Carbon Dioxide

DOC316.53.01167

Sodium Hydroxide Method **Method 8205**

10 to 1000 mg/L CO_2 **Digital Titrator**

Scope and application: For water and seawater.

Test preparation

Before starting

To prevent agitation of the sample, pour the sample directly into the Erlenmeyer flask. Fill a graduated cylinder with the sample volume of deionized water. Pour the water into the Erlenmeyer flask. Make a mark on the Erlenmeyer flask at the water level to identify the sample volume level.
As an alternative to the Phenolphthalein Indicator Powder Pillow, use 4 drops of Phenolphthalein Indicator Solution.
Color or turbidity in the sample can make it difficult to see the color change at the endpoint. For these samples, use a pH meter to determine the titration endpoint. The endpoint for phenolphthalein acidity is pH 8.3.
The optional TitraStir Titration Stand can hold the Digital Titrator and stir the sample.
Review the Safety Data Sheets (MSDS/SDS) for the chemicals that are used. Use the recommended personal protective equipment.
Dispose of reacted solutions according to local, state and federal regulations. Refer to the Safety Data Sheets for disposal information for unused reagents. Refer to the environmental, health and safety staff for your facility and/or local regulatory agencies for further disposal information.

Items to collect

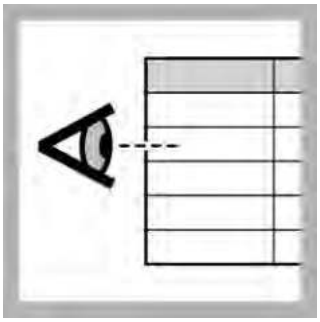
Description	Quantity
Phenolphthalein Indicator Powder Pillow	1
Sodium Hydroxide Titration Cartridge (refer to Sample volumes and digit multipliers on page 2)	1
pH meter and probe (for samples that have a lot of color or turbidity)	1
Clippers	1
Digital Titrator	1
Delivery tube for Digital Titrator	1
Erlenmeyer flask, 250-mL	1

Refer to Consumables and replacement items on page 3 for order information.

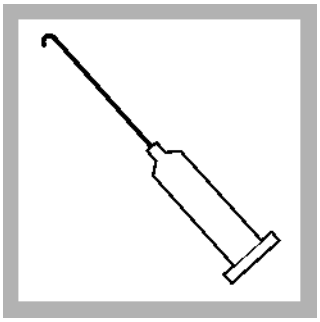
Sample collection

- Collect samples in clean glass or plastic bottles with tight-fitting caps. Completely fill the bottle and immediately tighten the cap.
- Prevent agitation of the sample and exposure to air.
- Analyze the samples as soon as possible for best results.
- If immediate analysis is not possible, keep the samples at or below 6 °C (43 °F) for a maximum of 24 hours.
- Let the sample temperature increase to room temperature before analysis.

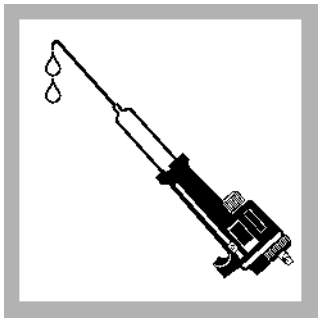
Test procedure



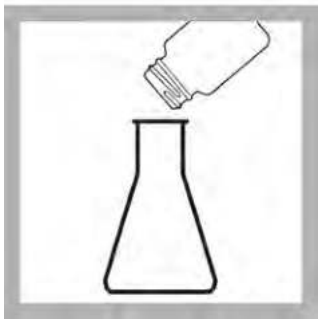
1. Select a sample volume and titration cartridge from Table 1 on page 2.



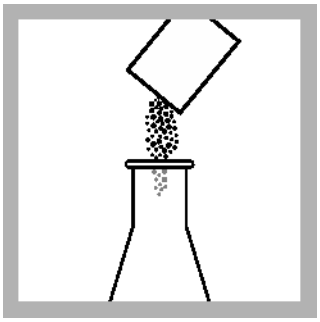
2. Insert a clean delivery tube into the digital titration cartridge. Attach the cartridge to the Digital Titrator.



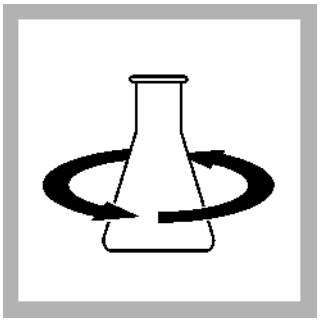
3. Hold the Digital Titrator with the cartridge tip up. Turn the delivery knob to eject air and a few drops of titrant. Reset the counter to zero and clean the tip.



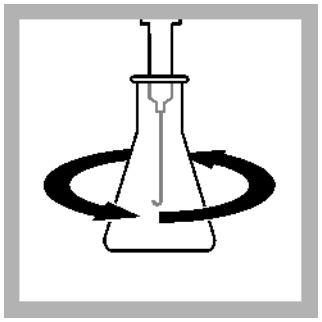
4. Pour the sample volume in Table 1 on page 2 in a 250-mL Erlenmeyer flask. When possible, collect the sample directly in the Erlenmeyer flask to prevent agitation of the sample.



