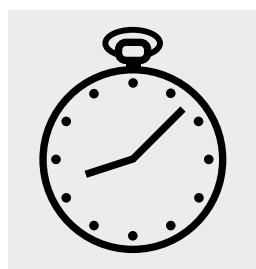
Add 2.0 ml of **Si-2** with pipette and mix.



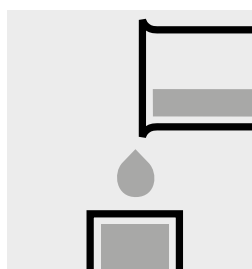
Reaction time: 2 minutes



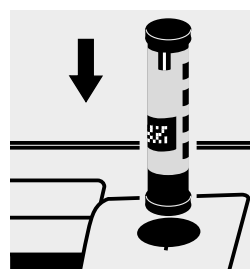
Add 4 drops of **Si-3** and mix.



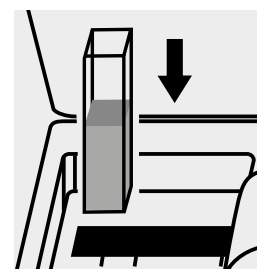
Reaction time: 2 minutes



Transfer the solution into a cell.



Select method with AutoSelector measuring range 0.5 – 50.0 mg/l Si.



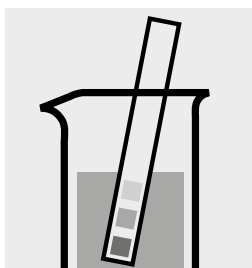
Place the cell into the cell compartment.

# Silicate (Silicic Acid)

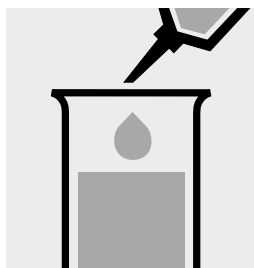
1.00857

Test

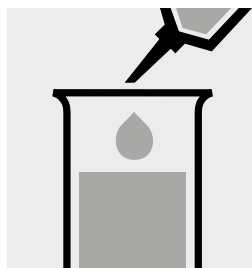
Measuring range: 11 – 1070 mg/l SiO<sub>2</sub>



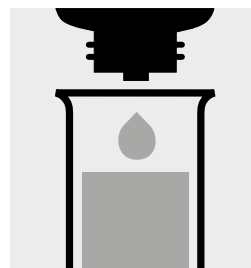
Check the pH of the sample, specified range: pH 2–10. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



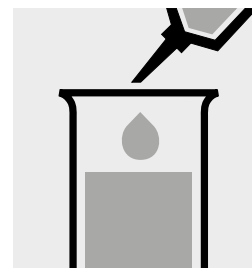
Pipette 5.0 ml of distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) into a test tube.



Add 0.50 ml of the sample with pipette and mix.



Add 4 drops of **Si-1** and mix.



Add 2.0 ml of **Si-2** with pipette and mix.



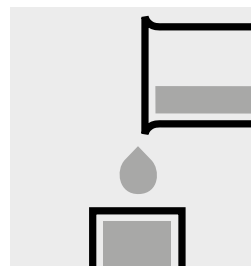
Reaction time:  
2 minutes



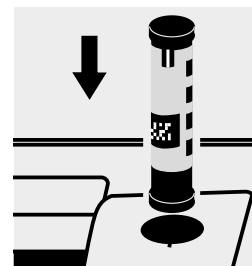
Add 4 drops of **Si-3** and mix.



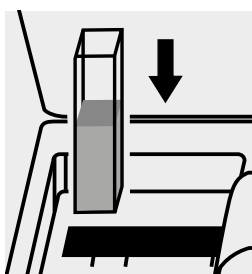
Reaction time:  
2 minutes



Transfer the solution into a cell.



Select method with AutoSelector measuring range 5 – 500 mg/l Si.



Place the cell into the cell compartment.

## Quality assurance:

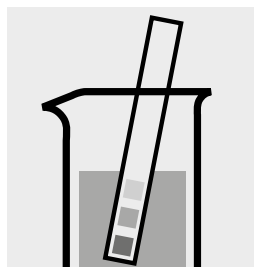
To check the measurement system (test reagents, measurement device, and handling) ready-to-use silicon standard solution Certipur®, Cat.No. 1.70236, concentration 1000 mg/l Si, can be used after diluting accordingly. (Attention! Do **not** store standard solutions in glass vessels - see section "Standard solutions"!)

# Silicate (Silicic Acid)

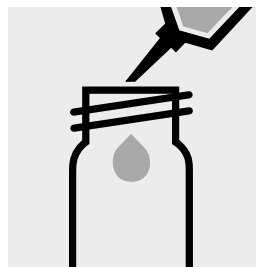
1.01813

Test

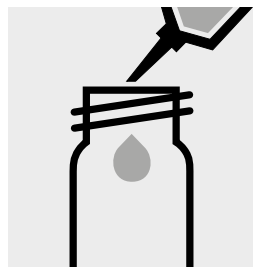
**Measuring range:** 0.5 – 500.0 µg/l SiO<sub>2</sub>    0.2 – 233.7 µg/l Si    50-mm cell  
Expression of results also possible in mmol/l.



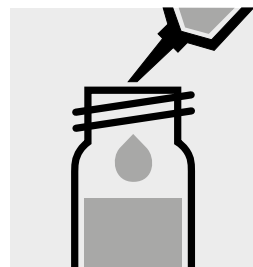
Check the pH of the sample, specified range: pH 2–10. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 10 ml of the sample into a plastic vessel (**Flat-bottomed tubes, Cat.No. 1.17988**).



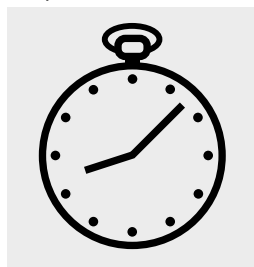
Pipette 10 ml of distilled water (Water Ultrapur, Cat.No. 1.01262, is recommended) into a second plastic vessel (**Flat-bottomed tubes, Cat. No. 1.17988**). (Blank)



Add to each vessel 0.10 ml of **Si-1** with pipette, close with the screw cap, and mix.



Check the pH, specified range: pH 1.2 – 1.6.



Reaction time:  
5 minutes



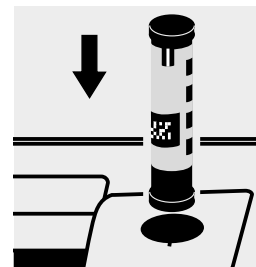
Add to each vessel 0.10 ml of **Si-2** with pipette, close with the screw cap, and mix.



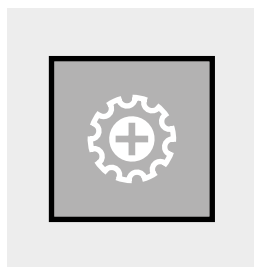
Add to each vessel 0.50 ml of **Si-3** with pipette, close with the screw cap, and mix.



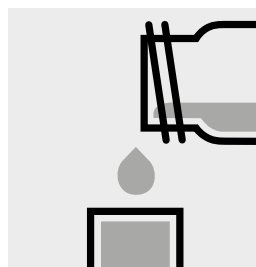
Reaction time:  
5 minutes



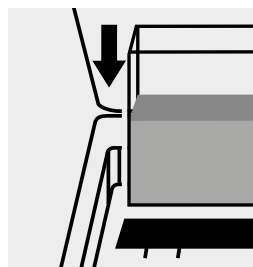
Select method with AutoSelector.



Tap the <Settings> button. Select "Reagent blank".



Transfer the blank into the cell and measure **immediately**.



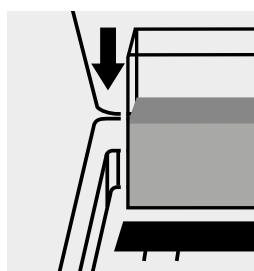
Insert the blank cell into the cell compartment.



Select "User RB". Confirm with <OK>.



Transfer the measurement sample into the cell and measure **immediately**.



Insert the cell containing the sample into the cell compartment.

## Important:

**No glass equipment** may be used in the course of the determination (e.g. pipettes etc.)!

## Quality assurance:

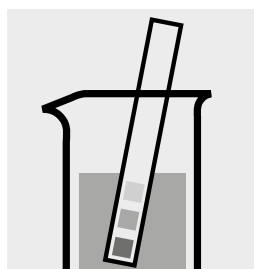
To check the measurement system (test reagents, measurement device, and handling) ready-to-use silicon standard solution Certipur®, Cat.No. 1.70236, concentration 1000 mg/l Si, can be used after diluting accordingly as well as the Standard solution for photometric applications, Cat.No. 1.32244. (Attention! Do **not** store standard solutions in glass vessels - see section "Standard solutions").

# Silver

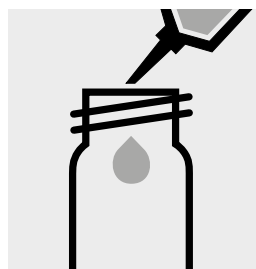
1.14831

Test

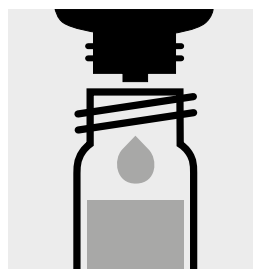
<b>Measuring</b>	0.50 – 3.00 mg/l Ag	10-mm cell
<b>range:</b>	0.25 – 1.50 mg/l Ag	20-mm cell
Expression of results also possible in mmol/l.		



Check the pH of the sample, specified range: pH 4–10. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



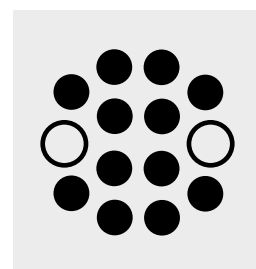
Pipette 10 ml of the sample into an empty round cell (Empty cells, Cat.No. 1.14724).



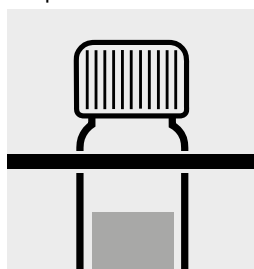
Add 2 drops of **Ag-1**.



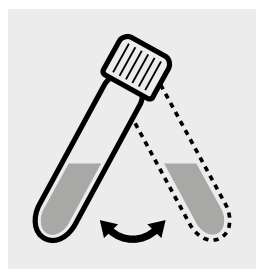
Add 1 level green microspoon of **Ag-2**, close the cell with the screw cap.



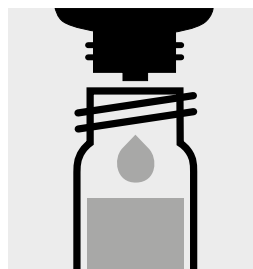
Heat the cell in the thermoreactor at 120 °C for 1 hours.



Remove the cell from the thermoreactor and place in a test-tube rack to cool to room temperature.



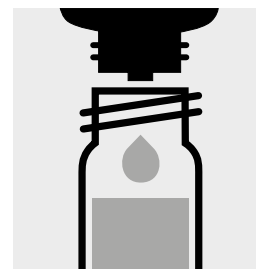
Swirl the cell before opening.



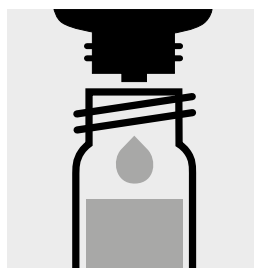
Add 3 drops of **Ag-3**, close with the screw cap, and mix.



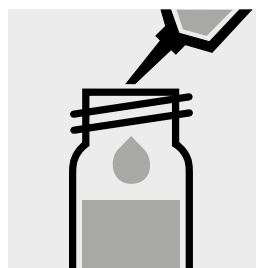
Check the pH, specified range: pH 4–10. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



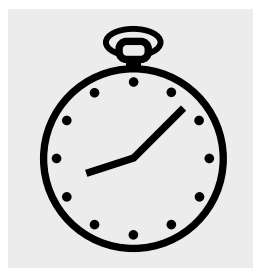
Add 1 drop of **Ag-4**, close with the screw cap, and mix.



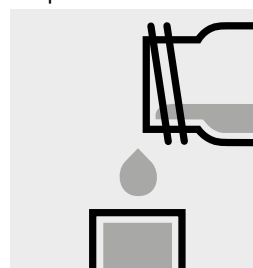
Add 5 drops of **Ag-5**, close with the screw cap, and mix.



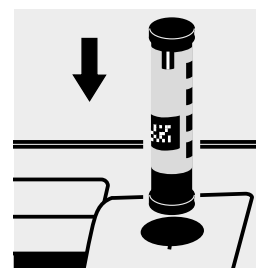
Add 1.0 ml of **Ag-6**, close with the screw cap, and mix.



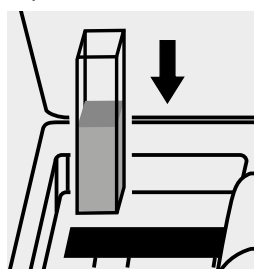
Reaction time: 5 minutes



Transfer the solution into a corresponding rectangular cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

### Important:

Very high silver concentrations in the sample produce turbid solutions (measurement solution should be clear). In such cases the sample must be diluted (plausibility check).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use silver standard solution Certipur®, Cat.No. 1.19797, concentration 1000 mg/l Ag, can be used after diluting accordingly.

# Sodium

in nutrient solutions

1.00885

Cell Test

**Measuring** 10 – 300 mg/l Na

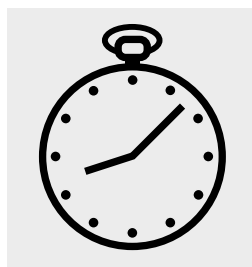
**range:** Expression of results also possible in mmol/l.



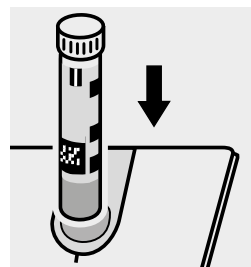
Pipette 0.50 ml of **Na-1K** into a reaction cell and mix.



Add 0.50 ml of the sample with pipette, close the cell with the screw cap, and mix.



Reaction time:  
1 minute



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Quality assurance:

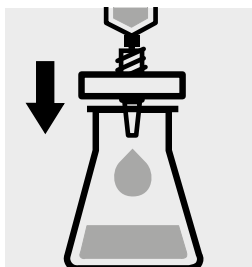
To check the measurement system (test reagents, measurement device, and handling) ready-to-use chloride standard solution Certipur®, Cat.No. 1.19897, concentration 1000 mg/l Cl<sup>-</sup> (corresponds to 649 mg/l Na), can be used after diluting accordingly (see section "Standard solutions").

# Spectral Absorption Coefficient

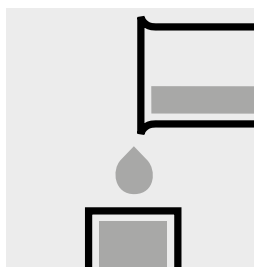
$\alpha(436)$

analogous to **EN ISO 7887**

<b>Measuring range:</b>	1 – 250 m <sup>-1</sup>	436 nm	10-mm cell	Method No. 302
	0.3 – 125.0 m <sup>-1</sup>	436 nm	20-mm cell	Method No. 302
	0.1 – 50.0 m <sup>-1</sup>	436 nm	50-mm cell	Method No. 302



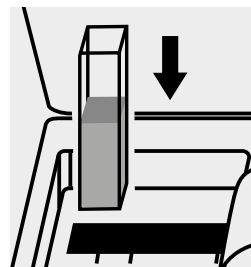
Filter sample solution through a membrane filter with 0.45  $\mu\text{m}$  pore size.



Transfer the solution into a corresponding cell.



Select method no. **302**.



Place the cell into the cell compartment. The measurement is performed automatically.

**Notes:**

Filtered sample = true color.

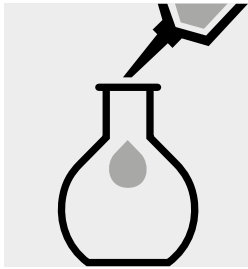
Unfiltered sample = apparent color.

# Sugars in beverages

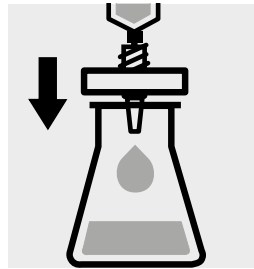
## Application

<b>Measuring range:</b> 0 – 200 g/l sugar (calculated as glucose)	50-mm cell	Method No. 314
<b>Attention!</b> Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from cell-culture medium or diluent, is recommended. This zero value remains valid until the method is exited.		

### Preparation:



Dilute the sample with distilled water (Water for analysis EMSURE®, Cat. No. 1.16754, is recommended) in the ratio 1:200 (1+199).



Filter turbid samples.

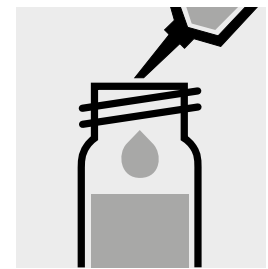


Degas the sample in ultrasonic bath.

### Sugar determination: Reagent blank



Pipette 2.0 ml of distilled water (Water for analysis EMSURE®, Cat.No. 1.16754, is recommended) into a closable vessel (20 ml).



Add 2.0 ml of **hydrochloric acid 6 mol/l** with pipette, close the vessel, and mix.



Temper the vessel in a water bath at  $95 \pm 5$  °C for **exactly** 10 minutes.



Add 8.0 ml of **sodium hydroxide solution 2.5 mol/l** with pipette and mix.



Add 2.0 ml of **DNSA reagent** with pipette, close the vessel, and mix.



Temper the vessel in a water bath at  $95 \pm 5$  °C for **exactly** 5 minutes.

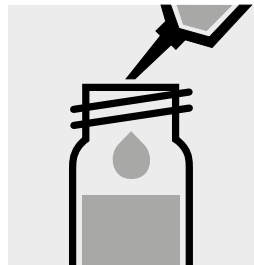


Cool the vessel in an ice bath/water bath for **exactly** 10 minutes.

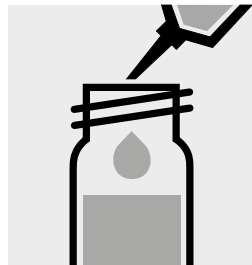
### Sugar determination: Measurement sample



Reaction time:  
10 minutes at room temperature:  
**reagent blank**



Pipette 2.0 ml of pre-treated sample into a closable vessel (20 ml).



Add 2.0 ml of **hydrochloric acid 6 mol/l** with pipette, close the vessel, and mix.



Temper the vessel in a water bath at  $95 \pm 5$  °C for **exactly** 10 minutes.



Add 8.0 ml of **sodium hydroxide solution 2.5 mol/l** with pipette and mix.



# Sugars in beverages

## Application



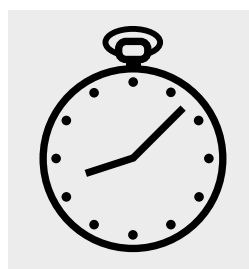
Add 2.0 ml of **DNSA reagent** with pipette, close the vessel, and mix.



Temper the vessel in a water bath at  $95 \pm 5$  °C for **exactly** 5 minutes.



Cool the vessel in an ice bath/water bath for **exactly** 10 minutes.

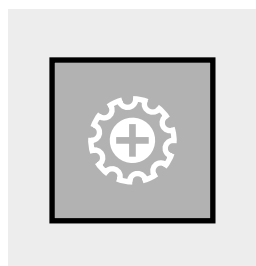


Reaction time: 10 minutes at room temperature: **measurement sample**

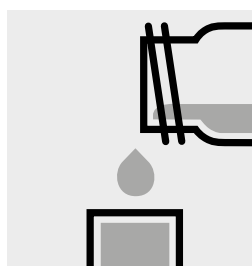
### Measurement:



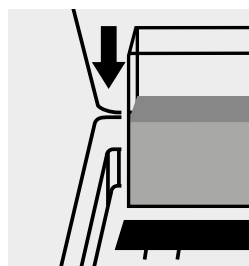
Select method no. **314**. Perform the zero adjustment and confirm by pressing the <OK> button.



Tap the <Settings> button. Select "Reagent blank".



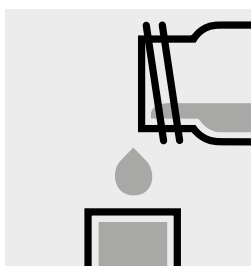
Transfer the solution "**reagent blank**" into the cell.



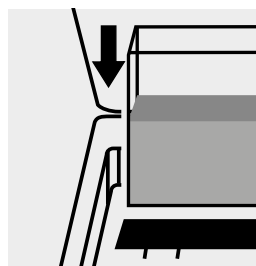
Place the cell into the cell compartment. The blank measurement is performed automatically.



Confirm with <OK>.



Transfer the solution "**measurement sample**" into the cell.



Place the cell into the cell compartment. The measurement is performed automatically.

### Important:

For each new measurement series, the pre-programmed calibration must be checked using standard solutions (see section "Calibration"). If there are any significant deviations, the method must be recalibrated. Proceed according to the application instructions.

### Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

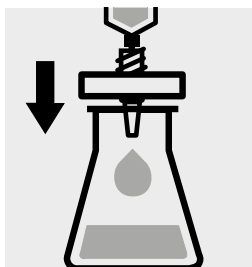
# Sulfate

1.02532

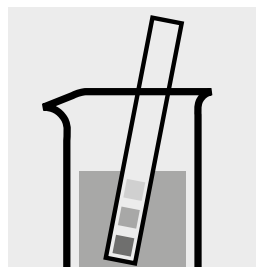
Cell Test

**Measuring** 1.0 – 50.0 mg/l SO<sub>4</sub>

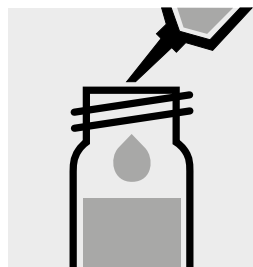
**range:** Expression of results also possible in mmol/l.



