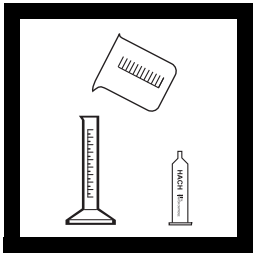
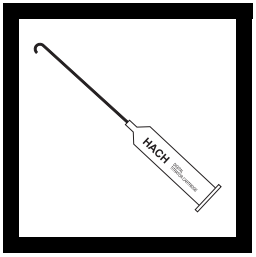
CHLORIDE

Mercuric Nitrate and Silver Nitrate Methods

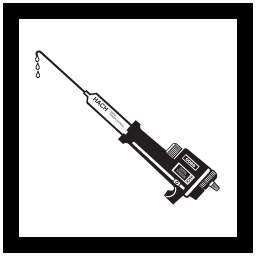
Mercuric Nitrate Method (10 to 8000 mg/L as Cl^-) Method 8206



1. Select the sample volume and Mercuric Nitrate Titration Cartridge corresponding to the expected chloride concentration from *Table 1*.

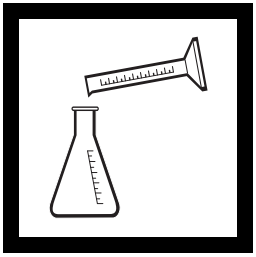


2. Insert a clean delivery tube into the titration cartridge. Attach the cartridge to the titrator body. See *General Description Section, Step-by-Step,* for assembly instructions if necessary.



3. Turn the delivery knob to eject a few drops of titrant. Reset the counter to zero and wipe the tip.

Note: *For added convenience use the TitraStir® Stir Plate. See General Description, step 3 in Step-by-Step.*



4. Use a graduated cylinder or pipet to measure the sample volume from *Table 1*. Transfer the sample into a clean 250-mL Erlenmeyer flask. Dilute to about the 100-mL mark with deionized water, if necessary.

Note: *See following these steps.*

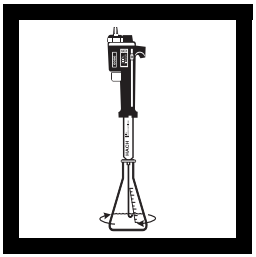
Table 1

Range (mg/L as Cl^-)	Sample Volume (mL)	Titration Cartridge ($N\ Hg(NO_3)_2$)	Catalog Number	Digit Multiplier
10-40	100	0.2256	14393-01	0.1
40-160	25	0.2256	14393-01	0.4
100-400	100	2.256	921-01	1.0
200-800	50	2.256	921-01	2.0
500-2000	20	2.256	921-01	5.0
1000-4000	10	2.256	921-01	10.0
2000-8000	5	2.256	921-01	20.00

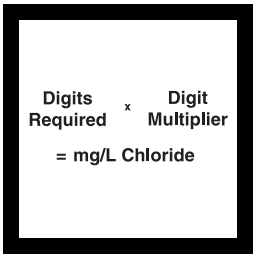


5. Add the contents of one Diphenylcarbazone Powder Pillow and swirl to mix.

Note: *Results will still be accurate if a small amount of the powder does not dissolve.*



6. Place the delivery tube tip into the solution and swirl the flask while titrating with mercuric nitrate from a yellow to light pink color.
Record the number of digits required.



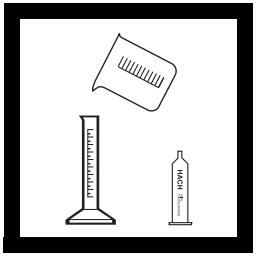
7. Calculate:

Digits Required x Digit Multiplier = mg/L Chloride

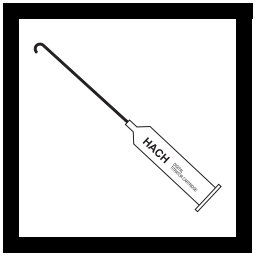
Note: *Results may be expressed as mg/L sodium chloride by multiplying the mg/L chloride by 1.65.*

Note: *meq/L Chloride = mg/L Cl^- ÷ 35.45.*

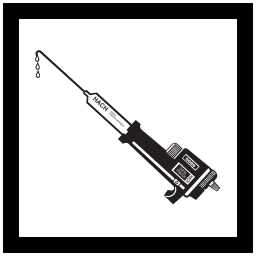
Silver Nitrate Method (10 to 10000 mg/L as Cl^-) Method 8207



1. Select the sample volume and Silver Nitrate Titration Cartridge corresponding to the expected chloride concentration from *Table 2*.



