

## Acid Determination and Base Determination

Method 8200 and 8233

1 to 4000 meq/L

Digital Titrator

Scope and application: For water, wastewater and seawater.



### Test preparation

#### Before starting

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. Titrate the sample until the pH is 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

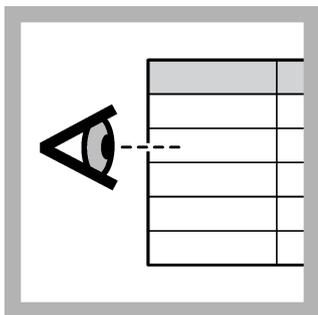
Description	Quantity
Phenolphthalein Indicator Powder Pillow	1
Acid determinations—Sodium Hydroxide Titration Cartridge	1
Base determinations—Hydrochloric Acid or Sulfuric Acid Titration Cartridge	1
pH Meter and probe (for samples that have a lot of color or turbidity)	1
Digital Titrator	1
Delivery tube for Digital Titrator	1
Graduated cylinder (use a size that is applicable to the selected sample volume)	1
Erlenmeyer flask, 250-mL	1
Water, deionized	varies

Refer to [Consumables and replacement items](#) on page 5 for order information.

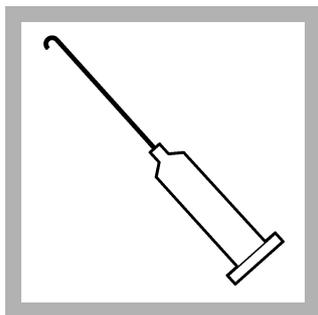
#### Sample collection

- 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—Acid determination (Method 8200)



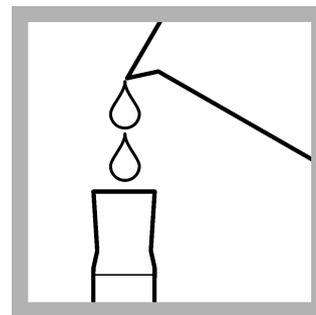
1. Select a sample volume and titration cartridge from [Table 1](#) on page 4. For acid determinations, use a Sodium Hydroxide Titration Cartridge.



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



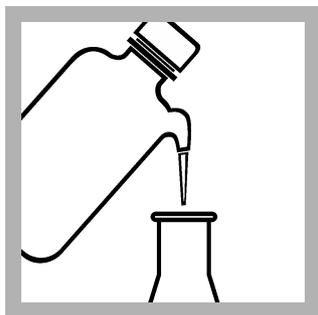
3. Hold the Digital Titrator with the cartridge tip up. Turn the delivery knob to eject air and a few drops of titrant. Reset the counter to zero and clean the tip.



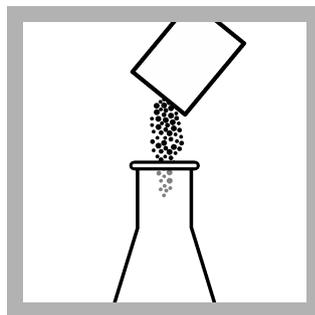
4. Use a graduated cylinder or pipet to measure the sample volume from [Table 1](#) on page 4.



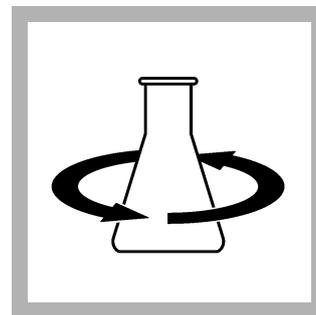
5. Pour the sample into a clean, 250-mL Erlenmeyer flask.



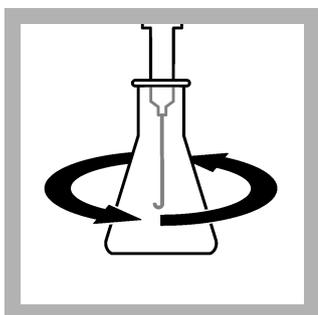
6. If the sample volume is less than 100 mL, dilute to approximately 100 mL with deionized water.



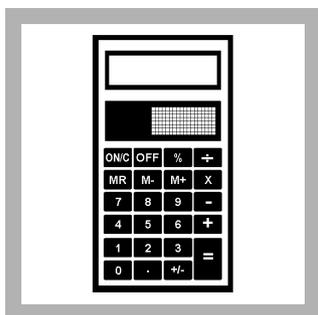
7. Add the contents of one Phenolphthalein Indicator Powder Pillow. The indicator is not necessary if a pH meter is used.