Filter turbid samples.



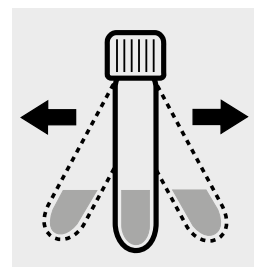
Check the pH of the sample, specified range: pH 2–10. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Pipette 10 ml of the sample into a reaction cell, close with the screw cap, and mix.



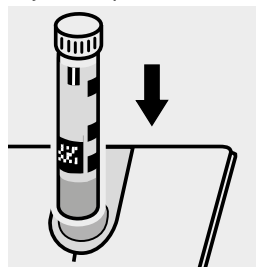
Add 1 level green microspoon of SO<sub>4</sub>-1K, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 2 minutes, **measure immediately**.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use sulfate standard solution Certipur®, Cat.No. 1.19813, concentration 1000 mg/l SO<sub>4</sub><sup>2-</sup>, can be used after diluting accordingly.

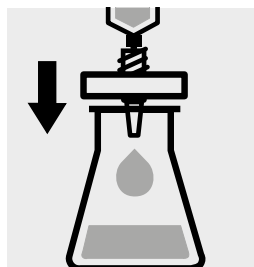
# Sulfate

1.14548

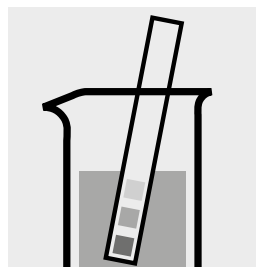
Cell Test

**Measuring** 5 – 250 mg/l SO<sub>4</sub>

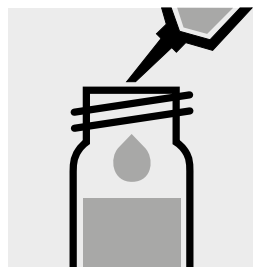
**range:** Expression of results also possible in mmol/l.



Filter turbid samples.



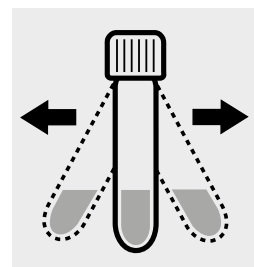
Check the pH of the sample, specified range: pH 2–10. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



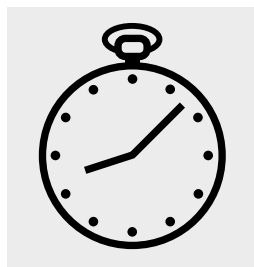
Pipette 5.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



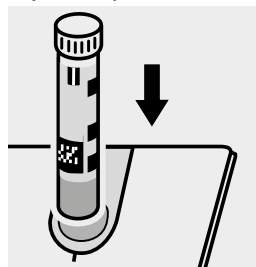
Add 1 level green microspoon of SO<sub>4</sub>-1K, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 2 minutes, **measure immediately**.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 1.14676, or the Standard solutions for photometric applications, Cat.Nos. 1.25050 and 1.25051.

Ready-to-use sulfate standard solution Certipur®, Cat.No. 1.19813, concentration 1000 mg/l SO<sub>4</sub><sup>2-</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

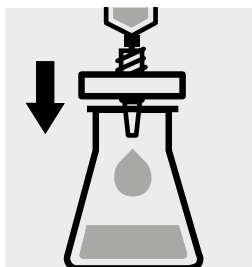
# Sulfate

1.00617

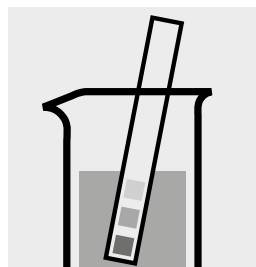
Cell Test

**Measuring** 50 – 500 mg/l  $\text{SO}_4$

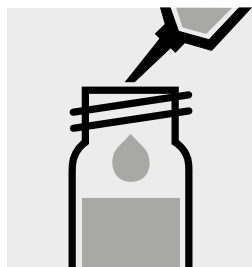
**range:** Expression of results also possible in mmol/l.



Filter turbid samples.



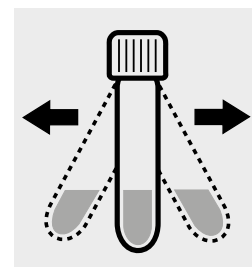
Check the pH of the sample, specified range: pH 2–10. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Pipette 2.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



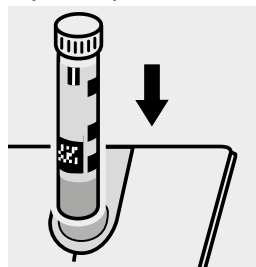
Add 1 level green microspoon of  $\text{SO}_4\text{-1K}$ , close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 2 minutes, **measure immediately**.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 1.14676, or the Standard solutions for photometric applications, Cat.Nos. 1.25051 and 1.25052.

Ready-to-use sulfate standard solution Certipur®, Cat.No. 1.19813, concentration 1000 mg/l  $\text{SO}_4^{2-}$ , can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

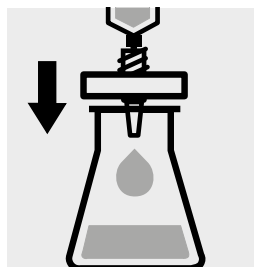
# Sulfate

1.14564

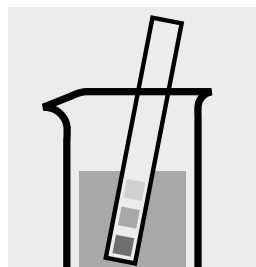
Cell Test

**Measuring** 100 – 1000 mg/l SO<sub>4</sub>

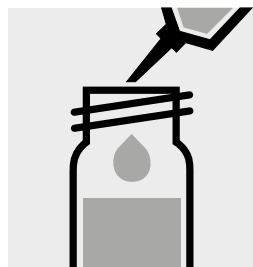
**range:** Expression of results also possible in mmol/l.



Filter turbid samples.



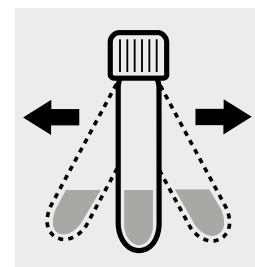
Check the pH of the sample, specified range: pH 2–10. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



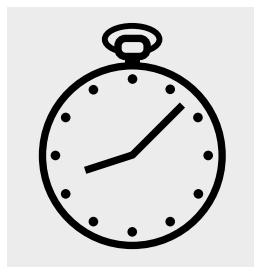
Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



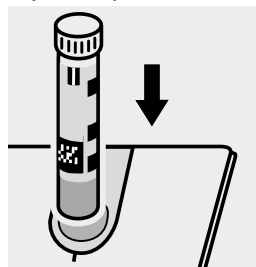
Add 1 level green microspoon of SO<sub>4</sub>-1K, close the cell with the screw cap.



Shake the cell vigorously to dissolve the solid substance.



Reaction time: 2 minutes, **measure immediately**.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 20, Cat.No. 1.14675, or the Standard solutions for photometric applications, Cat.Nos. 1.25051, 1.25052 and 1.25053.

Ready-to-use sulfate standard solution Certipur®, Cat.No. 1.19813, concentration 1000 mg/l SO<sub>4</sub><sup>2-</sup>, can also be used after diluting accordingly.

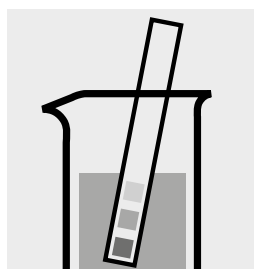
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 20) is highly recommended.

# Sulfate

1.14791

Test

<b>Measuring</b>	25 – 300 mg/l SO <sub>4</sub>	10-mm cell
<b>range:</b>	Expression of results also possible in mmol/l.	



Check the pH of the sample, specified range: pH 2–10. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



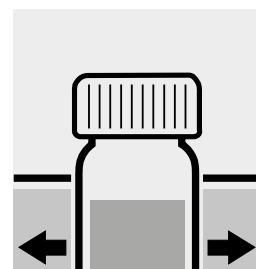
Pipette 2.5 ml of the sample into a test tube with screw cap.



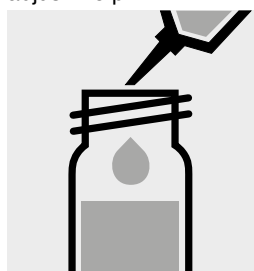
Add 2 drops of SO<sub>4</sub>-1 and mix.



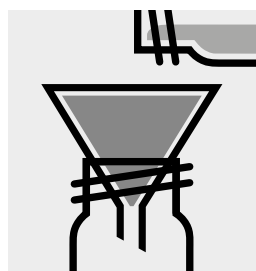
Add 1 level green microspoon of SO<sub>4</sub>-2, close the test tube with the screw cap, and mix.



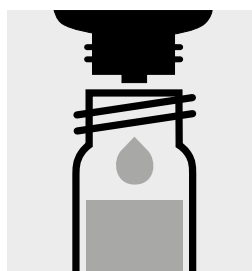
Temper the test tube in a water bath at 40 °C for 5 minutes.



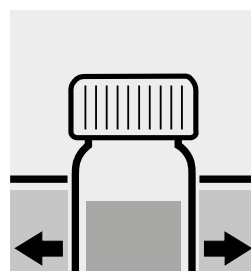
Add 2.5 ml of SO<sub>4</sub>-3 with pipette and mix.



Filter the content of the test tube with a round filter into another test tube with screw cap.



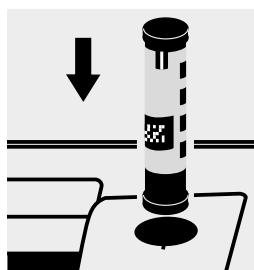
Add 4 drops of SO<sub>4</sub>-4 to the filtrate, close the test tube with the screw cap, and mix.



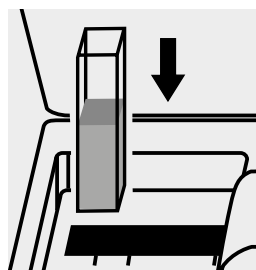
Temper the test tube again in the water bath for 7 minutes.



Transfer the solution into a cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 1.14676, or the Standard solutions for photometric applications, Cat.Nos. 1.25050 and 1.25051.

Ready-to-use sulfate standard solution Certipur®, Cat.No. 1.19813, concentration 1000 mg/l SO<sub>4</sub><sup>2-</sup>, can also be used after diluting accordingly.

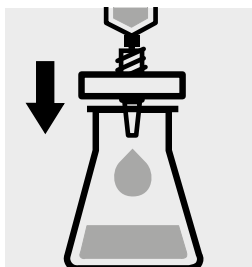
To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

# Sulfate

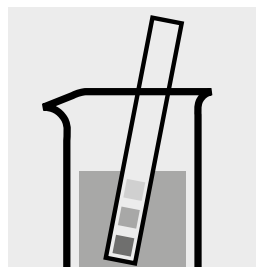
1.01812

Test

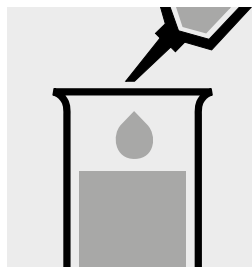
<b>Measuring range:</b>	2.5 – 50.0 mg/l SO <sub>4</sub>	10-mm cell
	1.3 – 25.0 mg/l SO <sub>4</sub>	20-mm cell
	0.50 – 10.00 mg/l SO <sub>4</sub>	50-mm cell
Expression of results also possible in mmol/l.		



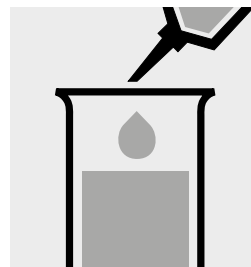
Filter turbid samples.



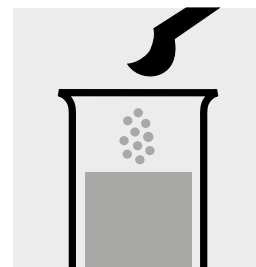
Check the pH of the sample, specified range: pH 2–10.  
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



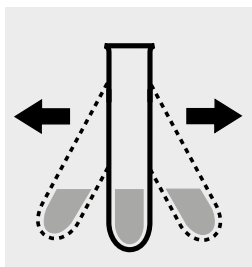
Pipette 0.50 ml of **SO<sub>4</sub>-1** into a test tube.



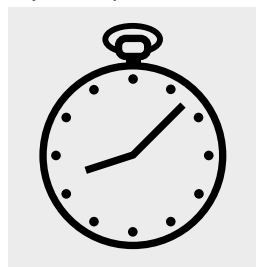
Add 10 ml of the sample with pipette and mix.



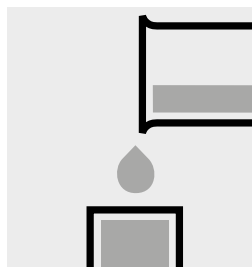
Add 1 level green micro-spoon of **SO<sub>4</sub>-2**.



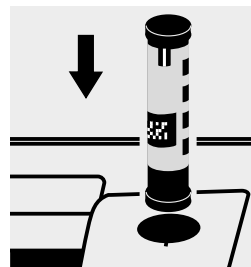
Shake the test tube vigorously to dissolve the solid substance.



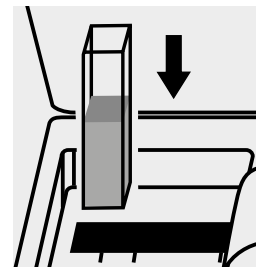
Reaction time: 2 minutes, **measure immediately**.



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Quality assurance:

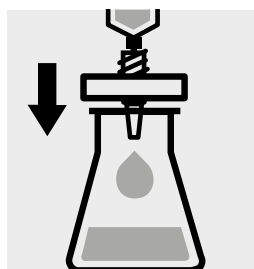
To check the measurement system (test reagents, measurement device, and handling) ready-to-use sulfate standard solution Certipur®, Cat.No. 1.19813, concentration 1000 mg/l SO<sub>4</sub><sup>2-</sup>, can be used after diluting accordingly.

# Sulfate

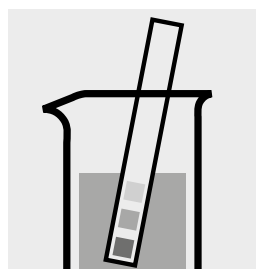
1.02537

Test

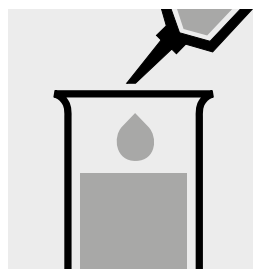
<b>Measuring</b>	5 – 300 mg/l SO <sub>4</sub>	10-mm cell
<b>range:</b>	Expression of results also possible in mmol/l.	



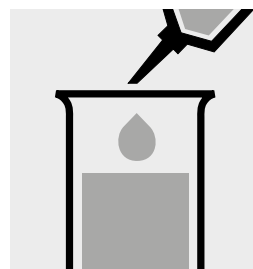
Filter turbid samples.



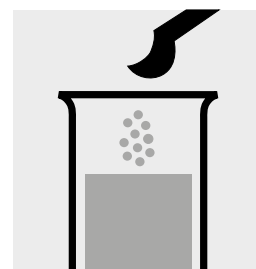
Check the pH of the sample, specified range: pH 2–10.  
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



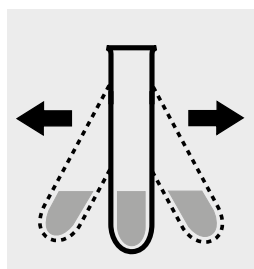
Pipette 0.50 ml of **SO<sub>4</sub>-1** into a test tube.



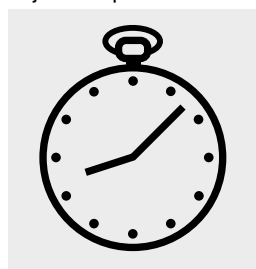
Add 5.0 ml of the sample with pipette and mix.



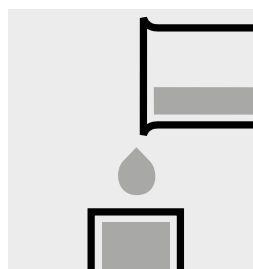
Add 1 level blue micro-spoon of **SO<sub>4</sub>-2**.



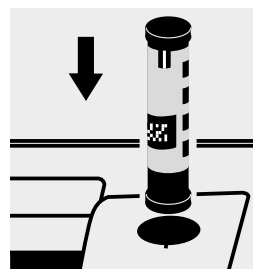
Shake the test tube vigorously to dissolve the solid substance.



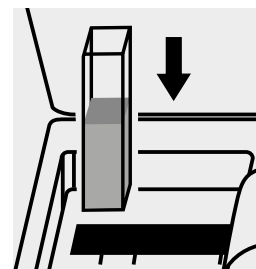
Reaction time: 2 minutes, **measure immediately**.



Transfer the solution into a cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

### Only when selecting the method manually:

For batches with a minimum shelf life **till** 2021/10/31:  
select method number **230**.

For batches with a minimum shelf life **after** 2021/10/31:  
select method number **236**.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 10, Cat.No. 1.14676, or the Standard solutions for photometric applications, Cat.Nos. 1.25050 and 1.25051.

Ready-to-use sulfate standard solution Certipur®, Cat.No. 1.19813, concentration 1000 mg/l SO<sub>4</sub><sup>2-</sup>, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 10) is highly recommended.

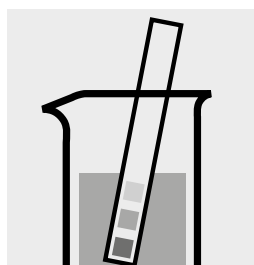


# Sulfide

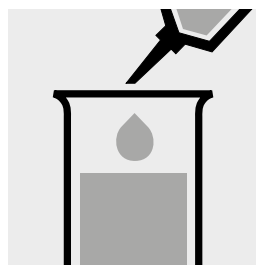
1.14779

Test

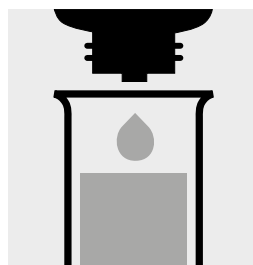
<b>Measuring range:</b>	0.10 – 1.50 mg/l S	0.10 – 1.55 mg/l HS	10-mm cell
	0.050 – 0.750 mg/l S	0.052 – 0.774 mg/l HS	20-mm cell
	0.020 – 0.500 mg/l S	0.021 – 0.516 mg/l HS	50-mm cell
Expression of results also possible in mmol/l.			



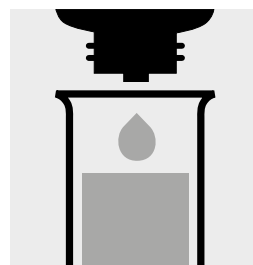
Check the pH of the sample, specified range: pH 2 – 10.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



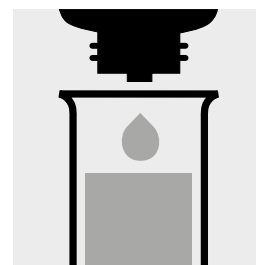
Pipette 5.0 ml of the sample into a test tube.



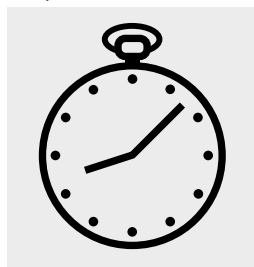
Add 1 drop of **S-1** and mix.



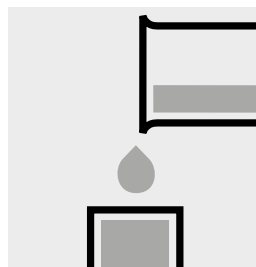
Add 5 drops of **S-2** and mix.



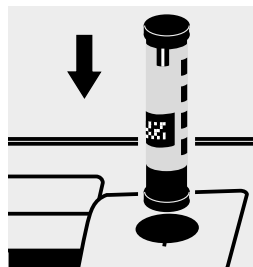
Add 5 drops of **S-3** and mix.



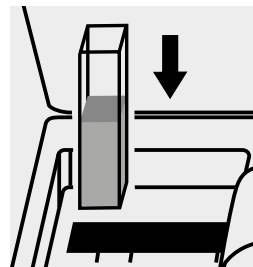
Reaction time:  
1 minute



Transfer the solution into a corresponding cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Important:

To measure in the 50-mm cell, the sample volume and the volume of the reagents have to be doubled for each. Alternatively, the semi-microcell, Cat.No. 1.73502, can be used.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a sulfide standard solution must be prepared from sodium sulfide GR (see section "Standard solutions").

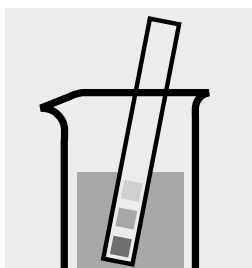
# Sulfite

1.14394

Cell Test

<b>Measuring range:</b>	1.0 – 20.0 mg/l SO <sub>3</sub>	0.8 – 16.0 mg/l SO <sub>2</sub>	Round cell
	0.05 – 3.00 mg/l SO <sub>3</sub>	0.04 – 2.40 mg/l SO <sub>2</sub>	50-mm cell
Expression of results also possible in mmol/l.			

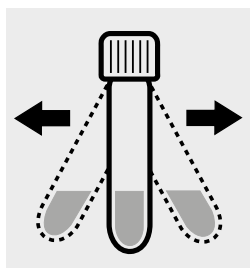
## Measuring range: 1.0 – 20.0 mg/l SO<sub>3</sub>



Check the pH of the sample, specified range: pH 4–9.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Add 1 level grey micro-spoon of **SO<sub>3</sub>-1K** into a reaction cell, close with the screw cap.