2. Insert a clean delivery tube into the titration cartridge. Attach the cartridge to the titrator body. See *General Description Section, Step-by-Step,* for assembly instructions if necessary.



3. Turn the delivery knob to eject a few drops of titrant. Reset the counter to zero and wipe the tip.

Note: *For added convenience use the TitraStir® Stir Plate. See General Description, Step 3 in Step-by-Step.*



4. Use a graduated cylinder or pipet to measure the sample volume from *Table 2*. Transfer the sample into a clean 250-mL Erlenmeyer flask. Dilute to about the 100-mL mark with deionized water, if necessary.

Note: *See following these steps.*

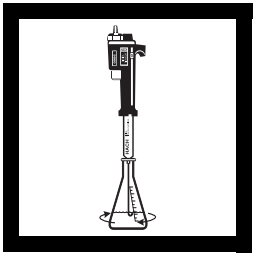
Table 2

Range (mg/L as Cl^-)	Sample Volume (mL)	Titration Cartridge (N $AgNO_3$)	Catalog Number	Digit Multiplier
10-40	100	0.2256	14396-01	0.1
25-100	40	0.2256	14396-01	0.25
100-400	50	1.128	14397-01	1.0
250-1000	20	1.128	14397-01	2.5
1000-4000	5	1.128	14397-01	10.0
2500-10000	2	1.128	14397-01	25.0

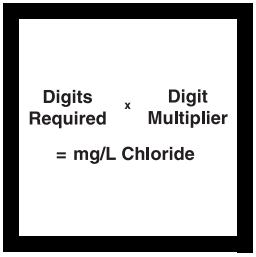


5. Add the contents of one Chloride 2 Indicator Powder Pillow and swirl to mix.

Note: *Results will still be accurate if a small amount of the powder does not dissolve.*



6. Place the delivery tube tip into the solution and swirl the flask while titrating with silver nitrate from a yellow to red-brown color.
Record the number of digits required.



7. Calculate:

Digits Required x Digit Multiplier = mg/L Chloride

Note: *Results may be expressed as mg/L sodium chloride by multiplying the mg/L chloride by 1.65.*

Note: *meq/L Chloride = mg/L Cl^- ÷ 35.45.*

Sampling and Storage

Collect at least 100 to 200 mL of sample in a clean glass or polyethylene container. Samples may be stored up to 7 days before analysis.

Accuracy Check

Standard Additions Method
This accuracy check should be performed when interferences are suspected or to verify analytical technique.

1. Snap the neck off a Chloride Standard Solution Voluette® Ampule, 12,500 mg/L Cl^-.

2. Use a TenSette® Pipet to add 0.1 mL of standard to the sample after titration in *step 6*. Resume titration back to the same end point. Record the number of digits required.

3. Repeat, using additions of 0.2 and 0.3 mL. Titrate to the end point after each addition.

4. Each 0.1 mL addition of standard should require 12.5 additional digits of 2.256 N titrant, 25 digits of 1.128 N titrant, or 125 digits of 0.2256 N titrant. If these uniform increases do not occur, refer to *Appendix A, Accuracy Check and Standard Additions*.

Interferences Using the Mercuric Nitrate Method

- Chromate, ferric iron, and sulfite in excess of 10 mg/L interfere with this method.

- Eliminate sulfite interference by adding three drops of hydrogen peroxide, 30%, in *step 4*.

- Remove sulfide interference by adding the contents of one Sulfide Inhibitor Reagent Powder Pillow to about 125 mL of sample, mixing for one minute, and filtering through a folded filter paper.

- Iodide and bromide interfere directly and titrate as chloride.

- Neutralize strongly alkaline or acid samples to a pH of 2 to 7 with 5.25 N Sulfuric Acid Standard Solution or 5.0 N Sodium Hydroxide Standard Solution. Determine the

amount of acid or base necessary in a separate sample because pH electrodes will introduce chloride into the sample.

Interferences Using the Silver Nitrate Method

- Iron in excess of 10 mg/L masks the end point.
- Orthophosphate in excess of 25 mg/L will precipitate the silver.
- Sulfite in excess of 10 mg/L interferes. Eliminate sulfite interference by adding three drops of 30% hydrogen peroxide in *step 4*.
- Remove sulfide interference by adding the contents of one Sulfide Inhibitor Reagent Powder Pillow to about 125 mL of sample, mixing for one minute, and filtering through a folded filter paper.
- Cyanide, iodide, and bromide interfere directly and titrate as chloride.
- Neutralize strongly alkaline or acid samples to a pH of 2 to 7 with 5.25 N Sulfuric Acid Standard Solution or 5.0 N Sodium Hydroxide Standard Solution. Determine the amount of acid or base necessary in a separate sample because pH electrodes will introduce chloride into the sample.