8. Swirl to mix. The solution color does not change.

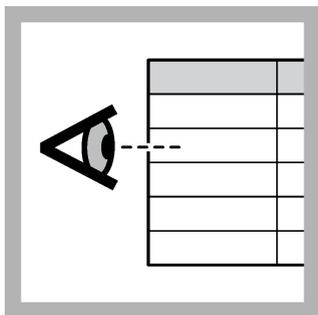


9. Put the end of the delivery tube fully into the solution. Swirl the flask. Turn the knob on the Digital Titrator to add titrant to the solution. Continue to swirl the flask. Add titrant until the color changes to light pink and stays pink for 30 seconds. Record the number of digits on the counter.

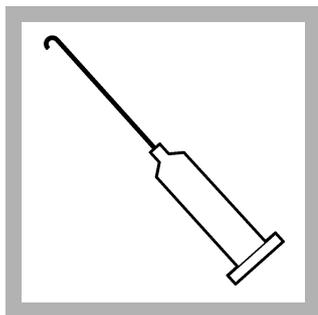


10. Use the multiplier in [Table 1](#) on page 4 to calculate the concentration. Digits used × digit multiplier = meq/L acid.

## Test procedure—Base determination (Method 8233)



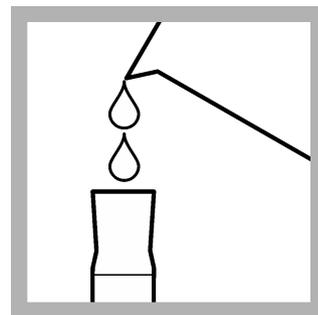
1. Select a sample volume and titration cartridge from [Table 1](#) on page 4. For base determinations, use a Hydrochloric Acid or Sulfuric Acid Titration Cartridge.



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



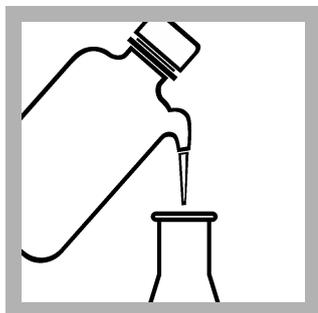
3. Hold the Digital Titrator with the cartridge tip up. Turn the delivery knob to eject air and a few drops of titrant. Reset the counter to zero and clean the tip.



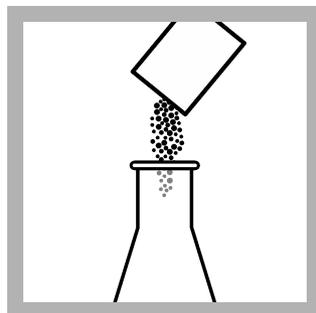
4. Use a graduated cylinder or pipet to measure the sample volume from [Table 1](#) on page 4.



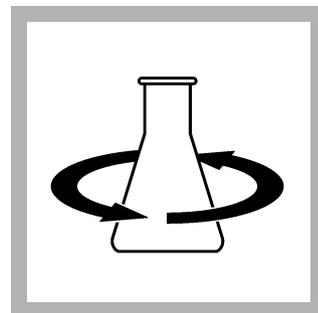
5. Pour the sample into a clean, 250-mL Erlenmeyer flask.



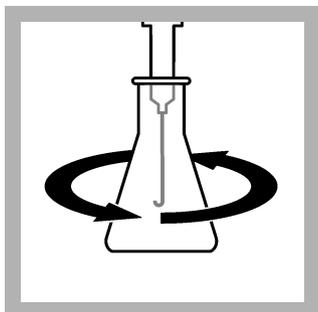
6. If the sample volume is less than 100 mL, dilute to approximately 100 mL with deionized water.



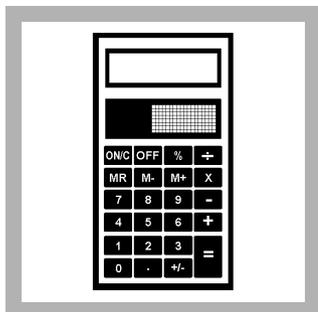
7. Add the contents of one Phenolphthalein Indicator Powder Pillow. The indicator is not necessary if a pH meter is used.



8. Swirl to mix. The solution color becomes pink.



9. 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 light pink to clear. Record the number of digits on the counter.



10. Use the multiplier in [Table 1](#) on page 4 to calculate the concentration. Digits used  $\times$  digit multiplier = meq/L base.

## 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 the 8.00 N Sodium Hydroxide Titration Cartridge and the counter showed 250 digits at the acid determination endpoint. The concentration is 250 digits x 0.1 = 25 meq/L acid.