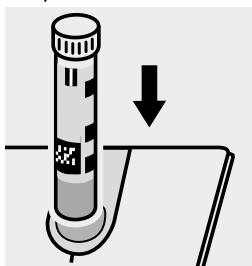
Shake the cell vigorously to dissolve the solid substance.



Add 3.0 ml of the sample with pipette, close the cell with the screw cap, and mix.

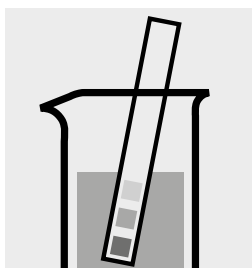


Reaction time:  
2 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

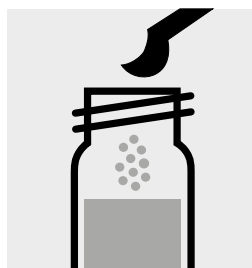
Measuring range: 0.05 – 3.00 mg/l SO<sub>3</sub>



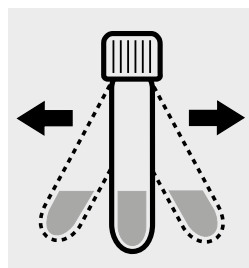
Check the pH of the sample, specified range: pH 4–9.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



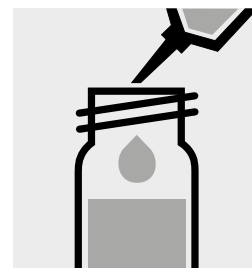
Select method no. 127.



Add 1 level grey micro-spoon each of SO<sub>3</sub>-1K into two reaction cells, close with the screw cap.



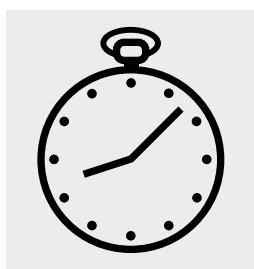
Shake both cells vigorously to dissolve the solid substance.



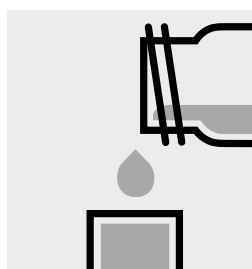
Add 7.0 ml of the sample with pipette to one reaction cell, close with the screw cap, and mix.



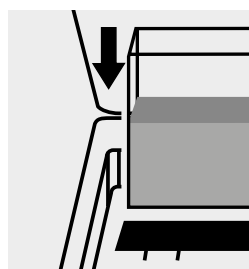
Add 7.0 ml of distilled water with pipette to the second reaction cell, close with the screw cap, and mix.  
(Blank)



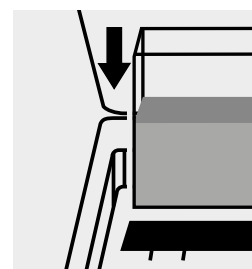
Reaction time:  
2 minutes



Transfer both solutions into two separate 50-mm cells.



Place the blank cell into the cell compartment.



Place the cell containing the sample into the cell compartment.

#### Quality assurance:

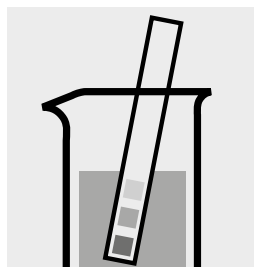
To check the measurement system (test reagents, measurement device, and handling) a sulfite standard solution must be prepared from sodium sulfite GR, Cat.No. 1.06657 (see section "Standard solutions").

# Sulfite

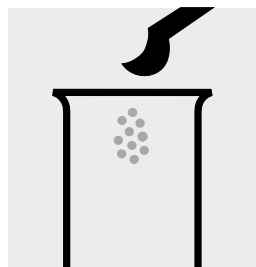
1.01746

Test

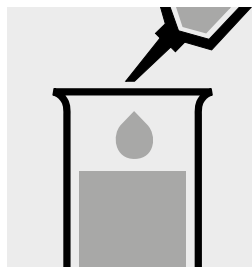
<b>Measuring</b>	1.0 – 60.0 mg/l $\text{SO}_3$	10-mm cell
<b>range:</b>	0.8 – 48.0 mg/l $\text{SO}_2$	10-mm cell
Expression of results also possible in mmol/l.		



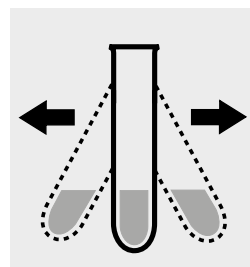
Check the pH of the sample, specified range: pH 4–9.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



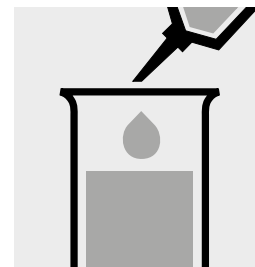
Place 1 level grey microspoon of  $\text{SO}_3\text{-1}$  into a dry test tube.



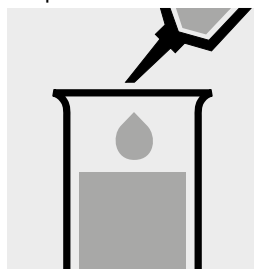
Add 3.0 ml of  $\text{SO}_3\text{-2}$  with pipette.



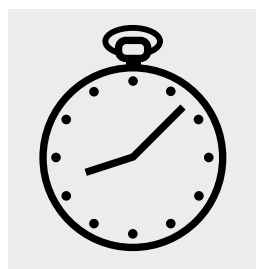
Shake vigorously to dissolve the solid substance.



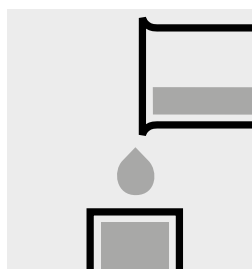
Add 5.0 ml of distilled water with pipette and mix.



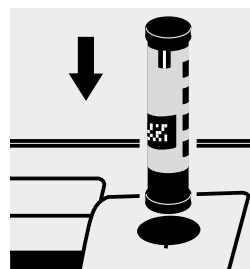
Add 2.0 ml of the sample with pipette and mix.



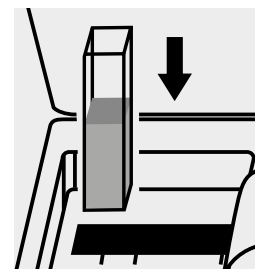
Reaction time: 2 minutes



Transfer the solution into a cell.



Select method with AutoSelector.



Place the cell into the cell compartment.

## Quality assurance:

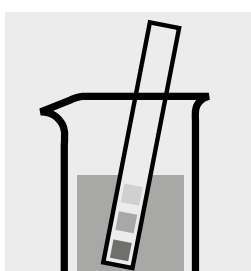
To check the measurement system (test reagents, measurement device, and handling) a sulfite standard solution must be prepared from sodium sulfite GR, Cat.No. 1.06657 (see section "Standard solutions").

# Surfactants (anionic)

1.02552

Cell Test

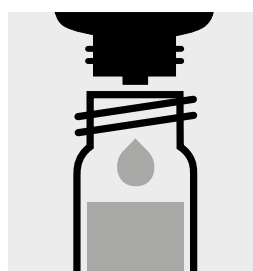
<b>Measuring</b>	0.05 – 2.00 mg/l SDAS*
<b>range:</b>	*sodium 1-dodecanesulfonate
	0.06 – 2.56 mg/l SDBS*
	*sodium dodecylbenzenesulfonate
	0.05 – 2.12 mg/l SDS*
	*sodium dodecyl sulfate
	0.08 – 3.26 mg/l SDOSSA*
	*sodium dioctyl sulfosuccinate
	Expression of results also possible in mmol/l.



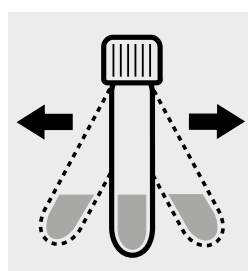
Check the pH of the sample, specified range: pH 5 – 10.  
If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a reaction cell, **do not mix!**



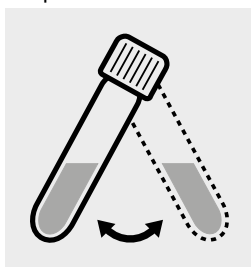
Add 2 drops of **T-1K**, close the cell with the screw cap.



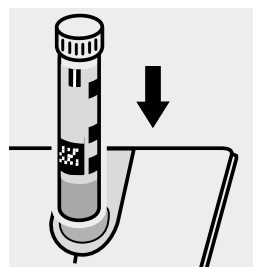
Shake the cell **vigorously for 30 seconds**.



Reaction time: 10 minutes



Swirl the cell before the measurement.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a surfactants standard solution must be prepared from dodecane-1-sulfonic acid sodium salt GR, Cat.No. 1.12146 (see section "Standard solutions").

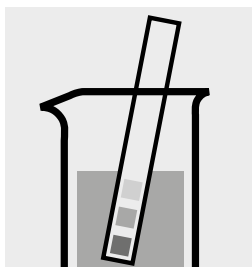
# Surfactants (cationic)

1.01764

Cell Test

**Measuring** 0.05 – 1.50 mg/l surfactants (cationic)

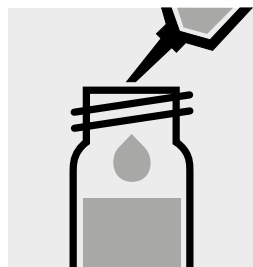
**range:** (calculated as N-cetyl-N,N,N-trimethylammonium bromide)



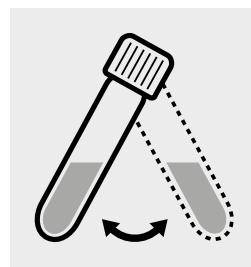
Check the pH of the sample, specified range: pH 3 – 8. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



Pipette 5.0 ml of the sample into a reaction cell, **do not mix!**



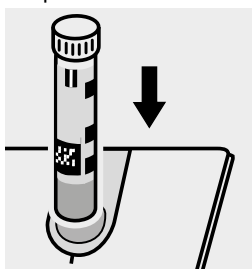
Add 0.50 ml of **T-1K** with pipette and close with the screw cap.



Swirl the cell for 30 seconds.



Reaction time: 5 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a surfactants standard solution must be prepared from Cetyltrimethylammonium Bromide, Cat.No. 2.19374 (see section "Standard solutions").

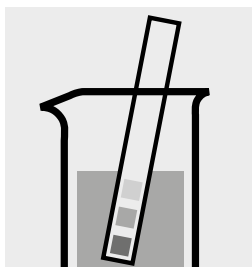
# Surfactants (nonionic)

1.01787

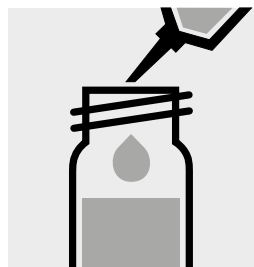
Cell Test

**Measuring** 0.10 – 7.50 mg/l surfactants (nonionic)

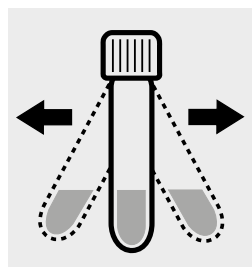
**range:** (calculated as Triton™ X-100)



Check the pH of the sample, specified range: pH 3 – 9. If required, add dilute sodium hydroxide solution or sulfuric acid drop by drop to adjust the pH.



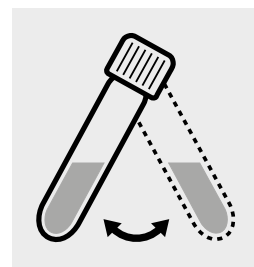
Pipette 4.0 ml of the sample into a reaction cell. Close with the screw cap.



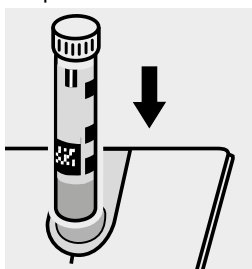
Shake the cell for **1 minute vigorously**.



Reaction time: 2 minutes



Swirl the cell before measurement.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

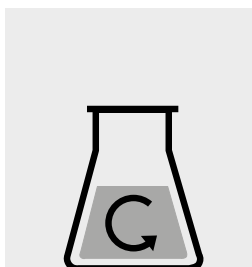
## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a surfactants standard solution must be prepared from Triton™ X-100, Cat.No. 1.12298 (see section "Standard solutions").

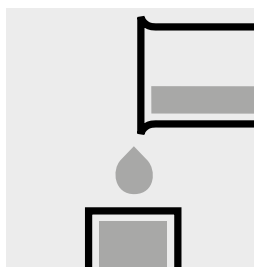
Standard solutions for photometric applications, Cat. Nos. 1.33022, 1.33023, and 1.33024 can also be used.

# Suspended Solids

<b>Measuring</b>	5 – 750 mg/l of suspended solid	20-mm cell	Method No. 182
<b>range:</b>	2 – 300 mg/l of suspended solid	50-mm cell	Method No. 182



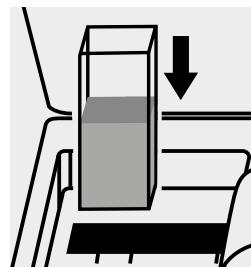
Homogenize 500 ml of sample for 2 minutes in a mixer running at high speed.



Transfer the solution into a cell.



Select method no. **182**.



Place the cell into the cell compartment. The measurement is performed automatically.



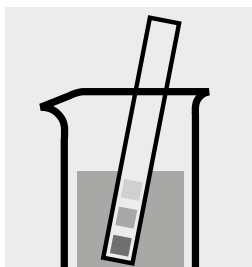
# Tin

1.14622

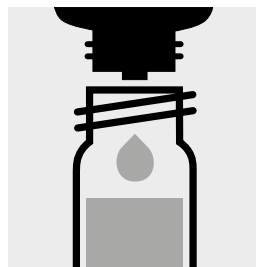
Cell Test

**Measuring** 0.10 – 2.50 mg/l Sn

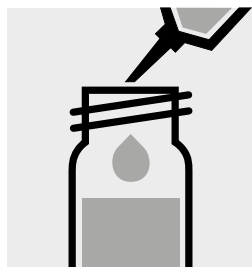
**range:** Expression of results also possible in mmol/l.



Check the pH of the sample, specified range: pH < 3.  
If required, add dilute sulfuric acid drop by drop to adjust the pH.



Add 6 drops of **Sn-1K** into a reaction cell, close with the screw cap, and mix.



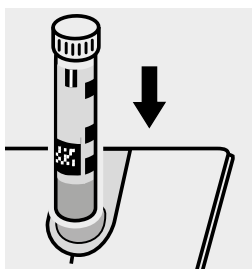
Add 5.0 ml of the sample with pipette, close the cell with the screw cap, and mix.



Check the pH, specified range: pH 1.5 – 3.5.  
If required, add dilute sulfuric acid drop by drop to adjust the pH.



Reaction time:  
15 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a tin standard solution must be prepared from ready-to-use tin standard solution Certipur®, Cat.No. 1.70242, concentration 1000 mg/l Sn (see section "Standard solutions").

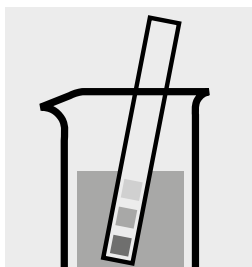
# Tin

1.17265

Cell Test

**Measuring** 0.10 – 2.50 mg/l Sn

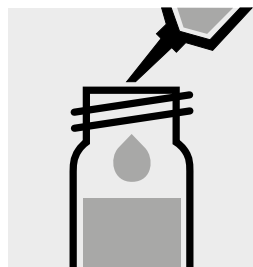
**range:** Expression of results also possible in mmol/l.



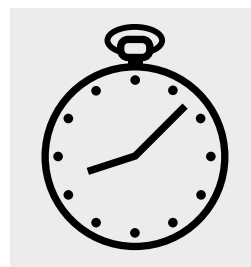
Check the pH of the sample, specified range: pH 1.5 – 2.2. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



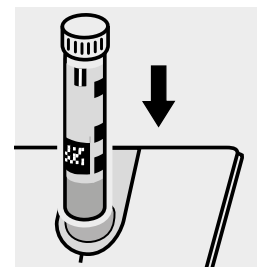
Pipette 4.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 0.50 ml of **Sn-1K** with pipette, close the cell with the screw cap, and mix.



Reaction time: 15 minutes, **measure immediately**.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a tin standard solution must be prepared from ready-to-use tin standard solution Certipur®, Cat.No. 1.70242, concentration 1000 mg/l Sn (see section "Standard solutions").

# TOC

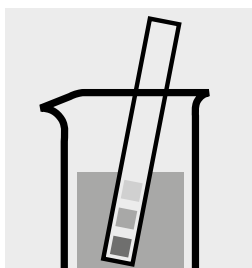
## Total Organic Carbon

1.14878

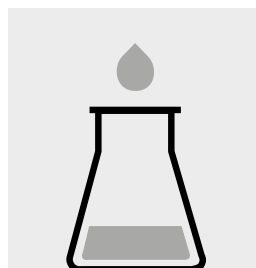
Cell Test

Measuring range: 5.0 – 80.0 mg/l TOC

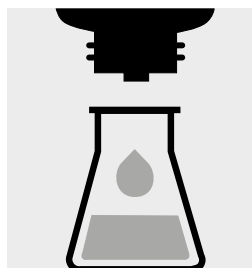
### Removal of inorganic bound carbon (TIC):



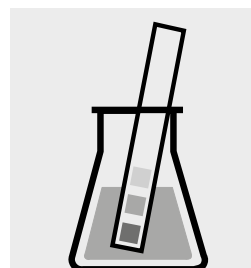
Check the pH of the sample, specified range: pH 2– 12.  
If required, add dilute sulfuric acid drop by drop to adjust the pH.



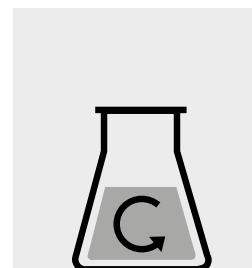
Place 25 ml of the sample into a suitable glass vessel.



Add 3 drops of **TOC-1K** and mix.



Check the pH, specified range pH < 2.5.



Stir for 10 minutes.

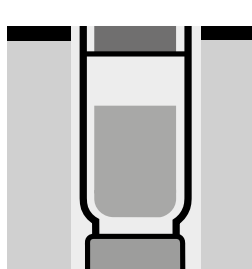
### Preparation of measurement sample:



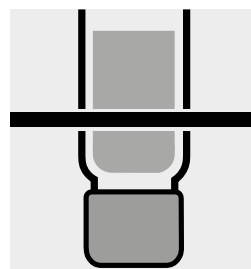
Pipette 3.0 ml of stirred sample into a reaction cell.



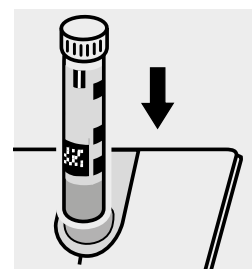
Add 1 level grey micro-spoon of **TOC-2K**. **Immediately** close the cell tightly with an **aluminium cap** (Cat.No. 1.73500).



Heat the cell, standing on its head, at 120 °C in the thermoreactor for 2 hours.



Remove the cell from the thermoreactor and let it, **standing on its head**, to cool for 1 hour.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

#### Note:

In order to enhance the accuracy of the measurement, it must be measured against an own prepared blank sample (preparation as per measurement sample, but with distilled water instead of sample).

#### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a TOC standard solution Certipur®, Cat.No. 1.09017, concentration 1000 mg/l TOC, can be used after diluting accordingly as well as the Standard solutions for photometric applications, Cat.Nos. 1.32247, 1.32248, and 1.32249.

# TOC

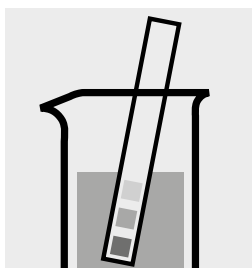
## Total Organic Carbon

1.14879

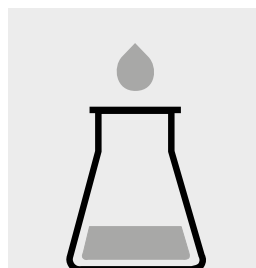
Cell Test

Measuring range: 50 – 800 mg/l TOC

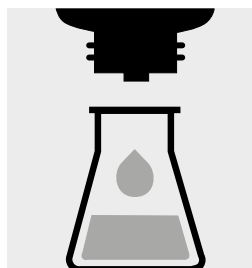
### Removal of inorganic bound carbon (TIC):



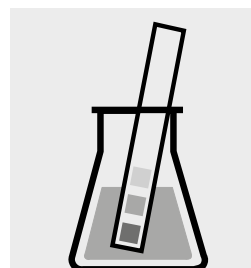
Check the pH of the sample, specified range: pH 2– 12.  
If required, add dilute sulfuric acid drop by drop to adjust the pH.



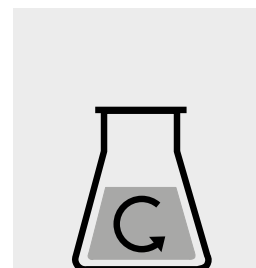
Pipette 1.0 ml of the sample and 9.0 ml of distilled water (Water for chromatography LiChrosolv®, Cat.No. 1.15333, is recommended) into a suitable glass vessel.



Add 2 drops of **TOC-1K** and mix.

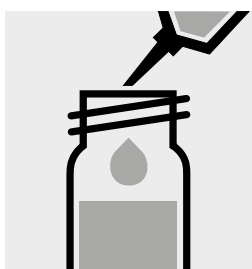


Check the pH, specified range pH < 2.5

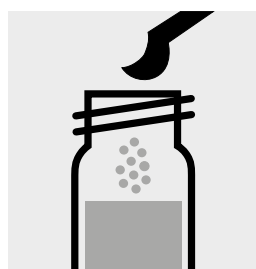


Stir for 10 minutes.