Summary of the Mercuric Nitrate Method

When using Mercuric Nitrate Standard Solution, the sample is titrated under acid conditions in the presence of diphenylcarbazone indicator. Upon addition of a slight excess of mercuric ion, a pink-purple complex is formed with the indicator, signaling the end point.

Summary of the Silver Nitrate Method

The sample is titrated with Silver Nitrate Standard Solution in the presence of potassium chromate (from the Chloride 2 Indicator Powder). The silver nitrate reacts with the chloride present to produce insoluble white silver chloride. After all the chloride has been precipitated, the silver ions react with

the excess chromate present to form a red-brown silver chromate precipitate, marking the end point of the titration.

Request Hach's *Water Analysis Handbook,* Publication 8376, to obtain additional information on chloride determinations.

REQUIRED REAGENTS FOR THE MERCURIC NITRATE METHOD

Description	Unit	Cat. No.
Mercuric Nitrate Chloride Reagent Set (about 100 tests) Includes: (2) 836-46, (1) 921-01, (1) 14393-01		22726-00
Diphenylcarbazone Reagent Powder Pillows	100/pkg	836-99
Mercuric Nitrate Titration Cartridge, 0.2256 N	each	14393-01
Mercuric Nitrate Titration Cartridge, 2.256 N	each	921-01
Water, deionized	4 L	272-56

REQUIRED REAGENTS FOR THE SILVER NITRATE METHOD

Silver Nitrate Chloride Reagent Set (about 50 tests) Includes: (2) 1057-66, (1) 14396-01, (1) 14397-01		22880-00
Chloride 2 Indicator Powder Pillows	50/pkg	1057-66
Silver Nitrate Titration Cartridge, 0.2256 N	each	14396-01
Silver Nitrate Titration Cartridge, 1.128 N	each	14397-01
Water, deionized	4 L	272-56

REQUIRED APPARATUS FOR THE MERCURIC NITRATE METHOD AND SILVER NITRATE METHOD

Clippers, for opening pillows	each	968-00
Digital Titrator	each	16900-01
Flask, Erlenmeyer, 250-mL	each	505-46
Select one or more based on sample concentration:		
Cylinder, graduated, 10-mL	each	508-38
Cylinder, graduated, 25-mL	each	508-40
Cylinder, graduated, 50-mL	each	508-41
Cylinder, graduated, 100-mL	each	508-42

OPTIONAL REAGENTS

Chloride Standard Solution, 1000 mg/L Cl^-	500 mL	183-49
Chloride Standard Solution Voluette® Ampules, 12,500 mg/L Cl^-, 10-mL	16/pkg	14250-10
Hydrogen Peroxide, 30%, ACS	200 mL	144-45
Sodium Hydroxide Standard Solution, 5.0 N	100 mL MDB	2450-32

CHLORIDE, continued

Sulfide Inhibitor Powder Pillows	100/pkg	2418-99
Sulfuric Acid Standard Solution, 5.25 N	100 mL MDB	2449-32

OPTIONAL APPARATUS

Description	Unit	Cat. No.
Bottle, wash, poly, 500-mL	each	620-11
Clamp, 2-prong extension, 38-mm	each	21145-00
Clamp Holder	each	326-00
Demineralizer Assembly, 473-mL	each	21846-00
Delivery Tubes, with 180° hook	5/pkg	17205-00
Delivery Tubes, 90° with hook for TitraStir® Stir Plate	5/pkg	41578-00
Filter Paper, folded, 12.5 cm	100/pkg	1894-57
Funnel, poly, 65-mm	each	1083-67
Pipet, TenSette®, 0.1 to 1.0 mL	each	19700-01
Pipet Tips for 19700-01 TenSette® Pipet	50/pkg	21856-96
Pipet, volumetric, Class A, 2-mL	each	14515-36
Pipet, volumetric, Class A, 5-mL	each	14515-37
Pipet, volumetric, Class A, 10-mL	each	14515-38
Pipet, volumetric, Class A, 20-mL	each	14515-20
Pipet, volumetric, Class A, 25-mL	each	14515-40
Pipet, volumetric, Class A, 50-mL	each	14515-41
Pipet, volumetric, Class A, 100-mL	each	14515-42
Pipet Filler, safety bulb	each	14651-00
*sens**ion***™***1*** Basic Portable pH Meter with electrode	each	51700-10
Support Ring Stand	each	563-00
TitraStir® Stir Plate, 115 Vac	each	19400-00
TitraStir® Stir Plate, 230 Vac	each	19400-10
Voluette® Ampule Breaker Kit	each	21968-00