5. Add the contents of one Phenolphthalein Indicator Powder Pillow.



6. Swirl to mix.
If a pink color forms, no carbon dioxide is in the sample.



7. Put the end of the delivery tube fully into the solution. Swirl the flask. Turn the knob on the Digital Titrator to add titrant to the solution. Continue to swirl the flask. Add titrant until the color changes from colorless to a light pink color for a minimum of 30 seconds (pH 8.3). Record the number of digits on the counter.



8. Use the multiplier in Table 1 on page 2 to calculate the concentration. Digits used × digit multiplier = mg/L CO_2.

Sample volumes and digit multipliers

Select a range in Table 1, then read across the table row to find the applicable information for this test. Use the digit multiplier to calculate the concentration in the test procedure.

Example: A 100-mL sample was titrated with 0.3636 N Sodium Hydroxide Titration Cartridge and the counter showed 250 digits at the endpoint. The concentration is 250 digits × 0.2 = 50 mg/L CO_2.

Table 1 Sample volumes and digit multipliers

Range (mg/L as CO_2)	Sample volume (mL)	Titration cartridge	Digit multiplier
10–50	200	0.3636 N	0.1
20–100	100	0.3636 N	0.2

Table 1 Sample volumes and digit multipliers (continued)

Range (mg/L as CO_2)	Sample volume (mL)	Titration cartridge	Digit multiplier
100–400	200	3.636 N	1.0
200–1000	100	3.636 N	2.0

Interferences

Interfering substance	Interference level
Other acids	Interferes directly and is included in the test result.
Color and turbidity	Color or turbidity in the sample can make it difficult to see the color change at the endpoint. For these samples, use a pH meter to determine the titration endpoint. The endpoint is pH 8.3.

Accuracy check

Standard additions method (sample spike)

Use the standard additions method to validate the test procedure, reagents, apparatus, technique and to find if there is an interference in the sample.

Items to collect:

- Carbon Dioxide Voluette Ampule Standard, 10,000 mg/L CO_2
- Ampule Breaker
- Pipet, TenSette, 0.1–1.0 mL and pipet tips

1. Use the test procedure to measure the concentration of the sample.
2. Use a TenSette pipet to add 0.1 mL of the standard solution to the titrated sample.
3. Titrate the spiked sample to the endpoint. Record the number of digits on the counter.
4. Add one more 0.1-mL addition of the standard solution to the titrated sample.
5. Titrate the spiked sample to the endpoint. Record the number of digits on the counter.
6. Add one more 0.1-mL addition of the standard solution to the titrated sample.
7. Titrate the spiked sample to the endpoint. Record the number of digits on the counter.
8. Compare the actual result to the correct result. The correct result for this titration is 50 digits of the 0.3636 N Sodium Hydroxide Titration Cartridge or 5 digits of the 3.636 N Sodium Hydroxide Titration Cartridge for each 0.1-mL addition of the standard solution. If much more or less titrant was used, there can be a problem with user technique, reagents, apparatus or an interference.

Summary of method

A phenolphthalein indicator is added to the sample. Carbonic acid formed by carbon dioxide in the sample is titrated with a sodium hydroxide standard solution until the indicator changes color at the endpoint pH of 8.3. Strong acids are not thought to be in the sample or at concentrations levels that will have an effect on the results.

Consumables and replacement items

Required reagents

Description	Quantity/Test	Unit	Item no.
Carbon Dioxide Reagent Set (approximately 100 tests)	—	each	2272700
Phenolphthalein Indicator Powder Pillows	1	100/pkg	94299
Sodium Hydroxide Titration Cartridge, 0.3636 N	varies	each	1437801
Sodium Hydroxide Titration Cartridge, 3.636 N	varies	each	1438001

Required apparatus

Description	Quantity/test	Unit	Item no.
Digital Titrator	1	each	1690001
Delivery tube for Digital Titrator, J-hook tip	1	5/pkg	1720500
Flask, Erlenmeyer, 125 mL	1	each	50543
Flask, Erlenmeyer, 250 mL	1	each	50546

Recommended standards

Description	Unit	Item no.
Carbon Dioxide Standard Solution, Voluette® Ampule, 10,000 mg/L as CO_2, 10 mL	16/pkg	1427510

Optional reagents and apparatus

Description	Unit	Item no.
Phenolphthalein Indicator Solution, 5-g/L	100 mL MDB	16232
Ampule Breaker, 10-mL Voluette® Ampules	each	2196800
Buffer Powder Pillows, pH 8.3	25/pkg	89868
Bottle, sampling, with cap, low density polyethylene, 250-mL	12/pkg	2087076
Clippers	each	96800
Water, deionized	500 mL	27249
Pipet, TenSette®, 0.1–1.0 mL	each	1970001
Pipet tips for TenSette® Pipet, 0.1–1.0 mL	50/pkg	2185696
Stir bar, octagonal	each	2095352
TitraStir® Titration Stand, 115 VAC	each	1940000
TitraStir® Titration Stand, 230 VAC	each	1940010
Delivery tube for Digital Titrator, 90-degree bend for use with TitraStir Titration Stand	5/pkg	4157800

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HACH COMPANY
WORLD HEADQUARTERS
Telephone: (970) 669-3050
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