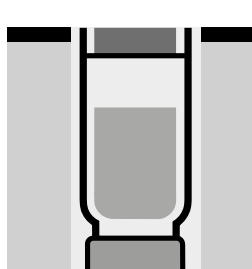
### Preparation of measurement sample:



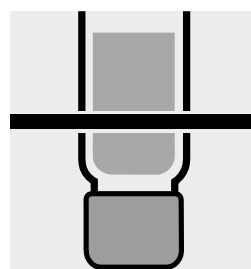
Pipette 3.0 ml of stirred sample into a reaction cell.



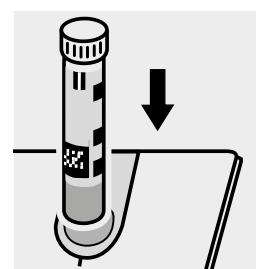
Add 1 level grey microspoon of **TOC-2K**. **Immediately** close the cell tightly with an **aluminium cap** (Cat.No. 1.73500).



Heat the cell, standing on its head, at 120 °C in the thermoreactor for 2 hours.



Remove the cell from the thermoreactor and let it, **standing on its head**, to cool for 1 hour.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

#### Note:

In order to enhance the accuracy of the measurement, it must be measured against an own prepared blank sample (preparation as per measurement sample, but with distilled water instead of sample).

#### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a TOC standard solution Certipur®, Cat.No. 1.09017, concentration 1000 mg/l TOC, can be used after diluting accordingly as well as the Standard solutions for photometric applications, Cat.Nos. 1.32251, 1.32252, and 1.32253.

# Total Hardness

1.00961

Determination of total hardness

Cell Test

**Measuring** 5 – 215 mg/l Ca

**range:** 0.7 – 30.1 °d

0.9 – 37.6 °e

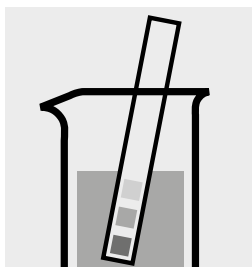
1.2 – 53.7 °f

**Measuring** 7 – 301 mg/l CaO

**range:** 12 – 537 mg/l CaCO<sub>3</sub>

0.12 – 5.36 mmol/l Ca/Mg

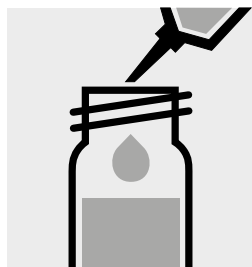
Expression of results also possible in mmol/l.



Check the pH of the sample, specified range: pH 3 – 9. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



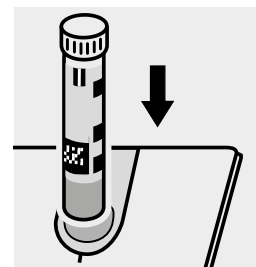
Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 1.0 ml of **H-1K** with pipette, close the cell with the screw cap, and mix.



Reaction time:  
3 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a freshly prepared standard solution can be used (see section "Standard solutions").

# Total Hardness

1.00961

Differentiation between Ca- and Mg-hardness

Cell Test

Measuring	0.12 – 5.36 mmol/l
range:	0.7 – 30.1 °d
	0.9 – 37.6 °e
	1.2 – 53.7 °f

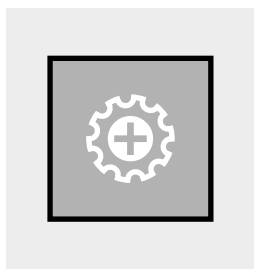
If the aim is to differentiate between Calcium- and Magnesium-hardness, after selecting the method it is possible to set the method-specific "Differentiation" mode.

**Differentiation possible only in mmol/l.**

**Note:** If no differentiation is to be measured, the "Differentiation" mode must be deactivated again.



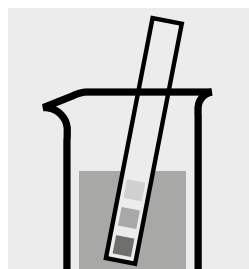
Select method no. **178**.



Tap the <Settings> button. Select "Differentiation" and activate.



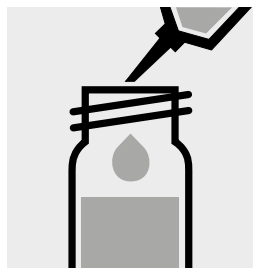
Confirm with <OK>.



Check the pH of the sample, specified range: pH 3 – 9. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



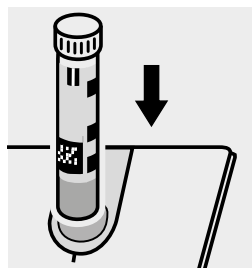
Pipette 1.0 ml of the sample into a reaction cell, close with the screw cap, and mix.



Add 1.0 ml of **H-1K** with pipette, close the cell with the screw cap, and mix.



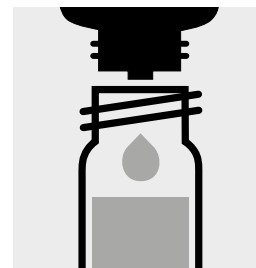
Reaction time: 3 minutes



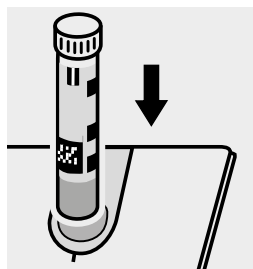
Place the cell into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically. = **cell A**



Confirm with <OK>.



Add 3 drops of **H-2K** to the already measured cell, close the cell with the screw cap, and mix.



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer. The measurement is performed automatically. = **cell B**



Confirm with <OK>. The results A ( $\Sigma$  Ca/Mg), B (Mg), and C (Ca) are shown in the display in mg/l.

# Turbidity

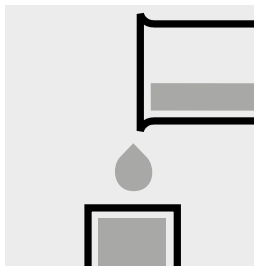
analogous to **EN ISO 7027**

**Measuring range:** 1 – 100 FAU

550 nm

50-mm cell

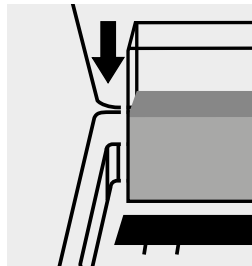
Method No. 77



Transfer the sample into a cell.



Select method no. 77.



Place the cell into the cell compartment.  
The measurement is performed automatically.

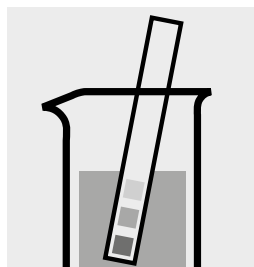
# Volatile Organic Acids

1.01749

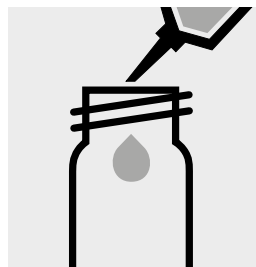
Cell Test

**Measuring** 50 – 3000 mg/l volatile organic acid (calculated as acetic acid)

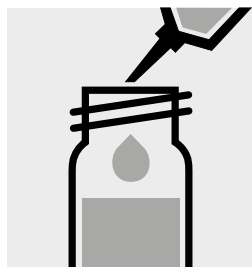
**range:** 71 – 4401 mg/l volatile organic acid (calculated as butyric acid)



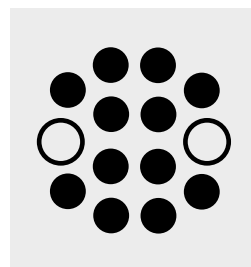
Check the pH of the sample, specified range: pH 2– 12.



Pipette 0.50 ml of **OA-1K** into a round cell.



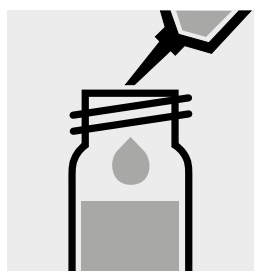
Add 0.50 ml of the sample with pipette, close with the screw cap, and mix.



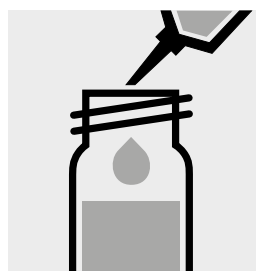
Heat the cell in the thermoreactor at 100 °C for 15 minutes. Then cool to room temperature under running water.



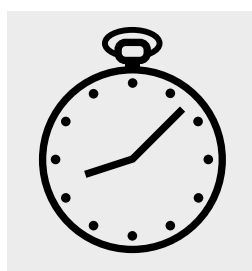
Add 1.0 ml of **OA-2K** with pipette.



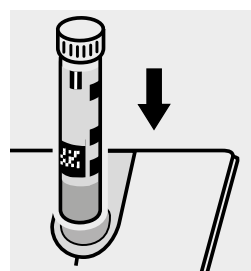
Add 1.0 ml of **OA-3K** with pipette, close the cell with the screw cap, and mix.



Add 1.0 ml of **OA-4K** with pipette, close the cell with the screw cap, and shake vigorously.



Reaction time:  
1 minute



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a standard solution must be prepared from sodium acetate anhydrous, Cat.No. 1.06268 (see section "Standard solutions").



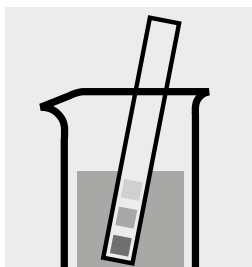
# Volatile Organic Acids

1.01809

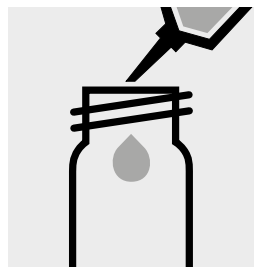
Test

**Measuring** 50 – 3000 mg/l volatile organic acid (calculated as acetic acid)

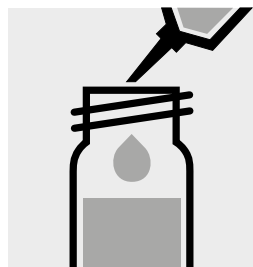
**range:** 71 – 4401 mg/l volatile organic acid (calculated as butyric acid)



Check the pH of the sample, specified range: pH 2 – 12.



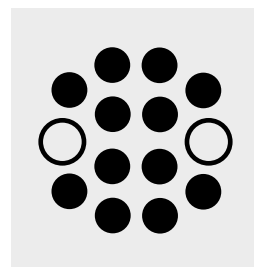
Pipette 0.75 ml of **OA-1** into a round cell.



Add 0.50 ml of **OA-2** with pipette.



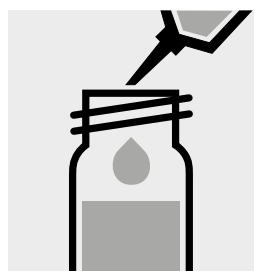
Add 0.50 ml of the sample with pipette, close with the screw cap, and mix.



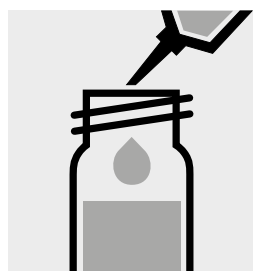
Heat the cell in the thermoreactor at 100 °C for 15 minutes. Then cool to room temperature under running water.



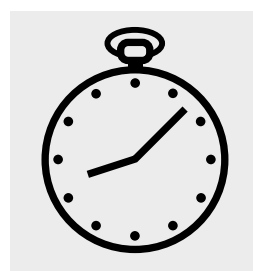
Add 1.0 ml of **OA-3** with pipette.



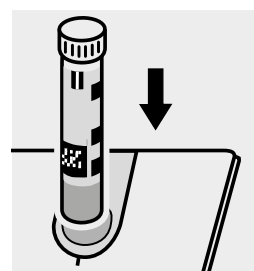
Add 1.0 ml of **OA-4** with pipette, close the cell with the screw cap, and mix.



Add 1.0 ml of **OA-5** with pipette, close the cell with the screw cap, and shake vigorously.



Reaction time: 1 minute



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) a standard solution must be prepared from sodium acetate anhydrous, Cat.No. 1.06268 (see section "Standard solutions").

# Yellow Pigment in Durum wheat flour and semolina

corresponds to **EN ISO 11052** and **German Food and Feed Code §64 LFGB 16.01-3**

## Application

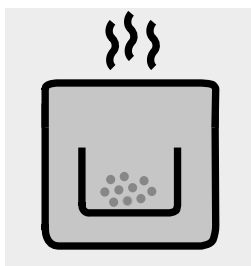
**Measuring range:** 0.000 – 1.250 mg/100 g      10-mm cell      Method No. 2541

**Attention!** Prior to the measurement of the first sample, the system automatically prompts a zero adjustment prepared from distilled water (Water for analysis EMSURE®, Cat.No. 1.16754), is recommended.  
This zero value remains valid until the method is exited.

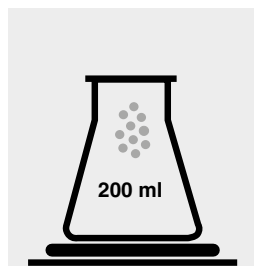
**Preparation:**  
Moisture content  
determination

Extraction

**Measurement:**



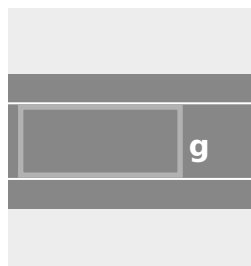
Determine the moisture content acc. to ISO 712 [3].  
**Note the moisture content, accurate to 0.01 %.**



Weigh 10 g of pretreated sample, accurately weighed to 1 mg, into a 200-ml Erlenmeyer flask perform an extraction acc. to EN ISO 11052 [1] or §64 LFGB 16.01-3 [2]: **measurement sample.**



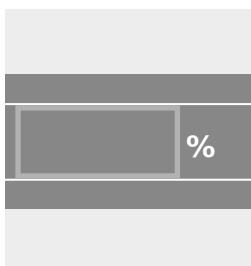
Select method no. **2541**. Perform the zero adjustment and confirm by pressing the <OK> button.



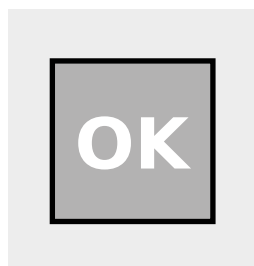
Enter the sample weight in grams.



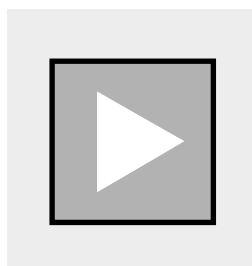
Confirm with <OK>.



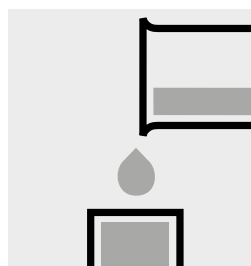
Enter the moisture content in %.



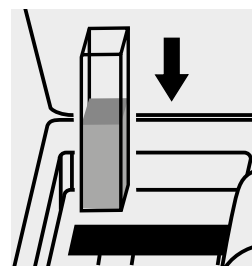
Confirm with <OK>.



Tap the <Start> button.



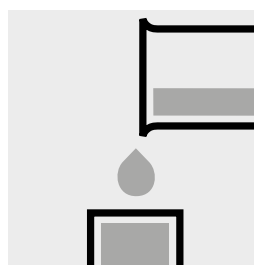
Transfer the **extraction solution** (reagent blank) into the cell.



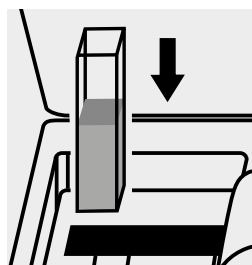
Place the cell into the cell compartment. The blank measurement is performed automatically.



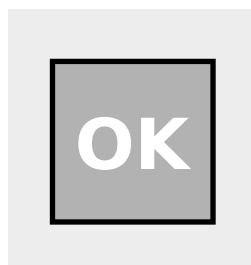
Confirm with <OK>.



Transfer the **measurement sample** into the cell.



Place the cell into the cell compartment. The measurement is performed automatically.



Confirm with <OK>. The result is shown in the display.



Tap the <Start> button to start the measurement procedure for the next sample. The system does not prompt a repeat of the zero adjustment.

### Important:

For each new measurement series, the pre-programmed calibration must be checked using standard solutions (see section "Adjustment"). If there are any significant deviations, the method must be recalibrated. Proceed according to the application instructions.

### Important:

The exact procedure as well as further details on the method used can be found in the corresponding application. This application can be downloaded from the website.

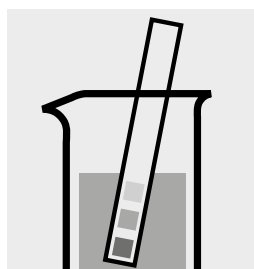
# Zinc

1.00861

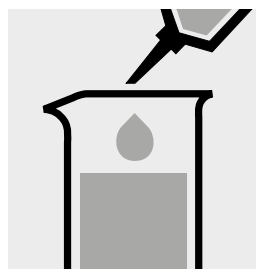
Cell Test

**Measuring** 0.025 – 1.000 mg/l Zn

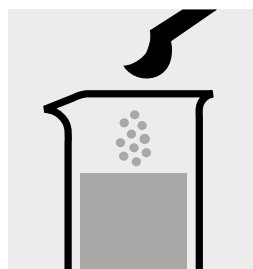
**range:** Expression of results also possible in mmol/l.



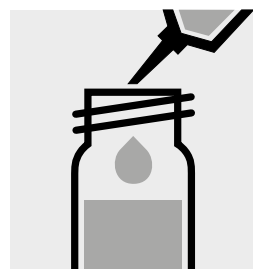
Check the pH of the sample, specified range: pH 1–7. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Pipette 10 ml of sample into a glass vessel.



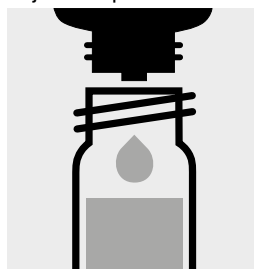
Add 1 level green micro-spoon of **Zn-1K** and shake to dissolve the solid substance: **sample-reagent mixture**.



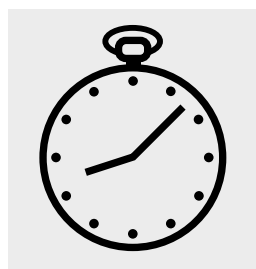
Pipette 0.50 ml of **Zn-2K** into a reaction cell, close with the screw cap, and mix.



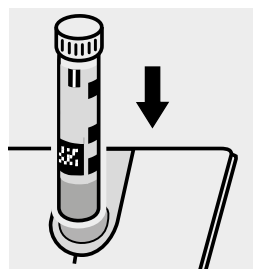
Add 2.0 ml of the **sample-reagent mixture** with pipette, close the cell with the screw cap, and mix.



Add 5 drops of **Zn-3K**, close the cell with the screw cap, and mix.



Reaction time: 15 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Important:

For the determination of **total zinc** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687, and thermoreactor is necessary.

Result can be expressed as sum of zinc ( $\Sigma$  Zn).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 100, Cat.No. 1.18701.

Ready-to-use zinc standard solution Certipur®, Cat.No. 1.19806, concentration 1000 mg/l Zn, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 100) is highly recommended.

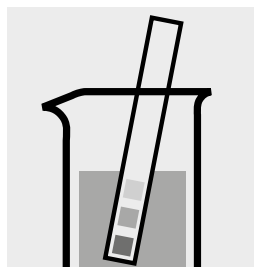
# Zinc

1.14566

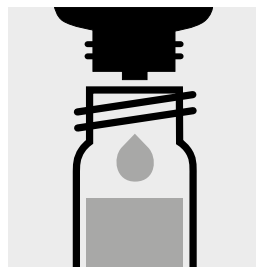
Cell Test

**Measuring** 0.20 – 5.00 mg/l Zn

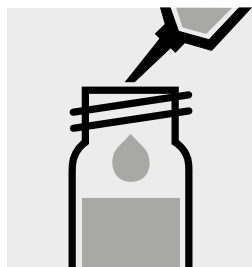
**range:** Expression of results also possible in mmol/l.



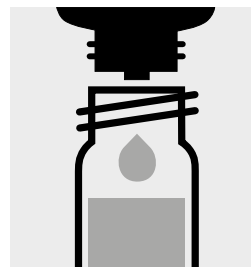
Check the pH of the sample, specified range: pH 3 – 10. If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



Add 5 drops of **Zn-1K** into a reaction cell, close with the screw cap, and mix.



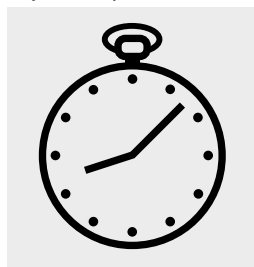
Add 0.50 ml of the sample with pipette, close the cell with the screw cap, and mix.



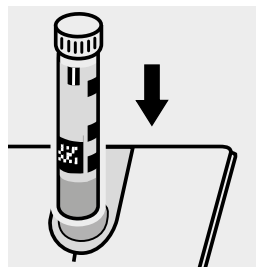
Add 5 drops of **Zn-2K**, close the cell with the screw cap, and mix.



Check the pH, specified range: pH 9.0 – 10.5.



Reaction time:  
15 minutes



Place the cell into the cell compartment. Align the mark on the cell with that on the photometer.

## Important:

For the determination of **total zinc** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687, and thermoreactor is necessary.

Result can be expressed as sum of zinc ( $\Sigma$  Zn).

## Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) ready-to-use zinc standard solution Certipur®, Cat.No. 1.19806, concentration 1000 mg/l Zn, can be used after diluting accordingly.