For acid determinations, use a Sodium Hydroxide Titration Cartridge. For base determinations, use a Hydrochloric Acid or Sulfuric Acid Titration Cartridge.

**Table 1 Sample volumes and digit multipliers**

Range (meq/L)	Sample volume (mL)	Titration cartridge normality, acid or sodium hydroxide	Digit multiplier
1–4	100	1.600 N	0.02
4–10	50	1.600 N	0.04
10–40	100	8.00 N	0.1
20–80	50	8.00 N	0.2
50–200	20	8.00 N	0.5
100–400	10	8.00 N	1.0
200–800	5	8.00 N	2.0
500–2000	2	8.00 N	5.0
1000–4000	1	8.00 N	10.0

## Conversions

To change the units or chemical form of the test result, multiply the test result by the factor in [Table 2](#).

**Table 2 Conversions**

meq/L to...	multiply by...	Example
N (normality)	0.001	25 meq/L × 0.001 = 0.025 N

## Interferences

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. Titrate the sample until the pH is 8.3.

## Accuracy check

### Standard solution method

Use the standard solution method to validate the test procedure, reagents, apparatus and technique.

Items to collect:

- Acid determinations—0.500 N Sulfuric Acid Standard Solution
  - Base determinations—0.500 N (25-g/L as CaCO<sub>3</sub>) Alkalinity Standard Solution
  - Ampule Breaker
  - Pipet, TenSette, 1.0–10 mL and pipet tips
1. Use a TenSette pipet to add the standard solution to a 250-mL Erlenmeyer flask:
    - Titrations with the 1.600 N Titration Cartridge—Add 1.0 mL of the standard solution to the flask.

- Titrations with the 8.00 N Titration Cartridge—Add 5.0 mL of the standard solution to the flask.
2. Dilute the standard solution to approximately 100 mL with deionized water.
  3. Add one Phenolphthalein Indicator Powder Pillow. Swirl to mix.
  4. Titrate the prepared standard solution to the endpoint color or pH. The correct number of digits for this titration is 250 digits.
  5. Compare the actual number of digits that were used in the titration to the correct number of digits. If much more or less titrant was used, there can be a problem with user technique, reagents or apparatus.

## Summary of method

A phenolphthalein indicator is added to the sample. For acid determinations, the sample is titrated with a sodium hydroxide standard solution until the indicator changes color at the endpoint pH of 8.3. For base determinations, the sample is titrated with a sulfuric acid or hydrochloric acid standard solution until the indicator changes color at the endpoint pH of 8.3. The quantity of titrant used is directly proportional to the milliequivalents of acid or base in the sample.

## Consumables and replacement items

### Required reagents

Description	Quantity/Test	Unit	Item no.
Hydrochloric Acid Titration Cartridge, 8.00 N	varies	each	1439001
Phenolphthalein Indicator Powder Pillows	1	100/pkg	94299
Sodium Hydroxide Titration Cartridge, 1.600 N	varies	each	1437901
Sodium Hydroxide Titration Cartridge, 8.00 N	varies	each	1438101
Sulfuric Acid Titration Cartridge, 1.600 N	varies	each	1438901
Sulfuric Acid Titration Cartridge, 8.00 N	varies	each	1439101
Water, deionized	varies	4 L	27256

### Required apparatus

Description	Quantity/test	Unit	Item no.
Graduated cylinders—Select one or more for the sample volume:			
Cylinder, graduated, 5-mL	1	each	50837
Cylinder, graduated, 10-mL	1	each	50838
Cylinder, graduated, 25-mL	1	each	50840
Cylinder, graduated, 50-mL	1	each	50841
Cylinder, graduated, 100-mL	1	each	50842
Digital Titrator	1	each	1690001
Delivery tube for Digital Titrator, J-hook tip	1	5/pkg	1720500
Flask, Erlenmeyer, 250-mL	1	each	50546

### Recommended standards

Description	Unit	Item no.
Alkalinity Voluette <sup>®</sup> Ampule Standard Solution, 0.500 N (25-g/L as CaCO <sub>3</sub> ), 10-mL	16/pkg	1427810
Sulfuric Acid Standard Solution, 0.500 N	100 mL MDB	212132

## Optional apparatus

Description	Unit	Item no.
Ampule Breaker, 10-mL Voluette <sup>®</sup> Ampules	each	2196800
Pipet, TenSette <sup>®</sup> , 1.0–10.0 mL	each	1970010
Pipet tips for TenSette <sup>®</sup> Pipet, 1.0–10.0 mL	50/pkg	2199796
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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