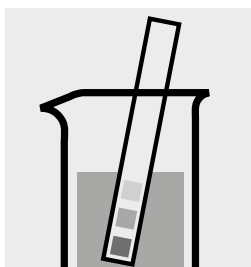
# Zinc

1.14832

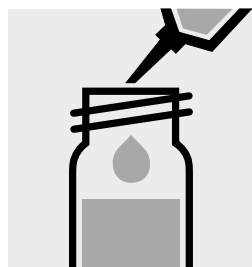
Test

**Measuring** 0.05 – 2.50 mg/l Zn 10-mm cell

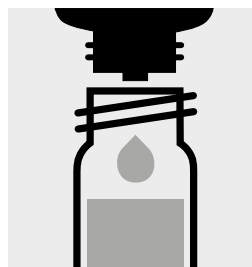
**range:** Expression of results also possible in mmol/l.



Check the pH of the sample, specified range: pH 4 – 10.  
If required, add dilute sodium hydroxide solution or hydrochloric acid drop by drop to adjust the pH.



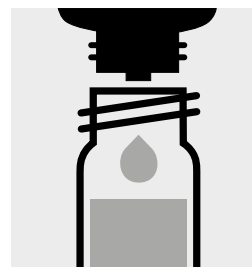
Pipette 5.0 ml of the sample into a test tube with screw cap.



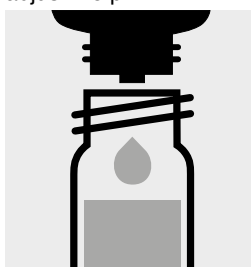
Add 5 drops of **Zn-1**, close the test tube with the screw cap, and mix.



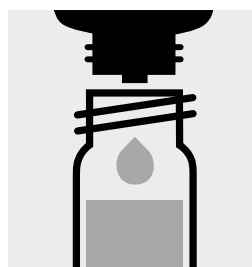
Check the pH, specified range: pH 12 – 13.  
If required, add dilute sodium hydroxide solution drop by drop to adjust the pH.



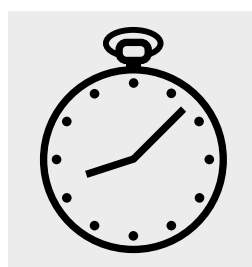
Add 2 drops of **Zn-2**, close the test tube with the screw cap, and mix.



Add 5 drops of **Zn-3**, close the test tube with the screw cap, and mix.



Add 3 drops of **Zn-4**, close the test tube with the screw cap, and mix.



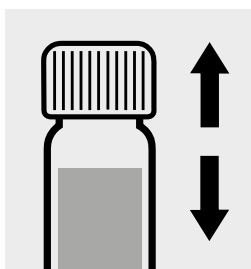
Reaction time: 3 minutes



Add 1 level grey micro-spoon of **Zn-5**, close the test tube with the screw cap, and dissolve the solid substance.



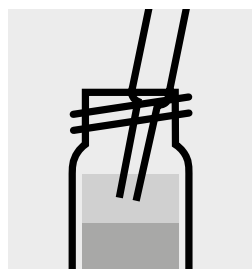
Add 5.0 ml of **Zn-6** (Cat.No. 1.06146, Isobutyl methyl ketone) with pipette and close the test tube with the screw cap.



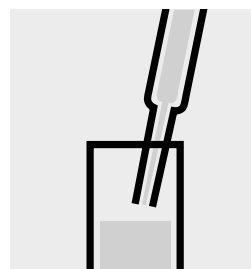
Shake the tube vigorously for 30 seconds.



Leave to stand for 2 minutes.



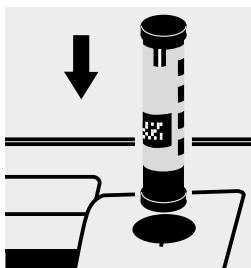
Aspirate the clear upper phase from the tube with pipette.



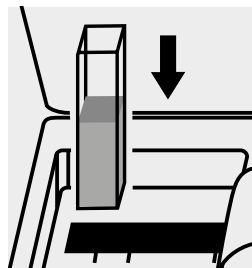
Transfer the solution into a cell.



Leave to stand for 3 minutes.



Select method with AutoSelector.



Place the cell into the cell compartment.

### Important note:

To compensate for any potential effects of the required auxiliary reagents on the measurement result, it is absolutely necessary to measure against an own prepared blank sample (preparation as per measurement sample, but with distilled water instead of sample).

### Important:

For the determination of **total zinc** a pretreatment with Crack Set 10C, Cat.No. 1.14688, or Crack Set 10, Cat.No. 1.14687, and thermoreactor is necessary.

Result can be expressed as sum of zinc ( $\Sigma$  Zn).

### Quality assurance:

To check the measurement system (test reagents, measurement device, and handling) we recommended to use Spectroquant® CombiCheck 100, Cat.No. 1.18701.

Ready-to-use zinc standard solution Certipur®, Cat.No. 1.19806, concentration 1000 mg/l Zn, can also be used after diluting accordingly.

To check for sample-dependent effects the use of addition solutions (e.g. in CombiCheck 100) is highly recommended.

# Analytical Procedures and Appendices

## II Suitability of test kits for testing seawater and tolerance limits of neutral salts

Test kit	Cat. No.	suitable for seawater	Limit of tolerance, salts in %		
			NaCl	NaNO <sub>3</sub>	Na <sub>2</sub> SO <sub>4</sub>
Acid Capacity Cell Test	1.01758	no	-	-	-
Aluminium Cell Test	1.00594	yes	20	20	20
Aluminium Test	1.14825	yes	10	20	20
Ammonium Cell Test	1.14739	no	5	5	5
Ammonium Cell Test	1.14558	yes	20	10	15
Ammonium Cell Test	1.14544	yes	20	15	20
Ammonium Cell Test	1.14559	yes	20	20	20
Ammonium Test	1.14752	yes <sup>1)</sup>	10	10	20
Ammonium Test	1.00683	yes	20	20	20
AOX Cell Test	1.00675	no	0.4	20	20
Arsenic Test	1.01747	no	10	10	10
BOD Cell Test	1.00687	yes	20	20	20
Boron Cell Test	1.00826	yes	10	20	20
Boron Test	1.14839	no	20	5	20
Bromine Test	1.00605	no	10	10	10
Cadmium Cell Test	1.14834	no	1	10	1
Cadmium Test	1.01745	no	1	10	1
Calcium Cell Test	1.00858	no	2	2	1
Calcium Test	1.14815	yes	20	20	10
Calcium Test	1.00049	no	-	-	-
Chloride Cell Test	1.14730	yes	-	20	1
Chloride Test	1.14897	yes	-	10	0.1
Chloride Cell Test	1.01804	no	-	0.5	0.05
Chloride Test	1.01807	no	-	0.5	0.05
Chlorine Cell Test	1.00595	yes <sup>2)</sup>	10	10	10
Chlorine Cell Test	1.00597	yes <sup>2)</sup>	10	10	10
Chlorine Test	1.00598	yes <sup>2)</sup>	10	10	10
Chlorine Test	1.00602	yes	10	10	10
Chlorine Test	1.00599	yes <sup>2)</sup>	10	10	10
Chlorine reagents (liquid) (free and total)	1.00086/1.00087/ 1.00088	yes <sup>2)</sup>	10	10	10

1) This test kit is also suitable for testing seawater after the addition of sodium hydroxide solution (see package insert).

2) The test is of limited suitability for seawater. When determining free chlorine in seawater, combined chlorine can be detected completely or partially.

## Analytical Procedures and Appendice –

### II Suitability of test kits for testing seawater and tolerance limits of neutral salts

Test kit	Cat. No.	suitable for seawater	Limit of tolerance, salts in %		
			NaCl	NaNO <sub>3</sub>	Na <sub>2</sub> SO <sub>4</sub>
Chlorine Dioxide Test	1.00608	yes	10	10	10
Chromate Cell Test (chromium(VI))	1.14552	yes	10	10	10
Chromate Cell Test (chromium total)	1.14552	no	1	10	10
Chromate Test	1.14758	yes	10	10	10
Cobalt Cell Test	1.17244	yes	10	10	20
COD Cell Test	1.14560	no	0.4	10	10
COD Cell Test	1.01796	no	0.4	10	10
COD Cell Test	1.14540	no	0.4	10	10
COD Cell Test	1.14895	no	0.4	10	10
COD Cell Test	1.14690	no	0.4	20	20
COD Cell Test	1.14541	no	0.4	10	10
COD Cell Test	1.14691	no	0.4	20	20
COD Cell Test	1.14555	no	1	10	10
COD Cell Test	1.01797	no	10	20	20
COD Cell Test (Hg free)	1.09772	no	0	10	10
COD Cell Test (Hg free)	1.09773	no	0	10	10
COD Cell Test (seawater)	1.17058	yes	35	10	10
COD Cell Test (seawater)	1.17059	yes	35	10	10
Copper Cell Test	1.14553	yes	15	15	15
Copper Test	1.14767	yes	15	15	15
Cyanide Cell Test	1.14561	no	10	10	10
Cyanide Cell Test	1.02531	no	10	10	10
Cyanide Test	1.09701	no	10	10	10
Cyanuric Acid Test	1.19253	yes	-	-	-
Fluoride Cell Test	1.00809	no	10	10	10
Fluoride Cell Test	1.17243	yes <sup>3)</sup>	0.2	0.2	0.001
Fluoride Test	1.14598	yes	20	20	20
Fluoride Test	1.00822	yes <sup>3)</sup>	0.05	0.05	0.001
Fluoride Test	1.17236	yes <sup>3)</sup>	0.2	0.2	0.002
Formaldehyde Cell Test	1.14500	no	5	0	10
Formaldehyde Test	1.14678	no	5	0	10
Gold Test	1.14821	yes	10	20	5

<sup>3)</sup> distill beforehand analogous APHA 4500-F<sup>-</sup> B

## Analytical Procedures and Appendice –

### II Suitability of test kits for testing seawater and tolerance limits of neutral salts

Test kit	Cat. No.	suitable for seawater	Limit of tolerance, salts in %		
			NaCl	NaNO <sub>3</sub>	Na <sub>2</sub> SO <sub>4</sub>
Hydrazine Test	1.09711	no	20	5	2
Hydrogenperoxide Cell Test	1.14731	yes	20	20	20
Hydrogenperoxide Test	1.18789	no	0.1	1	5
Iodine Test	1.00606	no	10	10	10
Iron Cell Test	1.14549	yes	20	20	20
Iron Cell Test	1.14896	no	5	5	5
Iron Test	1.14761	yes	20	20	20
Iron Test	1.00796	yes	20	20	20
Lead Cell Test	1.14833	no	20	20	1
Lead Test	1.09717	no	20	5	15
Magnesium Cell Test	1.00815	yes	2	2	1
Manganese Cell Test	1.00816	no	20	20	20
Manganese Test	1.14770	yes	20	20	20
Manganese Test	1.01846	no	20	25	5
Molybdenum Cell Test	1.00860	no	20	20	5
Molybdenum Test	1.19252	no	-	-	-
Monochloramine Test	1.01632	no	10	10	20
Nickel Cell Test	1.14554	no	20	20	20
Nickel Test	1.14785	no	20	20	20
Nitrat Cell Test	1.14542	no	0.4	-	20
Nitrate Cell Test	1.14563	no	0.2	-	20
Nitrate Cell Test	1.14764	no	0.5	-	20
Nitrate Cell Test	1.00614	no	2	-	20
Nitrate Test	1.14773	no	0.4	-	20
Nitrate Test	1.09713	no	0.2	-	20
Nitrate Cell Test (seawater)	1.14556	yes	20	-	20
Nitrate Test (seawater)	1.14942	yes	20	-	20
Nitrate Test	1.01842	no	0.001	-	0.001
Nitrite Cell Test	1.14547	yes	20	20	15
Nitrite Cell Test	1.00609	yes	20	15	15
Nitrite Test	1.14776	yes	20	20	15
Nitrogen (total) Cell Test	1.14537	no	0.5	-	10



## Analytical Procedures and Appendice –

### II Suitability of test kits for testing seawater and tolerance limits of neutral salts

Test kit	Cat. No.	suitable for seawater	Limit of tolerance, salts in %		
			NaCl	NaNO <sub>3</sub>	Na <sub>2</sub> SO <sub>4</sub>
Nitrogen (total) Cell Test	1.00613	no	0.2	-	10
Nitrogen (total) Cell Test	1.14763	no	2	-	20
Oxygen Cell Test	1.14694	no	10	5	1
Oxygen Scavengers Test	1.19251	no	-	-	-
Ozone Test	1.00607	yes	10	10	10
pH Cell Test	1.01744	yes	-	-	-
Phenol Cell Test	1.14551	yes	20	20	15
Phenol Test	1.00856	yes	20	20	20
Phosphate Cell Test	1.00474	yes	5	10	10
Phosphate Cell Test (ortho-phosphates)	1.14543	yes	5	10	10
Phosphate Cell Test (phosphorus total)	1.14543	no	1	10	10
Phosphat Cell Test	1.00475	yes	20	20	20
Phosphate Cell Test (ortho-phosphates)	1.14729	yes	20	20	20
Phosphate Cell Test (phosphorus total)	1.14729	yes	5	20	20
Phosphate Cell Test	1.00616	yes	20	20	20
Phosphate Cell Test (ortho-phosphates)	1.00673	yes	20	20	20
Phosphate Cell Test (phosphorus total)	1.00673	yes	20	20	20
Phosphate Test	1.14848	yes	5	10	10
Phosphate Test	1.00798	yes	15	20	10
Phosphate Cell Test	1.14546	yes	20	20	20
Phosphate Test	1.14842	yes	20	20	20
Potassium Cell Test	1.14562	yes	20	20	20
Potassium Cell Test	1.00615	yes	20	20	20
Residual Hardness Cell Test	1.14683	no	0.01	0.01	0.01
Silicate (silicic acid) Test	1.14794	yes	5	10	5
Silicate (silicic acid) Test	1.00857	no	5	10	2.5
Silicate (silicic acid) Test	1.01813	no	0.5	1	0.2
Silver Test	1.14831	no	0	1	5
Sodium Cell Test	1.00885	no	-	10	1
Sulfate Cell Test	1.02532	no	2	0.007	-

## Analytical Procedures and Appendice –

### II Suitability of test kits for testing seawater and tolerance limits of neutral salts

Test kit	Cat. No.	suitable for seawater	Limit of tolerance, salts in %		
			NaCl	NaNO <sub>3</sub>	Na <sub>2</sub> SO <sub>4</sub>
Sulfate Cell Test	1.14548	yes	10	0.1	-
Sulfate Cell Test	1.00617	yes	10	0.1	-
Sulfate Cell Test	1.14564	yes	10	0.5	-
Sulfate Test	1.14791	no	0.2	0.2	-
Sulfate Test	1.01812	no	2	0.007	-
Sulfate Test	1.02537	yes	10	0.015	-
Sulfide Test	1.14779	no	0.5	1	1
Sulfite Cell Test	1.14394	no	20	20	20
Sulfite Test	1.01746	no	20	20	20
Surfactants (anionic) Cell Test	1.02552	no	0.1	0.01	10
Surfactants (cationic) Cell Test	1.01764	no	0.1	0.1	20
Surfactants (nonionic) Cell Test	1.01787	no	2	5	2
Tin Cell Test	1.14622	yes	20	20	20
Tin Cell Test	1.17265	yes	5	5	0.5
TOC Cell Test	1.14878	no	0.5	10	10
TOC Cell Test	1.14879	no	5	20	20
Total Hardness Cell Test	1.00961	no	2	2	1
Volatile Organic Acids Cell Test	1.01749	no	20	20	10
Volatile Organic Acids Test	1.01809	no	20	20	10
Zinc Cell Test	1.00861	no	20	20	1
Zinc Cell Test	1.14566	no	10	10	10
Zinc Test	1.14832	no	5	15	15

# Analytical Procedures and Appendices

## III Spectroquant® CombiCheck and Standard solutions

Test kit Cat. No. or method	Evaluation as	CombiCheck Cat. No.	Confidence interval		Diluted and ready-to-use standard solutions			Ready-to-use standard solution Cat. No.
			Spec. value for the standard	Max. working tolerance	Cat. No.	Concen- tration	Expanded measurement uncertainty	
Acid Capacity Cell Test, 1.01758	OH	-	5.00 mmol/l <sup>1)</sup>	± 0.50 mmol/l	-	-	-	see prep. instruction
ADMI	-	-	50 <sup>1)</sup>	-	-	-	-	1.00246
ADMI	-	-	250 <sup>1)</sup>	-	-	-	-	1.00246
Aluminium Cell Test, 1.00594	Al	CC 100, 1.18701	0.40 mg/l	± 0.05 mg/l	1.32225	0.200 mg/l	± 0.006 mg/l	1.19770
Aluminium Test, 1.14825	Al	CC 100, 1.18701	0.40 mg/l	± 0.05 mg/l	1.32225	0.200 mg/l	± 0.006 mg/l	1.19770
Ammonium Cell Test, 1.14739	NH <sub>4</sub> -N	CC 50, 1.14695	1.00 mg/l	± 0.10 mg/l	1.25022	0.400 mg/l	± 0.012 mg/l	1.19812
		-	-	-	1.25023	1.00 mg/l	± 0.04 mg/l	
		-	-	-	1.32227	0.250 mg/l	± 0.011 mg/l	
Ammonium Cell Test, 1.14558	NH <sub>4</sub> -N	CC 10, 1.14676	4.00 mg/l	± 0.30 mg/l	1.25022	0.400 mg/l	± 0.012 mg/l	1.19812
					1.25023	1.00 mg/l	± 0.04 mg/l	
					1.25024	2.00 mg/l	± 0.07 mg/l	
					1.25025	6.00 mg/l	± 0.13 mg/l	
Ammonium Cell Test, 1.14544	NH <sub>4</sub> -N	CC 20, 1.14675	12.0 mg/l	± 1.0 mg/l	1.25023	1.00 mg/l	± 0.04 mg/l	1.19812
					1.25024	2.00 mg/l	± 0.07 mg/l	
					1.25025	6.00 mg/l	± 0.13 mg/l	
					1.25026	12.0 mg/l	± 0.4 mg/l	
Ammonium Cell Test, 1.14559	NH <sub>4</sub> -N	CC 70, 1.14689	50.0 mg/l	± 5.0 mg/l	1.25025	6.00 mg/l	± 0.13 mg/l	1.19812
					1.25026	12.0 mg/l	± 0.4 mg/l	
					1.25027	50.0 mg/l	± 1.2 mg/l	
Ammonium Test, 1.14752	NH <sub>4</sub> -N	CC 50, 1.14695	1.00 mg/l	± 0.10 mg/l	1.25022	0.400 mg/l	± 0.012 mg/l	1.19812
					1.25023	1.00 mg/l	± 0.04 mg/l	
					1.25024	2.00 mg/l	± 0.07 mg/l	
					1.32227	0.250 mg/l	± 0.011 mg/l	
Ammonium Test, 1.00683	NH <sub>4</sub> -N	CC 70, 1.14689	50.0 mg/l	± 5.0 mg/l	1.25025	6.00 mg/l	± 0.13 mg/l	1.19812
					1.25026	12.0 mg/l	± 0.4 mg/l	
					1.25027	50.0 mg/l	± 1.2 mg/l	
AOX Cell Test, 1.00675	AOX	-	1.00 mg/l <sup>1)</sup>	± 0.10 mg/l	-	-	-	1.00680
Arsenic Test, 1.01747	As	-	0.050 mg/l <sup>1)</sup>	± 0.005 mg/l	1.33002	1.00 mg/l	± 0.05 mg/l	1.19773
BOD Cell Test, 1.00687	O <sub>2</sub>	-	198 mg/l	± 40 mg/l	-	-	-	1.00718
Boron Cell Test, 1.00826	B	-	1.00 mg/l <sup>1)</sup>	± 0.15 mg/l	1.33005	1.00 mg/l	± 0.06 mg/l	1.19500
Boron Test, 1.14839	B	-	0.400 mg/l <sup>1)</sup>	± 0.040 mg/l	-	-	-	1.19500
Bromine Test, 1.00605	Br <sub>2</sub>	-	5.00 mg/l <sup>1)</sup>	± 0.50 mg/l	-	-	-	see prep. instruction
Cadmium Cell Test, 1.14834	Cd	CC 90, 1.18700	0.250 mg/l	± 0.030 mg/l	-	-	-	1.19777
Cadmium Test, 1.01745	Cd	CC 90, 1.18700	0.250 mg/l	± 0.030 mg/l	1.33008	0.00500 mg/l	± 0,00020 mg/l	1.19777
Calcium Cell Test, 1.00858	Ca	-	75 mg/l <sup>1)</sup>	± 7 mg/l	-	-	-	see prep. instruction
Calcium Test, 1.14815	Ca	-	80 mg/l <sup>1)</sup>	± 8 mg/l	-	-	-	1.19778

1) self prepared, recommended concentration

## Analytical Procedures and Appendice – III Spectroquant® CombiCheck and Standard solutions

Test kit Cat. No. or method	Evaluation as	CombiCheck Cat. No.	Confidence interval		Diluted and ready-to-use standard solutions			Ready-to-use standard solution Cat. No.
			Spec. value for the standard	Max. working tolerance	Cat. No.	Concen- tration	Expanded measurement uncertainty	
Calcium Test, 1.00049	Ca	-	2.00 mg/l <sup>1)</sup>	± 0.20 mg/l	-			1.19778
Chloride Cell Test, 1.14730	Cl	CC 20, 1.14675	60 mg/l	± 10 mg/l	1.32229	10.0 mg/l	± 0.5 mg/l	1.19897
		CC 10, 1.14676	25 mg/l	± 6 mg/l	1.32230	50 mg/l	± 3 mg/l	
Chloride Test, 1.14897	Cl	CC 60, 1.14696	125 mg/l	± 13 mg/l	1.32229	10.0 mg/l	± 0.5 mg/l	1.19897
		-	12.5 mg/l <sup>1)</sup>	± 1.3 mg/l	1.32230	50 mg/l	± 3 mg/l	
Chloride Cell Test, 1.01804	Cl	-	7.5 mg/l <sup>1)</sup>	± 0.8 mg/l	1.33010	1.00 mg/l	± 0.04 mg/l	1.19897
					1.33011	2.50 mg/l	± 0.08 mg/l	
					1.32229	10.0 mg/l	± 0.5 mg/l	
Chloride Test, 1.01807	Cl	-	2.50 mg/l <sup>1)</sup>	± 0.25 mg/l	1.33010	1.00 mg/l	± 0.04 mg/l	1.19897
					1.33011	2.50 mg/l	± 0.08 mg/l	
Chlorine Cell Test, 1.00595	Cl <sub>2</sub>	-	3.00 mg/l <sup>1)</sup>	± 0.30 mg/l	-			see prep. instruction
Chlorine Cell Test, 1.00597	Cl <sub>2</sub>	-	3.00 mg/l <sup>1)</sup>	± 0.30 mg/l	-			see prep. instruction
Chlorine Test, 1.00598	Cl <sub>2</sub>	-	3.00 mg/l <sup>1)</sup>	± 0.30 mg/l	-			see prep. instruction
Chlorine Test, 1.00602	Cl <sub>2</sub>	-	3.00 mg/l <sup>1)</sup>	± 0.30 mg/l	-			see prep. instruction
Chlorine Test, 1.00599	Cl <sub>2</sub>	-	3.00 mg/l <sup>1)</sup>	± 0.30 mg/l	-			see prep. instruction
Chlorine Cell Test (liquid reagent), 1.00086/1.00087	Cl <sub>2</sub>	-	3.00 mg/l <sup>1)</sup>	± 0.30 mg/l	-			see prep. instruction
Chlorine Test (liquid reagent), 1.00086/1.00087	Cl <sub>2</sub>	-	0.500 mg/l <sup>1)</sup>	± 0.050 mg/l	-			see prep. instruction
Chlorine Cell Test (liquid reagent), 1.00086/1.00087/1.00088	Cl <sub>2</sub>	-	3.00 mg/l <sup>1)</sup>	± 0.30 mg/l	-			see prep. instruction
Chlorine Test (liquid reagent), 1.00086/1.00087/1.00088	Cl <sub>2</sub>	-	0.500 mg/l <sup>1)</sup>	± 0.050 mg/l	-			see prep. instruction
Chlorine Dioxide Test, 1.00608	ClO <sub>2</sub>	-	5.00 mg/l <sup>1)</sup>	± 0.50 mg/l	-			see prep. instruction
Chromate Cell Test, 1.14552	Cr	-	1.00 mg/l <sup>1)</sup>	± 0.10 mg/l	1.33013	1.00 mg/l	± 0.03 mg/l	1.19780
Chromate Test, 1.14758	Cr	-	1.00 mg/l <sup>1)</sup>	± 0.10 mg/l	1.33012	0.050 mg/l	± 0.002 mg/l	1.19780
					1.33013	1.00 mg/l	± 0.03 mg/l	
Cobalt Cell Test, 1.17244	Co	-	1.00 mg/l <sup>1)</sup>	± 0.10 mg/l	-			1.19785
COD Cell Test, 1.14560	COD	CC 50, 1.14695	20.0 mg/l	± 4.0 mg/l	1.25028	20.0 mg/l	± 0.7 mg/l	see prep. instruction
COD Cell Test, 1.01796	COD	CC 50, 1.14695	20.0 mg/l	± 2.0 mg/l	1.25028	20.0 mg/l	± 0.7 mg/l	see prep. instruction
COD Cell Test, 1.14540	COD	CC 10, 1.14676	80 mg/l	± 12 mg/l	1.25029	100 mg/l	± 3 mg/l	see prep. instruction
COD Cell Test, 1.14895	COD	CC 60, 1.14696	250 mg/l	± 20 mg/l	1.25029	100 mg/l	± 3 mg/l	see prep. instruction
					1.25030	200 mg/l	± 4 mg/l	
COD Cell Test, 1.14690	COD	CC 60, 1.14696	250 mg/l	± 25 mg/l	1.25029	100 mg/l	± 3 mg/l	see prep. instruction
					1.25030	200 mg/l	± 4 mg/l	
					1.25031	400 mg/l	± 5 mg/l	
COD Cell Test, 1.14541	COD	CC 20, 1.14675	750 mg/l	± 75 mg/l	1.25029	100 mg/l	± 3 mg/l	see prep. instruction
					1.25030	200 mg/l	± 4 mg/l	
					1.25031	400 mg/l	± 5 mg/l	
					1.25032	1000 mg/l	± 11 mg/l	

1) self prepared, recommended concentration

I

Test kit Cat. No. or method	Evaluation as	CombiCheck Cat. No.	Confidence interval		Diluted and ready-to-use standard solutions			Ready-to-use standard solution Cat. No.
			Spec. value for the standard	Max. working tolerance	Cat. No.	Concen- tration	Expanded measurement uncertainty	
COD Cell Test, 1.14691	COD	CC 80, 1.14738	1500 mg/l	± 150 mg/l	1.25031	400 mg/l	± 5 mg/l	see prep. instruction
					1.25032	1000 mg/l	± 11 mg/l	
					1.25033	2000 mg/l	± 32 mg/l	
COD Cell Test, 1.14555	COD	CC 70, 1.14689	5000 mg/l	± 400 mg/l	1.25032	1000 mg/l	± 11 mg/l	see prep. instruction
					1.25033	2000 mg/l	± 32 mg/l	
					1.25034	8000 mg/l	± 68 mg/l	
COD Cell Test, 1.01797	COD	-	50 000 mg/l <sup>1)</sup>	± 5000 mg/l	1.25034	8000 mg/l	± 68 mg/l	see prep. instruction
					1.25035	50 000 mg/l	± 894 mg/l	
COD Cell Test, 1.09772	COD	-	80 mg/l <sup>1)</sup>	± 12 mg/l	1.25028	20.0 mg/l	± 0.7 mg/l	see prep. instruction
					1.25029	100 mg/l	± 3 mg/l	
COD Cell Test, 1.09773	COD	-	750 mg/l <sup>1)</sup>	± 75 mg/l	1.25029	100 mg/l	± 3 mg/l	see prep. instruction
					1.25030	200 mg/l	± 4 mg/l	
					1.25031	400 mg/l	± 5 mg/l	
					1.25032	1000 mg/l	± 11 mg/l	
COD Cell Test, 1.17058	COD	-	30.0 mg/l <sup>1)</sup>	± 3.0 mg/l	-	-	see prep. instruction	
COD Cell Test, 1.17059	COD	-	1500 mg/l <sup>1)</sup>	± 150 mg/l	-	-	see prep. instruction	
Color Hazen	Pt/Co (Hazen)	-	250 mg/l <sup>1)</sup>	-	-	-	1.00246	
Color Hazen	Pt/Co (Hazen)	-	500 mg/l	-	-	-	1.00246	
Copper Cell Test, 1.14553	Cu	CC 90, 1.18700	2.00 mg/l	± 0.20 mg/l	-	-	1.19786	
Copper Test, 1.14767	Cu	CC 90, 1.18700	2.00 mg/l	± 0.20 mg/l	-	-	1.19786	
Cyanide Cell Test, 1.02531	CN	-	0.250 mg/l <sup>1)</sup>	± 0.030 mg/l	-	-	1.19533	
Cyanide Cell Test, 1.14561	CN	-	0.250 mg/l <sup>1)</sup>	± 0.030 mg/l	-	-	1.19533	
Cyanide Test, 1.09701	CN	-	0.250 mg/l <sup>1)</sup>	± 0.030 mg/l	-	-	1.19533	
Cyanuric Acid Test, 1.19253	Cyan Acid	-	80 mg/l <sup>1)</sup>	± 10 mg/l	-	-	see prep. instruction	
Fluoride Cell Test, 1.00809	F	-	0.75 mg/l <sup>1)</sup>	± 0.08 mg/l	1.32234	0.200 mg/l	± 0.012 mg/l	1.19814
					1.32233	0.50 mg/l	± 0.02 mg/l	
					1.32235	1.00 mg/l	± 0.03 mg/l	
					1.32236	1.50 mg/l	± 0.04 mg/l	
Fluoride Cell Test, 1.17243	F	-	1.00 mg/l <sup>1)</sup>	± 0.15 mg/l	1.32234	0.200 mg/l	± 0.012 mg/l	1.19814
					1.32233	0.50 mg/l	± 0.02 mg/l	
					1.32235	1.00 mg/l	± 0.03 mg/l	
					1.32236	1.50 mg/l	± 0.04 mg/l	
Fluoride Test, 1.14598	F	-	1.00 mg/l <sup>1)</sup>	± 0.15 mg/l	1.32234	0.200 mg/l	± 0.012 mg/l	1.19814
			10.0 mg/l <sup>1)</sup>	± 1.2 mg/l	1.32233	0.50 mg/l	± 0.02 mg/l	
					1.32235	1.00 mg/l	± 0.03 mg/l	
					1.32236	1.50 mg/l	± 0.04 mg/l	
Fluoride Test, 1.00822	F	-	1.00 mg/l <sup>1)</sup>	± 0.15 mg/l	1.32234	0.200 mg/l	± 0.012 mg/l	1.19814
					1.32233	0.50 mg/l	± 0.02 mg/l	
					1.32235	1.00 mg/l	± 0.03 mg/l	
					1.32236	1.50 mg/l	± 0.04 mg/l	

1) self prepared, recommended concentration

II

III

IV

Test kit Cat. No. or method	Evaluation as	CombiCheck Cat. No.	Confidence interval		Diluted and ready-to-use standard solutions			Ready-to-use standard solution Cat. No.
			Spec. value for the standard	Max. working tolerance	Cat. No.	Concen- tration	Expanded measurement uncertainty	
Fluoride Test, 1.17236	F	-	1.00 mg/l <sup>1)</sup>	± 0.15 mg/l	1.32234	0.200 mg/l	± 0.012 mg/l	1.19814
					1.32233	0.50 mg/l	± 0.02 mg/l	
					1.32235	1.00 mg/l	± 0.03 mg/l	
					1.32236	1.50 mg/l	± 0.04 mg/l	
Formaldehyde Cell Test, 1.14500	HCHO	-	5.00 mg/l <sup>1)</sup>	± 0.50 mg/l	-	-	-	see prep. instruction
Formaldehyde Test, 1.14678	HCHO	-	4.50 mg/l <sup>1)</sup>	± 0.50 mg/l	-	-	-	see prep. instruction
Gold Test, 1.14821	Au	-	6.0 mg/l <sup>1)</sup>	± 0.6 mg/l	-	-	-	1.70216
Hydrazine Test, 1.09711	N <sub>2</sub> H <sub>4</sub>	-	1.00 mg/l <sup>1)</sup>	± 0.10 mg/l	-	-	-	see prep. instruction
Hydrogenperoxide Cell Test, 1.14731	H <sub>2</sub> O <sub>2</sub>	-	10.0 mg/l <sup>1)</sup>	± 1.0 mg/l	-	-	-	see prep. instruction
Hydrogenperoxide Test, 1.18789	H <sub>2</sub> O <sub>2</sub>	-	2.00 mg/l <sup>1)</sup>	± 0.20 mg/l	-	-	-	see prep. instruction
Iodine Test, 1.00606	I <sub>2</sub>	-	5.00 mg/l <sup>1)</sup>	± 0.50 mg/l	-	-	-	see prep. instruction
Iron Cell Test, 1.14549	Fe	CC 90, 1.18700	1.00 mg/l	± 0.15 mg/l	1.33018	0.1000 mg/l	± 0.0030 mg/l	1.19781
					1.33019	0.300 mg/l	± 0.009 mg/l	
					1.33020	1.00 mg/l	± 0.04 mg/l	
Iron Cell Test, 1.14896	Fe	-	25.0 mg/l <sup>1)</sup>	± 2.5 mg/l	-	-	-	1.19781
Iron Test, 1.14761	Fe	CC 90, 1.18700	1.00 mg/l	± 0.15 mg/l	1.33014	0.0500 mg/l	± 0.0015 mg/l	1.19781
					1.33018	0.1000 mg/l	± 0.0030 mg/l	
					1.33019	0.300 mg/l	± 0.009 mg/l	
					1.33020	1.00 mg/l	± 0.04 mg/l	
Iron Test, 1.00796	Fe	CC 90, 1.18700	1.00 mg/l	± 0.15 mg/l	1.33014	0.0500 mg/l	± 0.0015 mg/l	1.19781
					1.33018	0.1000 mg/l	± 0.0030 mg/l	
					1.33019	0.300 mg/l	± 0.009 mg/l	
					1.33020	1.00 mg/l	± 0.04 mg/l	
Lead Cell Test, 1.14833	Pb	CC 100, 1.18701	2.00 mg/l	± 0.20 mg/l	-	-	-	1.19776
Lead Test, 1.09717	Pb	CC 100, 1.18701	2.00 mg/l	± 0.20 mg/l	1.33003	0.050 mg/l	± 0.004 mg/l	1.19776
					1.33004	0.100 mg/l	± 0.005 mg/l	
Magnesium Cell Test, 1.00815	Mg	-	40.0 mg/l <sup>1)</sup>	± 4.0 mg/l	-	-	-	see prep. instruction
Manganese Cell Test, 1.00816	Mn	CC 90, 1.18700	1.00 mg/l	± 0.15 mg/l	1.32238	0.200 mg/l	± 0.005 mg/l	1.19789
					1.32239	1.00 mg/l	± 0.03 mg/l	
Manganese Test, 1.14770	Mn	CC 90, 1.18700	1.00 mg/l	± 0.15 mg/l	1.32237	0.050 mg/l	± 0.004 mg/l	1.19789
					1.32238	0.200 mg/l	± 0.005 mg/l	
					1.32239	1.00 mg/l	± 0.03 mg/l	
Manganese Test, 1.01846	Mn	CC 90, 1.18700	1.00 mg/l	± 0.15 mg/l	1.32237	0.050 mg/l	± 0.004 mg/l	1.19789
					1.32238	0.200 mg/l	± 0.005 mg/l	
					1.32239	1.00 mg/l	± 0.03 mg/l	
Molybdenum Cell Test, 1.00860	Mo	-	0.50 mg/l <sup>1)</sup>	± 0.05 mg/l	-	-	-	1.70227
Molybdenum Test, 1.19252	Mo	-	25.0 mg/l <sup>1)</sup>	± 2.5 mg/l	-	-	-	1.70227

1) self prepared, recommended concentration

I

Test kit Cat. No. or method	Evaluation as	CombiCheck Cat. No.	Confidence interval		Diluted and ready-to-use standard solutions			Ready-to-use standard solution Cat. No.	
			Spec. value for the standard	Max. working tolerance	Cat. No.	Concen- tration	Expanded measurement uncertainty		
Monochloramine Test, 1.01632	Cl <sub>2</sub>	-	5.00 mg/l <sup>1)</sup>	± 0.50 mg/l	-	-	-	see prep. instruction	
Nickel Cell Test, 1.14554	Ni	CC 100, 1.18701	2.00 mg/l	± 0.20 mg/l	-	-	-	1.09989	
Nickel Test, 1.14785	Ni	CC 100, 1.18701	2.00 mg/l	± 0.20 mg/l	-	-	-	1.09989	
Nitrate Cell Test, 1.14542	NO <sub>3</sub> -N	CC 20, 1.14675	9.0 mg/l	± 0.9 mg/l	1.25037	2.50 mg/l	± 0.06 mg/l	1.19811	
		-	-	-	1.25038	15.0 mg/l	± 0.4 mg/l		
	NO <sub>3</sub>	-	-	-	-	1.32241	10.0 mg/l	± 0.3 mg/l	1.19811
		-	-	-	-	1.32242	50.0 mg/l	± 2.0 mg/l	
Nitrate Cell Test, 1.14563	NO <sub>3</sub> -N	CC 20, 1.14675	9.0 mg/l	± 0.9 mg/l	1.25037	2.50 mg/l	± 0.06 mg/l	1.19811	
		-	-	-	1.25038	15.0 mg/l	± 0.4 mg/l		
	NO <sub>3</sub>	-	-	-	-	1.32241	10.0 mg/l	± 0.3 mg/l	1.19811
		-	-	-	-	1.32242	50.0 mg/l	± 2.0 mg/l	
Nitrate Cell Test, 1.14764	NO <sub>3</sub> -N	CC 80, 1.14738	25.0 mg/l	± 2.5 mg/l	1.25037	2.50 mg/l	± 0.06 mg/l	1.19811	
		-	-	-	1.25038	15.0 mg/l	± 0.4 mg/l		
		-	-	-	1.25039	40.0 mg/l	± 1.0 mg/l		
	-	-	-	-	-	1.32241	10.0 mg/l	± 0.3 mg/l	1.19811
-	-	-	-	-	1.32242	50.0 mg/l	± 2.0 mg/l	1.19811	
Nitrate Cell Test, 1.00614	NO <sub>3</sub> -N	-	100 mg/l <sup>1)</sup>	± 10 mg/l	1.25039	40.0 mg/l	± 1.0 mg/l	1.19811	
		-	-	-	1.25040	200 mg/l	± 5 mg/l		
Nitrate Test, 1.14773	NO <sub>3</sub> -N	CC 20, 1.14675	9.0 mg/l	± 0.9 mg/l	1.25036	0.500 mg/l	± 0.05 mg/l	1.19811	
		CC 10, 1.14676	2.50 mg/l	± 0.25 mg/l	1.25037	2.50 mg/l	± 0.06 mg/l		
		-	-	-	1.25038	15.0 mg/l	± 0.4 mg/l		
	NO <sub>3</sub>	-	-	-	-	1.32240	1.00 mg/l		± 0.03 mg/l
		-	-	-	-	1.32241	10.0 mg/l		± 0.3 mg/l
		-	-	-	-	1.32242	50.0 mg/l		± 2.0 mg/l
Nitrate Test, 1.09713	NO <sub>3</sub> -N	CC 20, 1.14675	9.0 mg/l	± 0.9 mg/l	1.25036	0.500 mg/l	± 0.05 mg/l	1.19811	
		CC 10, 1.14676	2.50 mg/l	± 0.25 mg/l	1.25037	2.50 mg/l	± 0.06 mg/l		
		-	-	-	1.25038	15.0 mg/l	± 0.4 mg/l		
	NO <sub>3</sub>	-	-	-	-	1.32240	1.00 mg/l		± 0.03 mg/l
		-	-	-	-	1.32241	10.0 mg/l		± 0.3 mg/l
		-	-	-	-	1.32242	50.0 mg/l		± 2.0 mg/l
Nitrate Cell Test, 1.14556	NO <sub>3</sub> -N	CC 10, 1.14676	2.50 mg/l	± 0.25 mg/l	1.25036	0.500 mg/l	± 0.05 mg/l	1.19811	
		-	-	-	1.25037	2.50 mg/l	± 0.06 mg/l		
	NO <sub>3</sub>	-	-	-	-	1.32240	1.00 mg/l	± 0.03 mg/l	1.19811
		-	-	-	-	1.32241	10.0 mg/l	± 0.3 mg/l	
Nitrate Test, 1.14942	NO <sub>3</sub> -N	CC 20, 1.14675	9.0 mg/l	± 0.9 mg/l	1.25036	0.500 mg/l	± 0.05 mg/l	1.19811	
		-	-	-	1.25037	2.50 mg/l	± 0.06 mg/l		
		-	-	-	1.25038	15.0 mg/l	± 0.4 mg/l		
	NO <sub>3</sub>	-	-	-	-	1.32240	1.00 mg/l		± 0.03 mg/l
		-	-	-	-	1.32241	10.0 mg/l		± 0.3 mg/l
		-	-	-	-	1.32242	50.0 mg/l		± 2.0 mg/l
Nitrate Test, 1.01842	NO <sub>3</sub> -N	-	10.0 mg/l <sup>1)</sup>	± 1.5 mg/l	1.32241	10.0 mg/l	± 0.3 mg/l	1.19811	
	NO <sub>3</sub>	-	-	-	1.32242	50.0 mg/l	± 2.0 mg/l	1.19811	
Nitrite Cell Test, 1.14547	NO <sub>2</sub> -N	-	0.300 mg/l <sup>1)</sup>	± 0.030 mg/l	1.25041	0.200 mg/l	± 0.009 mg/l	1.19899	
Nitrite Cell Test, 1.00609	NO <sub>2</sub> -N	-	45.0 mg/l <sup>1)</sup>	± 5 mg/l	1.25042	40.0 mg/l	± 1.3 mg/l	1.19899	
Nitrite Test, 1.14776	NO <sub>2</sub> -N	-	0.50 mg/l <sup>1)</sup>	± 0.05 mg/l	1.25041	0.200 mg/l	± 0.009 mg/l	1.19899	
Nitrogen (total) Cell Test, 1.14537	N	CC 50, 1.14695	5.0 mg/l	± 0.7 mg/l	1.25043	2.50 mg/l	± 0.06 mg/l	see prep. instruction	
		-	-	-	1.25044	12.0 mg/l	± 0.3 mg/l		

1) self prepared, recommended concentration

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## Analytical Procedures and Appendice – III Spectroquant® CombiCheck and Standard solutions

Test kit Cat. No. or method	Evaluation as	CombiCheck Cat. No.	Confidence interval		Diluted and ready-to-use standard solutions			Ready-to-use standard solution Cat. No.
			Spec. value for the standard	Max. working tolerance	Cat. No.	Concen- tration	Expanded measurement uncertainty	
Nitrogen (total) Cell Test, 1.00613	N	CC 50, 1.14695	5.0 mg/l	± 0.7 mg/l	1.25043 1.25044	2.50 mg/l 12.0 mg/l	± 0.06 mg/l ± 0.3 mg/l	see prep. instruction
Nitrogen (total) Cell Test, 1.14763	N	CC 70, 1.14689	50 mg/l	± 7 mg/l	1.25044 1.25045	12.0 mg/l 100 mg/l	± 0.3 mg/l ± 3 mg/l	see prep. instruction
Oxygen Cell Test, 1.14694	O <sub>2</sub>	-	-	± 0.6 mg/l	-	-	-	see the website
Oxygen Scavengers Test, 1.19251	DEHA	-	0.250 mg/l <sup>1)</sup>	± 0.030 mg/l	-	-	-	see prep. instruction
Ozone Test, 1.00607	O <sub>3</sub>	-	2.00 mg/l <sup>1)</sup>	± 0.20 mg/l	-	-	-	see prep. instruction
pH Cell Test, 1.01744	pH	-	7.0	± 0.2	-	-	-	109407
Phenol Cell Test, 1.14551	C <sub>6</sub> H <sub>5</sub> OH	-	1.25 mg/l <sup>1)</sup>	± 0.13 mg/l	-	-	-	see prep. instruction
Phenol Test, 1.00856	C <sub>6</sub> H <sub>5</sub> OH	-	2.50 mg/l <sup>1)</sup>	± 0.25 mg/l	-	-	-	see prep. instruction
Phosphate Cell Test, 1.00474	PO <sub>4</sub> -P	CC 10, 1.14676	0.80 mg/l	± 0.08 mg/l	-	-	-	1.19898
Phosphate Cell Test, 1.14543	PO <sub>4</sub> -P	CC 10, 1.14676	0.80 mg/l	± 0.08 mg/l	1.25046 1.25047	0.400 mg/l 4.00 mg/l	± 0.016 mg/l ± 0.08 mg/l	1.19898
Phosphate Cell Test, 1.00475	PO <sub>4</sub> -P	CC 80, 1.14738 CC 20, 1.14675	15.0 mg/l 8.0 mg/l	± 1.0 mg/l ± 0.7 mg/l	-	-	-	1.19898
Phosphate Cell Test, 1.14729	PO <sub>4</sub> -P	CC 80, 1.14738 CC 20, 1.14675	15.0 mg/l 8.0 mg/l	± 1.0 mg/l ± 0.7 mg/l	1.25047 1.25048	4.00 mg/l 15.0 mg/l	± 0.08 mg/l ± 0.4 mg/l	1.19898
Phosphate Cell Test, 1.00616	PO <sub>4</sub> -P	-	50.0 mg/l <sup>1)</sup>	± 5.0 mg/l	-	-	-	1.19898
Phosphate Cell Test, 1.00673	PO <sub>4</sub> -P	-	50.0 mg/l <sup>1)</sup>	± 5.0 mg/l	1.25047 1.25048 1.25049	4.00 mg/l 15.0 mg/l 75.0 mg/l	± 0.08 mg/l ± 0.4 mg/l ± 1.6 mg/l	1.19898
Phosphate Test, 1.14848	PO <sub>4</sub> -P	CC 10, 1.14676	0.80 mg/l	± 0.08 mg/l	-	-	-	1.19898
Phosphate Test, 1.00798	PO <sub>4</sub> -P	-	50.0 mg/l <sup>1)</sup>	± 5.0 mg/l	-	-	-	1.19898
Phosphate Cell Test, 1.14546	PO <sub>4</sub> -P	-	15.0 mg/l <sup>1)</sup>	± 1.0 mg/l	-	-	-	1.19898
Phosphate Test, 1.14842	PO <sub>4</sub> -P	-	15.0 mg/l <sup>1)</sup>	± 1.0 mg/l	-	-	-	1.19898
Potassium Cell Test, 1.14562	K	-	25.0 mg/l <sup>1)</sup>	± 4.0 mg/l	-	-	-	1.70230
Potassium Cell Test, 1.00615	K	-	150 mg/l <sup>1)</sup>	± 15 mg/l	-	-	-	1.70230
Residual Hardness Cell Test, 1.14683	Ca	-	2.50 mg/l <sup>1)</sup>	± 0.30 mg/l	-	-	-	1.19778
Silicate Test, 1.14794	SiO <sub>2</sub>	-	5.00 mg/l <sup>1)</sup> 0.750 mg/l <sup>1)</sup>	± 0.50 mg/l ± 0.075 mg/l	1.32244 1.32243 1.32245	0.1000 mg/l 0.500 mg/l 1.000 mg/l	± 0.0040 mg/l ± 0.025 mg/l ± 0.030 mg/l	1.70236
Silicate Test, 1.00857	SiO <sub>2</sub>	-	50.0 mg/l <sup>1)</sup>	± 5.0 mg/l	-	-	-	1.70236
Silicate Test, 1.01813	SiO <sub>2</sub>	-	0.1000 mg/l <sup>1)</sup>	± 0.0100 mg/l	1.32244	0.1000 mg/l	± 0.0040 mg/l	1.70236
Silver Test, 1.14831	Ag	-	1.50 mg/l <sup>1)</sup>	± 0.20 mg/l	-	-	-	1.19797
Sodium Cell Test, 1.00885	Na	-	100 mg/l <sup>1)</sup>	± 10 mg/l	-	-	-	see prep. instruction
Sulfate Cell Test, 1.02532	SO <sub>4</sub>	-	25.0 mg/l <sup>1)</sup>	± 3.0 mg/l	-	-	-	1.19813

1) self prepared, recommended concentration



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Test kit Cat. No. or method	Evaluation as	CombiCheck Cat. No.	Confidence interval		Diluted and ready-to-use standard solutions			Ready-to-use standard solution Cat. No.
			Spec. value for the standard	Max. working tolerance	Cat. No.	Concen- tration	Expanded measurement uncertainty	
Sulfate Cell Test, 1.14548	SO <sub>4</sub>	CC 10, 1.14676	100 mg/l	± 15 mg/l	1.25050 1.25051	40 mg/l 125 mg/l	± 6 mg/l ± 6 mg/l	1.19813
Sulfate Cell Test, 1.00617	SO <sub>4</sub>	CC 10, 1.14676	100 mg/l	± 15 mg/l	1.25051 1.25052	125 mg/l 400 mg/l	± 6 mg/l ± 20 mg/l	1.19813
Sulfate Cell Test, 1.14564	SO <sub>4</sub>	CC 20, 1.14675	500 mg/l	± 75 mg/l	1.25051 1.25052 1.25053	125 mg/l 400 mg/l 800 mg/l	± 6 mg/l ± 20 mg/l ± 27 mg/l	1.19813
Sulfate Test, 1.14791	SO <sub>4</sub>	CC 10, 1.14676	100 mg/l	± 15 mg/l	1.25050 1.25051	40 mg/l 125 mg/l	± 6 mg/l ± 6 mg/l	1.19813
Sulfate Test, 1.01812	SO <sub>4</sub>	-	5.00 mg/l <sup>1)</sup>	± 0.50 mg/l	-	-	-	1.19813
Sulfate Test, 1.02537	SO <sub>4</sub>	CC 10, 1.14676	100 mg/l	± 15 mg/l	1.25050 1.25051	40 mg/l 125 mg/l	± 6 mg/l ± 6 mg/l	1.19813
Sulfide Test, 1.14779	S	-	0.75 mg/l <sup>1)</sup>	± 0.08 mg/l	-	-	-	see prep. instruction
Sulfite Cell Test, 1.14394	SO <sub>3</sub>	-	12.5 mg/l <sup>1)</sup>	± 1.5 mg/l	-	-	-	see prep. instruction
Sulfite Test, 1.01746	SO <sub>3</sub>	-	30.0 mg/l <sup>1)</sup>	± 1.0 mg/l	-	-	-	see prep. instruction
Surfactants (anionic) Cell Test, 1.02552	SDAS	-	1.00 mg/l <sup>1)</sup>	± 0.20 mg/l	-	-	-	see prep. instruction
Surfactants (cationic) Cell Test, 1.01764	k-Ten	-	1.00 mg/l <sup>1)</sup>	± 0.10 mg/l	-	-	-	see prep. instruction
Surfactants (nonionic) Cell Test, 1.01787	n-Ten	-	4.00 mg/l <sup>1)</sup>	± 0.40 mg/l	1.33022 1.33023	1.00 mg/l 5.00 mg/l	± 0.16 mg/l ± 0.30 mg/l	see prep. instruction
Tin Cell Test, 1.14622	Sn	-	1.25 mg/l <sup>1)</sup>	± 0.13 mg/l	-	-	-	see prep. instruction
Tin Cell Test, 1.17265	Sn	-	1.25 mg/l <sup>1)</sup>	± 0.13 mg/l	-	-	-	see prep. instruction
TOC Cell Test, 1.14878	TOC	-	40.0 mg/l <sup>1)</sup>	± 3.0 mg/l	1.32247 1.32248 1.32249	10.0 mg/l 25.0 mg/l 50.0 mg/l	± 0.2 mg/l ± 0.5 mg/l ± 1.0 mg/l	1.09017
TOC Cell Test, 1.14879	TOC	-	400 mg/l <sup>1)</sup>	± 30 mg/l	1.32251 1.32252 1.32253	100 mg/l 200 mg/l 500 mg/l	± 2 mg/l ± 4 mg/l ± 10 mg/l	1.09017
Total Hardness Cell Test, 1.00961	Ca	-	75 mg/l <sup>1)</sup>	± 7 mg/l	-	-	-	see prep. instruction
Volatile Organic Acids Cell Test, 1.01749	CH <sub>3</sub> COOH	-	1500 mg/l <sup>1)</sup>	± 80 mg/l	-	-	-	see prep. instruction
Volatile Organic Acids Test, 1.01809	CH <sub>3</sub> COOH	-	1500 mg/l <sup>1)</sup>	± 80 mg/l	-	-	-	see prep. instruction
Zinc Cell Test, 1.00861	Zn	CC 100, 1.18701	0.750 mg/l	± 0.150 mg/l	-	-	-	1.19806
Zinc Cell Test, 1.14566	Zn	-	2.00 mg/l <sup>1)</sup>	± 0.40 mg/l	-	-	-	1.19806
Zinc Test, 1.14832	Zn	CC 100, 1.18701	0.75 mg/l	± 0.15 mg/l	-	-	-	1.19806

1) self prepared, recommended concentration

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# Analytical Procedures and Appendices

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## IV Instructions for the preparation of standard solutions

### Standard solution of acid capacity

#### Preparation of a standard solution:

A sodium hydroxide solution of 0.1 mol/l (corresponds to 100 mmol/l) is used.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

#### Stability:

When stored in a cool place (refrigerator), the diluted investigational solutions remain stable for one week.

#### Reagents required:

1.09141.1000	Sodium hydroxide solution 0.1 mol/l Titripur®
1.16754.9010	Water for analysis EMSURE®

### Standard solution of bromine analogous to DIN EN ISO 7393

#### Preparation of a KIO<sub>3</sub> stock solution:

Dissolve 1.006 g of KIO<sub>3</sub> in 250 ml of distilled water in a calibrated or conformity-checked 1000-ml volumetric flask. Subsequently make up to the mark with distilled water.

#### Preparation of a KIO<sub>3</sub>/KI standard solution:

Transfer 11.13 ml of the KIO<sub>3</sub> stock solution to a calibrated or conformity-checked 1000-ml volumetric flask, add approx. 1 g of KI and make up to the mark with distilled water.

1 ml of this solution is equivalent to 0.025 mg of bromine.

#### Preparation of a bromine standard solution:

Pipette 20.0 ml (full pipette) KIO<sub>3</sub>/KI standard solution into a calibrated or conformity-checked 100-ml volumetric flask, add 2.0 ml of H<sub>2</sub>SO<sub>4</sub> 0.5 mol/l, leave to stand for 1 minute, and then add NaOH 2 mol/l dropwise (approx. 1 ml) until the solution just loses its color. Subsequently make up the solution to the mark with distilled water.

The concentration of the solution is 5.00 mg/l bromine.

#### Stability:

The KIO<sub>3</sub> stock solution remains stable for 4 weeks when stored in a cool place (refrigerator). The KIO<sub>3</sub>/KI standard solution can be used for 5 hours when stored in a cool place (refrigerator). The diluted bromine standard solution is not stable and must be used immediately.

#### Reagents required:

1.02404.0100	Potassium iodate, volum. standard
1.05043.0250	Potassium iodide for analysis EMSURE®
1.09072.1000	Sulfuric acid 0.5 mol/l Titripur®
1.09136.1000	Sodium hydroxide solution 2 mol/l Titripur®
1.16754.9010	Water for analysis EMSURE®

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**Standard solution of calcium**

**Preparation of a standard solution:**

Dissolve 2.946 g of calcium nitrate tetrahydrate with distilled water in a calibrated or conformity-checked 500-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 1000 mg/l calcium.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

**Stability:**

The standard solution of 1000 mg/l remains stable for one week. The diluted standard solutions (investigational concentrations) remain stable for one day.

**Reagents required:**

1.02121.0500	Calcium nitrate tetrahydrate for analysis EMSURE®
1.16754.9010	Water for analysis EMSURE®

**Standard solutions of free chlorine**

All standard solutions described here for free chlorine yield equivalent results and are identically suited for the determination of chlorine.

**Standard solution of free chlorine**

**Preparation of a standard solution:**

Dissolve 1.85 g of dichloroisocyanuric acid sodium salt dihydrate GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 1000 mg/l free chlorine.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

**Stability:**

When stored in a cool place (refrigerator), the standard solution of 1000 mg/l and the diluted standard solutions (investigational concentrations) remain stable for one day.

**Note:**

This is a standard solution that can be prepared particularly rapidly and easily.

**Reagents required:**

1.10888.0250	Dichloroisocyanuric acid sodium salt GR for analysis
1.16754.9010	Water for analysis EMSURE®

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**Standard solution of free chlorine analogous to DIN EN ISO 7393**

**Preparation of a KIO<sub>3</sub> stock solution:**

Dissolve 1.006 g of KIO<sub>3</sub> in 250 ml of distilled water in a calibrated or conformity-checked 1000-ml volumetric flask. Subsequently make up to the mark with distilled water.

**Preparation of a KIO<sub>3</sub>/KI standard solution:**

Transfer 15.00 ml (5.00 ml) of the KIO<sub>3</sub> stock solution to a calibrated or conformity-checked 1000-ml volumetric flask, add approx. 1 g of KI and make up to the mark with distilled water.

1 ml of this solution is equivalent to 0.015 mg (0.05 mg) of free chlorine.

**Preparation of a chlorine standard solution:**

Pipette 20.0 ml (10.0 ml) (full pipette) KIO<sub>3</sub>/KI standard solution into a calibrated or conformity-checked 100-ml volumetric flask, add 2.0 ml of H<sub>2</sub>SO<sub>4</sub> 0.5 mol/l, leave to stand for 1 minute, and then add NaOH 2 mol/l dropwise (approx. 1 ml) until the solution just loses its color. Subsequently make up the solution to the mark with distilled water.

The concentration of the solution is 3.00 mg/l (0.500 mg/l) free chlorine.

**Stability:**

The KIO<sub>3</sub> stock solution remains stable for 4 weeks when stored in a cool place (refrigerator). The KIO<sub>3</sub>/KI standard solution can be used for 5 hours when stored in a cool place (refrigerator). The diluted chlorine standard solution is not stable and must be used immediately.

**Note:**

This procedure involves the preparation according to a standardized method.

**Reagents required:**

1.02404.0100	Potassium iodate, volum. standard
1.05043.0250	Potassium iodide for analysis EMSURE®
1.09072.1000	Sulfuric acid 0.5 mol/l Titripur®
1.09136.1000	Sodium hydroxide solution 2 mol/l Titripur®
1.16754.9010	Water for analysis EMSURE®

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**Standard solution of free chlorine**

**Preparation of a stock solution:**

First prepare a 1:10 dilution using a sodium hypochlorite solution containing approx. 13% of active chlorine. For this pipette 10 ml of sodium hypochlorite solution into a calibrated or conformity-checked 100-ml volumetric flask and then make up to the mark with distilled water.

**Precise assay of the stock solution:**

Pipette 10.0 ml of the stock solution into a 250-ml ground-glass-stoppered conical flask containing 60 ml of distilled water. Subsequently add to this solution 5 ml of hydrochloric acid 25% and 3 g of potassium iodide. Close the conical flask with the ground-glass stopper, mix thoroughly, and leave to stand for 1 minute.

Titrate the eliminated iodine with sodium thiosulfate solution 0.1 mol/l until a weakly yellow color emerges. Add 2 ml of zinc iodide-starch solution and titrate from blue to colorless.

**Calculation and preparation of a standard solution:**

$$\text{Consumption of sodium thiosulfate solution } 0.1 \text{ mol/l (ml)} \cdot 355 = \\ = \text{content of free chlorine, in mg/l}$$

Further investigational concentrations may be prepared from the stock solution prepared according to the procedure described above by diluting accordingly with distilled water.

**Stability:**

When stored in a cool place (refrigerator), a standard solution remains stable for approx. one week. The diluted standard solutions (investigational concentrations) are stable for approx. 2 hours.

**Note:**

This is a standard solution that is absolutely necessary for the preparation of the monochloramine standard.

**Reagents required:**

1.00316.1000	Hydrochloric acid 25% for analysis EMSURE®
1.05614.9025	Sodium hypochlorite solution techn. approx. 13% active chlorine
1.09147.1000	Sodium thiosulfate solution 0.1 mol/l Titripur®
1.05043.0250	Potassium iodide GR for analysis
1.05445.0500	Zinc iodide-starch solution GR for analysis
1.16754.9010	Water for analysis EMSURE®

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**Standard solution of total chlorine****Preparation of a stock solution:**

Dissolve 4.00 g of chloramine T GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.

The stock solution prepared according to this procedure has a concentration of approx. 1000 mg/l total chlorine.

**Precise assay of the stock solution:**

Pipette 10.0 ml of the stock solution into a 250-ml ground-glass-stoppered conical flask containing 60 ml of distilled water. Subsequently add to this solution 5 ml of hydrochloric acid 25% and 3 g of potassium iodide. Close the conical flask with the ground-glass stopper, mix thoroughly, and leave to stand for 1 minute.

Titrate the eliminated iodine with sodium thiosulfate solution 0.1 mol/l until a weakly yellow color emerges. Add 2 ml of zinc iodide-starch solution and titrate from blue to colorless.

**Calculation and preparation of a standard solution:**

*Consumption of sodium thiosulfate solution 0.1 mol/l (ml) · 355 =*  
*= content of free chlorine, in mg/l*

Further investigational concentrations may be prepared from the stock solution prepared according to the procedure described above by diluting accordingly with distilled water.

**Stability:**

When stored in a cool place (refrigerator), the stock solution of approx. 1000 mg/l and the diluted standard solutions (investigational concentrations) remain stable for one day.

**Reagents required:**

1.00316.1000	Hydrochloric acid 25% for analysis EMSURE®
1.02426.0250	Chloramine T trihydrate GR for analysis
1.09147.1000	Sodium thiosulfate solution 0.1 mol/l Titripur®
1.05043.0250	Potassium iodide GR for analysis
1.05445.0500	Zinc iodide-starch solution GR for analysis
1.16754.9010	Water for analysis EMSURE®

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**Standard solution of chlorine dioxide analogous to DIN EN ISO 7393**

**Preparation of a KIO<sub>3</sub> stock solution:**

Dissolve 1.006 g of KIO<sub>3</sub> in 250 ml of distilled water in a calibrated or conformity-checked 1000-ml volumetric flask. Subsequently make up to the mark with distilled water.

**Preparation of a KIO<sub>3</sub>/KI standard solution:**

Transfer 13.12 ml of the KIO<sub>3</sub> stock solution to a calibrated or conformity-checked 1000-ml volumetric flask, add approx. 1 g of KI and make up to the mark with distilled water.

1 ml of this solution is equivalent to 0.025 mg of chlorine dioxide.

**Preparation of a chlorine dioxide standard solution:**

Pipette 20.0 ml (full pipette) KIO<sub>3</sub>/KI standard solution into a calibrated or conformity-checked 100-ml volumetric flask, add 2.0 ml of H<sub>2</sub>SO<sub>4</sub> 0.5 mol/l, leave to stand for 1 minute, and then add NaOH 2 mol/l dropwise (approx. 1 ml) until the solution just loses its color. Subsequently make up the solution to the mark with distilled water.

The concentration of the solution is 5.00 mg/l chlorine dioxide.

**Stability:**

The KIO<sub>3</sub> stock solution remains stable for 4 weeks when stored in a cool place (refrigerator). The KIO<sub>3</sub>/KI standard solution can be used for 5 hours when stored in a cool place (refrigerator). The diluted chlorine dioxide standard solution is not stable and must be used immediately.

**Reagents required:**

1.02404.0100	Potassium iodate, volum. standard
1.05043.0250	Potassium iodide for analysis EMSURE®
1.09072.1000	Sulfuric acid 0.5 mol/l Titripur®
1.09136.1000	Sodium hydroxide solution 2 mol/l Titripur®
1.16754.9010	Water for analysis EMSURE®

**Standard solution of COD**

**Preparation of a standard solution:**

Dissolve 0.851 g of potassium hydrogen phthalate GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 1000 mg/l COD.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

**Stability:**

When stored in a cool place (refrigerator), the standard solution remains stable for one month. When stored under appropriate cool conditions (refrigerator), the diluted standard solutions (investigational concentrations) remain stable – depending on the respective concentration – for approx. one week to one month.

**Reagents required:**

1.02400.0080	Potassium hydrogen phthalate GR for analysis, volum. standard
1.16754.9010	Water for analysis EMSURE®

I

### Standard solution COD/chloride

#### Preparation of a chloride dilution solution:

Dissolve 32.9 g of sodium chloride (free from organic material, e. g. Suprapur®) with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.

The dilution solution prepared according to this procedure has a concentration of 20 g/l Cl<sup>-</sup>

#### Preparation of a COD/chloride standard solution:

Dissolve 0.851 g of potassium hydrogen phthalate GR with **dilution solution** in a calibrated or conformity-checked 100-ml volumetric flask and make up to the mark with **dilution solution**.

The standard solution prepared according to this procedure has a concentration of 10 000 mg/l COD and 20 g/l Cl<sup>-</sup>.

Further investigational concentrations may be prepared from this stock solution by diluting accordingly with **dilution solution**.

#### Stability:

When stored in a cool place (refrigerator), the dilution solution of 20 g/l Cl<sup>-</sup> and the standard solution of 10 000 mg/l COD / 20 g/l Cl<sup>-</sup> remain stable for one month. When stored under appropriate cool conditions (refrigerator), the diluted standard solutions (investigational concentrations) remain stable - depending on the respective concentration - for approximately one week to one month.

#### Reagents required:

1.02400.0080	Potassium hydrogen phthalate GR for analysis, volum. standard
1.06406.0050	Sodium chloride 99.99 Suprapur®
1.16754.9010	Water for analysis EMSURE®

II

### Standard solution of cyanuric acid

#### Preparation of a standard solution:

Dissolve 1.00 g of cyanuric acid with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water. The substance is slightly soluble and the dissolution process may take several hours.

The standard solution prepared according to this procedure has a concentration of 1000 mg/l cyanuric acid.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

#### Stability:

When stored in a cool place (refrigerator), the standard solution of 1000 mg/l and the diluted standard solutions (investigational concentrations) remain stable for one day.

#### Reagents required:

8.20358.0005	Cyanuric acid for synthesis
1.16754.9010	Water for analysis EMSURE®

III

IV



### Standard solution of formaldehyde

#### Preparation of a stock solution:

In a calibrated or conformity-checked 1000-ml volumetric flask make up 2.50 ml of formaldehyde solution min. 37% GR to the mark with distilled water.

The stock solution prepared according to this procedure has a concentration of approx. 1000 mg/l formaldehyde.

#### Precise assay of the stock solution:

Pipette 40.0 ml (full pipette) of the formaldehyde stock solution into a 300-ml ground-glass conical flask and add 50.0 ml (buret) of iodine solution 0.05 mol/l and 20 ml of sodium hydroxide solution 1 mol/l.

Leave to stand for 15 minutes and subsequently add 8 ml of sulfuric acid 25%. Subsequently titrate with sodium thiosulfate solution 0.1 mol/l until the yellow iodine color has disappeared, add 1 ml of zinc iodide-starch solution, and continue to titrate until a milky, pure white color emerge.

#### Calculation and preparation of a standard solution:

$C1$  = consumption of sodium thiosulfate solution 0.1 mol/l (ml)

$C2$  = quantity of iodine solution 0.05 mol/l (50.0 ml)

$$\text{mg/l formaldehyde} = (C2 - C1) \cdot 37.525$$

Further investigational concentrations may be prepared from the stock solution prepared according to the procedure described above by diluting accordingly with distilled water.

#### Stability:

When stored in a cool place (refrigerator), the stock solution of approx. 1000 mg/l remains stable for one week. After this time, the stock solution must be determined anew. The diluted standard solutions (investigational concentrations) must be used immediately.

### Standard solution of hydrazine

#### Preparation of a standard solution:

Dissolve 4.07 g of hydrazinium sulfate GR with oxygen-low (boil previously) distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with oxygen-low distilled water.

The standard solution prepared according to this procedure has a concentration of 1000 mg/l hydrazine.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with oxygen-low distilled water.

#### Stability:

When stored in a cool place (refrigerator), the standard solution of 1000 mg/l and the diluted standard solutions (investigational concentrations) remain stable for one day.

#### Reagents required:

1.04003.1000	Formaldehyde solution min. 37% GR for analysis
1.09099.1000	Iodine solution 0.05 mol/l Titripur®
1.09147.1000	Sodium thiosulfate solution 0.1 mol/l Titripur®
1.09137.1000	Sodium hydroxide solution 1 mol/l Titripur®
1.00716.1000	Sulfuric acid 25% for analysis EMSURE®
1.05445.0500	Zinc iodide-starch solution GR for analysis
1.16754.9010	Water for analysis EMSURE®

#### Reagents required:

1.04603.0100	Hydrazinium sulfate GR for analysis
1.16754.9010	Water for analysis EMSURE®

I

**Standard solution of hydrogenperoxide****Preparation of a stock solution:**

Place 10.0 ml of Perhydrol® 30% H<sub>2</sub>O<sub>2</sub> in a calibrated or conformity-checked 100-ml volumetric flask and make up to the mark with distilled water. Transfer 30.0 ml (full pipette) of this solution to a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water. The stock solution prepared according to this procedure has a concentration of approx. 1000 mg/l hydrogenperoxide.

**Precise assay of the stock solution:**

Pipette 50.0 ml (full pipette) of the hydrogen peroxide stock solution into a 500-ml conical flask, dilute with 200 ml of distilled water, and add 30 ml of sulfuric acid 25%. Titrate with a 0.02 mol/l potassium permanganate solution until the color changes to pink.

**Calculation and preparation of a standard solution:**

*Consumption of potassium permanganate solution 0.02 mol/l (ml) · 34.02 = content of hydrogenperoxide, in mg/l*

Further investigational concentrations may be prepared from the stock solution exactly determined according to the procedure described above by diluting accordingly with distilled water.

**Stability:**

When stored in a cool place (refrigerator), the stock solution of approx. 1000 mg/l and the diluted standard solutions (investigational concentrations) remain stable for one day.

**Reagents required:**

1.09122.1000	Potassium permanganate solution 0.02 mol/l Titripur®
1.07209.0250	Perhydrol® 30% for analysis EMSURE®
1.00716.1000	Sulfuric acid 25% for analysis EMSURE®
1.16754.9010	Water for analysis EMSURE®

II

**Standard solution of iodine analogous to DIN EN ISO 7393****Preparation of a KIO<sub>3</sub> stock solution:**

Dissolve 1.006 g of KIO<sub>3</sub> in 250 ml of distilled water in a calibrated or conformity-checked 1000-ml volumetric flask. Subsequently make up to the mark with distilled water.

**Preparation of a KIO<sub>3</sub>/KI standard solution:**

Transfer 7.00 ml of the KIO<sub>3</sub> stock solution to a calibrated or conformity-checked 1000-ml volumetric flask, add approx. 1 g of KI and make up to the mark with distilled water.

1 ml of this solution is equivalent to 0.025 mg of iodine.

**Preparation of a iodine standard solution:**

Pipette 20.0 ml (full pipette) KIO<sub>3</sub>/KI standard solution into a calibrated or conformity-checked 100-ml volumetric flask, add 2.0 ml of H<sub>2</sub>SO<sub>4</sub> 0.5 mol/l, leave to stand for 1 minute, and then add NaOH 2 mol/l dropwise (approx. 1 ml) until the solution just loses its color. Subsequently make up the solution to the mark with distilled water.

The concentration of the solution is 5.00 mg/l iodine.

**Stability:**

The KIO<sub>3</sub> stock solution remains stable for 4 weeks when stored in a cool place (refrigerator). The KIO<sub>3</sub>/KI standard solution can be used for 5 hours when stored in a cool place (refrigerator). The diluted iodine standard solution is not stable and must be used immediately.

**Reagents required:**

1.02404.0100	Potassium iodate, volum. standard
1.05043.0250	Potassium iodide for analysis EMSURE®
1.09072.1000	Sulfuric acid 0.5 mol/l Titripur®
1.09136.1000	Sodium hydroxide solution 2 mol/l Titripur®
1.16754.9010	Water for analysis EMSURE®

III

IV

**Standard solution of magnesium**

**Preparation of a standard solution:**

Dissolve 1.055 g of magnesium nitrate hexahydrate with distilled water in a calibrated or conformity-checked 100-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 1000 mg/l magnesium.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

**Stability:**

The standard solution of 1000 mg/l remains stable for one week. The diluted standard solutions (investigational concentrations) remain stable for one day.

**Reagents required:**

1.05853.0500	Magnesium nitrate hexahydrate for analysis EMSURE®
1.16754.9010	Water for analysis EMSURE®

**Standard solution of monochloramine**

**Preparation of a standard solution:**

Place 5.0 ml of chlorine standard solution 100 mg/l Cl<sub>2</sub> and 10.0 ml ammonium standard solution 10 mg/l NH<sub>4</sub>-N in a calibrated or conformity-checked 100-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 5.00 mg/l free chlorine or 3.63 mg/l monochloramine.

**Stability:**

The standard solution is not stable and must be used immediately.

**Reagents required:**

	Chlorine standard solution 100 mg/l Cl <sub>2</sub> Preparation see "Standard solution of free chlorine" with hypochlorite solution (standard solution that is <u>absolutely</u> necessary for the preparation of the monochloramine standard)
	Ammonium standard solution 10 mg/l NH <sub>4</sub> -N Preparation with Ammonium standard solution Certipur®, Cat.No. 1.19812.0500, 1000 mg/l NH <sub>4</sub> = 777 mg/l NH <sub>4</sub> -N
1.16754.9010	Water for analysis EMSURE®

**Standard solution of nitrogen (total)**

**Preparation of a standard solution:**

Dissolve 5.36 g of glycine GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 1000 mg/l total nitrogen.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

**Stability:**

When stored in a cool place (refrigerator), the standard solution of 1000 mg/l remains stable for one week. The diluted standard solutions (investigational concentrations) must be used immediately.

**Reagents required:**

1.04201.0100	Glycine GR for analysis
1.16754.9010	Water for analysis EMSURE®

I

### Standard solution of oxygen scavengers

#### Preparation of a standard solution:

Dissolve 1.00 g of N,N-diethylhydroxylamine with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 1000 mg/l N,N-diethylhydroxylamine (DEHA).

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

#### Stability:

When stored in a cool place (refrigerator), the standard solution of 1000 mg/l and the diluted standard solutions (investigational concentrations) remain stable for one day.

#### Reagents required:

8.18473.0050	N,N-Diethylhydroxylamine for synthesis
1.16754.9010	Water for analysis EMSURE®

II

### Standard solution of ozone analogous to DIN EN ISO 7393

#### Preparation of a KIO<sub>3</sub> stock solution:

Dissolve 1.006 g of KIO<sub>3</sub> in 250 ml of distilled water in a calibrated or conformity-checked 1000-ml volumetric flask. Subsequently make up to the mark with distilled water.

#### Preparation of a KIO<sub>3</sub>/KI standard solution:

Transfer 14.80 ml of the KIO<sub>3</sub> stock solution to a calibrated or conformity-checked 1000-ml volumetric flask, add approx. 1 g of KI and make up to the mark with distilled water.

1 ml of this solution is equivalent to 0.010 mg of ozone.

#### Preparation of a ozone standard solution:

Pipette 20.0 ml (full pipette) KIO<sub>3</sub>/KI standard solution into a calibrated or conformity-checked 100-ml volumetric flask, add 2.0 ml of H<sub>2</sub>SO<sub>4</sub> 0.5 mol/l, leave to stand for 1 minute, and then add NaOH 2 mol/l dropwise (approx. 1 ml) until the solution just loses its color. Subsequently make up the solution to the mark with distilled water.

The concentration of the solution is 2.00 mg/l ozone.

#### Stability:

The KIO<sub>3</sub> stock solution remains stable for 4 weeks when stored in a cool place (refrigerator). The KIO<sub>3</sub>/KI standard solution can be used for 5 hours when stored in a cool place (refrigerator). The diluted ozone standard solution is not stable and must be used immediately.

#### Reagents required:

1.02404.0100	Potassium iodate, volum. standard
1.05043.0250	Potassium iodide for analysis EMSURE®
1.09072.1000	Sulfuric acid 0.5 mol/l Titripur®
1.09136.1000	Sodium hydroxide solution 2 mol/l Titripur®
1.16754.9010	Water for analysis EMSURE®

III

IV

**Standard solution of phenol**

**Preparation of a standard solution:**

Dissolve 1.00 g of phenol GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 1000 mg/l phenol.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

**Stability:**

When stored in a cool place (refrigerator), the standard solution of 1000 mg/l remains stable for one week. The diluted standard solutions (investigational concentrations) must be used immediately.

**Reagents required:**

1.00206.0250	Phenol GR for analysis
1.16754.9010	Water for analysis EMSURE®

**Standard solution of silicate**

**Preparation of a standard solution:**

A silicon standard solution of 1000 mg/l Si is used. 1000 mg/l Si corresponds to 2139 mg/l SiO<sub>2</sub>.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

**Example:**

Mix 4.675 ml of silicon standard solution (1000 mg/l Si) with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 10.00 mg/l SiO<sub>2</sub>.

After its preparation, the solution must be immediately transferred to a clean polyethylene vessel for further storage.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

After its preparation, the solution with the desired working concentration must be immediately transferred to a clean polyethylene vessel for further storage.

**Stability:**

The diluted standard solutions (investigational concentrations) remain stable - depending on the respective concentration - for one day to approximately six months.

**Reagents required:**

1.70236.0100	Silicone standard solution Certipur®
1.16754.9010	Water for analysis EMSURE®

**Standard solution of sodium**

**Preparation of a standard solution:**

A chloride standard solution of 1000 mg/l is used. 1000 mg/l chloride corresponds to 649 mg/l sodium.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

**Stability:**

When stored in a cool place (refrigerator), the diluted standard solutions (investigational concentrations) remain stable for one month.

**Reagents required:**

1.19897.0500	Chloride standard solution Certipur®
1.16754.9010	Water for analysis EMSURE®

I

**Standard solution of sulfide****Preparation of a stock solution:**

Dissolve 7.5 g of glass-clear, if necessary washed crystals of sodium sulfide nonahydrate GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water. The stock solution prepared according to this procedure has a concentration of approx. 1000 mg/l sulfide.

**Precise assay of the stock solution:**

Place 100 ml of distilled water and 5.0 ml (full pipette) of sulfuric acid 25% in a 500-ml ground-glass-stoppered conical flask.

To this solution add 25.0 ml (full pipette) of the sulfide stock solution and 25.0 ml (full pipette) of iodine solution 0.05 mol/l. Shake the contents of the flask

thoroughly for about 1 minute, subsequently titrate with sodium thiosulfate solution 0.1 mol/l until the yellow iodine color has disappeared, add 1 ml of zinc iodide-starch solution, and continue to titrate until a milky, pure white color emerges.

**Calculation and preparation of a standard solution:**

$C1$  = consumption of sodium thiosulfate 0.1 mol/l (ml)

$C2$  = quantity of iodine solution 0.05 mol/l (25.0 ml)

$$\text{mg/l sulfide} = (C2 - C1) \cdot 64.13$$

Further investigational concentrations may be prepared from the stock solution prepared according to the procedure described above by diluting accordingly with distilled water.

**Stability:**

When stored in a cool place (refrigerator), the stock solution of approx. 1000 mg/l remains stable for at most one day. The diluted standard solutions (investigational concentrations) must be used immediately.

**Reagents required:**

	Sodium sulfide nonahydrat GR for analysis
1.09099.1000	Iodine solution 0.05 mol/l Titripur®
1.09147.1000	Sodium thiosulfate solution 0.1 mol/l Titripur®
1.00716.1000	Sulfuric acid 25% for analysis EMSURE®
1.05445.0500	Zinc iodide-starch solution GR for analysis
1.16754.9010	Water for analysis EMSURE®

II

III

IV

**Standard solution of sulfite****Preparation of a stock solution:**

Dissolve 1.57 g of sodium sulfite and 0.4 g of Titriplex® III GR with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of approx. 1000 mg/l sulfite.

**Precise assay of the stock solution:**

Place 50.0 ml (full pipette) of the sulfite stock solution and 5.0 ml (full pipette) of hydrochloric acid 25 % in a 300-ml conical flask.

To this solution add 25.0 ml (full pipette) of iodine solution 0.05 mol/l and process immediately. After mixing the contents of the flask, subsequently titrate with sodium thiosulfate solution 0.1 mol/l until the yellow iodine color has disappeared, add 1 ml of zinc iodide-starch solution, and continue to titrate from blue to colorless.

**Calculation and preparation of a standard solution:**

$C_1$  = consumption of sodium thiosulfate 0.1 mol/l (ml)

$C_2$  = quantity of iodine solution 0.05 mol/l (25.0 ml)

$$\text{mg/l sulfite} = (C_2 - C_1) \cdot 80.06$$

Further investigational concentrations may be prepared from the stock solution exactly determined according to the procedure described above by diluting accordingly with distilled water and buffer solution pH 9.00.

This is done in the following manner:

Withdraw the desired aliquot from the stock solution, place in a calibrated or conformity-approved 1000-ml volumetric flask, add 20 ml of buffer solution pH 9.00, make up to the mark with distilled water, and mix.

**Stability:**

When stored in a cool place (refrigerator), the stock solution of approx. 1000 mg/l remains stable for at most one day. The diluted standard solutions (investigational concentrations) must be used immediately.

**Standard solution of surfactants (anionic)****Preparation of a standard solution:**

Dissolve 1.00 g of dodecane-1-sulfonic acid sodium salt with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 1000 mg/l anionic surfactant.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

**Stability:**

When stored in a cool place (refrigerator), the standard solution of 1000 mg/l remains stable for one month. The diluted standard solutions (investigational concentrations) must be used immediately.

**Reagents required:**

1.06657.0500	Sodium sulfite anhydrous for analysis EMSURE®
1.08418.0100	Titriplex® III GR for analysis
1.09099.1000	Iodine solution 0.05 mol/l Titripur®
1.09147.1000	Sodium thiosulfate solution 0.1 mol/l Titripur®
1.00316.1000	Hydrochloric acid 25% GR for analysis EMSURE®
1.05445.0500	Zinc iodide-starch solution GR for analysis
1.09461.1000	Buffer solution pH 9.00 Certipur®
1.16754.9010	Water for analysis EMSURE®

**Reagents required:**

1.12146.0005	Dodecane-1-sulfonic acid sodium salt
1.16754.9010	Water for analysis EMSURE®

I

**Standard solution of surfactants (cationic)**

**Preparation of a standard solution:**

Dissolve 1.00 g of Cetyltrimethylammonium Bromide, Molecular Biology Grade with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 1000 mg/l cationic surfactant.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

**Stability:**

When stored in a cool place (refrigerator), the standard solution of 1000 mg/l remains stable for one month. The diluted standard solutions (investigational concentrations) must be used immediately.

**Reagents required:**

219374	Cetyltrimethylammonium Bromide, Molecular Biology Grade Calbiochem® (CTAB)
1.16754.9010	Water for analysis EMSURE®

II

**Standard solution of surfactants (nonionic)**

**Preparation of a standard solution:**

Dissolve 1.00 g of Triton™ X-100 with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 1000 mg/l nonionic surfactant.

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

**Stability:**

When stored in a cool place (refrigerator), the standard solution of 1000 mg/l remains stable for one week. The diluted standard solutions (investigational concentrations) must be used immediately.

**Reagents required:**

1.12298.0101	Triton™ X-100
1.16754.9010	Water for analysis EMSURE®

III

**Standard solution of tin**

**Preparation of a standard solution:**

A tin standard solution of 1000 mg/l is used.

Transfer 30 ml of HCl 1 mol/l to a calibrated or conformity-checked 100-ml volumetric flask, add 10.0 ml (full pipette) of the tin standard solution, and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 100 mg/l tin.

Further investigational concentrations may be prepared from the standard solution by diluting accordingly with distilled water and HCl 1 mol/l.

This is done in the following manner:

Transfer 1 ml of HCl 1 mol/l to a calibrated or conformity-checked 100-ml volumetric flask. Withdraw the desired aliquot from the tin standard solution 100 mg/l, add, make up to the mark with distilled water, and mix.

**Stability:**

The tin standard solution 100 mg/l remains stable for 30 minutes. The diluted standard solutions (investigational concentrations) must be used immediately.

**Reagents required:**

1.70242.0100	Tin standard solution Certipur®
1.09057.1000	Hydrochloric acid 1 mol/l Titripur®
1.16754.9010	Water for analysis EMSURE®

IV



### Standard solution of total hardness

#### Preparation of a standard solution:

Dissolve 2.946 g of calcium nitrate tetrahydrate with distilled water in a calibrated or conformity-checked 500-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 1000 mg/l calcium (corresponds to 175 °e).

Further investigational concentrations may be prepared from this standard solution by diluting accordingly with distilled water.

#### Stability:

The standard solution of 1000 mg/l remains stable for one week. The diluted standard solutions (investigational concentrations) remain stable for one day.

#### Reagents required:

1.02121.0500 Calcium nitrate tetrahydrate for analysis EMSURE®

1.16754.9010 Water for analysis EMSURE®

### Standard solution of volatile organic acids

#### Preparation of a standard solution:

Dissolve 2,05 g of sodium acetate anhydrous with distilled water in a calibrated or conformity-checked 1000-ml volumetric flask and make up to the mark with distilled water.

The standard solution prepared according to this procedure has a concentration of 1500 mg/l acetic acid.

#### Stability:

When stored in a cool place (refrigerator), the standard solution remains stable for one week.

#### Reagents required:

1.06268.0250 Sodium acetate anhydrous for analysis EMSURE®

1.16754.9010 Water for analysis EMSURE®

I

II

III

IV

We provide information and advice to our customers on application technologies and regulatory matters to the best of our knowledge and ability, but without obligation or liability. Existing laws and regulations are to be observed in all cases by our customers. This also applies in respect to any rights of third parties. Our information and advice do not relieve our customers of their own responsibility for checking the suitability of our products for the envisaged purpose.

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