

## USEPA Electrode Method

## Method 8156

## pH Meter

**Scope and Application:** For drinking water<sup>1</sup>, wastewater<sup>2</sup> and process water applications.

<sup>1</sup> Based on Standard Method 4500-H+B, ASTM Method D1293-95 and USEPA Method 150.1

<sup>2</sup> Based on Standard Method 4500-H+B, ASTM Method D1293-84(90)/(A or B) and USEPA Method 150.1



## Test preparation

## How to use instrument-specific information

The [Instrument-specific information](#) table displays requirements that may vary between instruments. To use this table, select an instrument then read across to find the corresponding information required to perform this test.

Table 474 Instrument-specific information

Meter	Standard probe	Rugged probe <sup>1</sup>
HQ40d	PHC10101, PHC10103 (gel) PHC30101, PHC30103 (liquid)	PHC10105, PHC10110, PHC10115, PHC10130
HQ30d	PHC10101, PHC10103 (gel) PHC30101, PHC30103 (liquid)	PHC10105, PHC10110, PHC10115, PHC10130
HQ11d	PHC10101, PHC10103 (gel) PHC30101, PHC30103 (liquid)	PHC10105, PHC10110, PHC10115, PHC10130
<i>sens<sup>ion</sup></i> <sup>TM</sup> 1	5191000 (platinum) 5193500 (gel) 5194000 (refillable) 5191500 (flat)	—
<i>sens<sup>ion</sup></i> <sup>TM</sup> 3	5191000 (platinum) 5193500 (gel) 5194000 (refillable) 5191500 (flat)	—

<sup>1</sup> Designed for field use.

## Before starting the test:

For optimal response time, condition the electrode for several minutes in a solution comparable to the sample in terms of pH and ionic strength.

For rugged IntelliCAL<sup>TM</sup> electrodes, the shroud may need to be removed before measurement and calibration.

For HQd meters, data is stored automatically when Press to Read or Interval is selected in the Setup Measurement Mode. When Continuous is selected, data will only be stored when the key under **STORE** is pressed. For *sens<sup>ion</sup>* meters, the **STORE** key must be pressed.

## Collect the following items:

Description	Quantity
pH meter and probe combination	1
pH buffers (4.0, 7.0, 10.0)	3
Beakers/sample containers	3

See [Consumables and replacement items](#) for reorder information.

## Sample pH measurement (calibration required)



1. Refer to the operation section of the electrode or meter manual to prepare the pH electrode and meter.



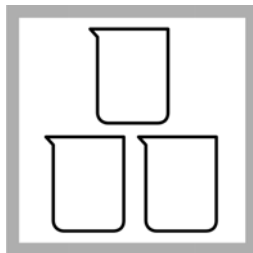
2. Connect the pH electrode to the meter.



3. Turn the meter on. Make sure that the meter is set to measure to measure pH.



4. For setup options such as measurement resolution, temperature units, calibration buffer set and other options refer to appropriate meter or electrode manual.



5. In three separate beakers or appropriate containers, prepare fresh buffers of 4.0, 7.0 and 10.0 pH.

The sample pH should fall within the pH range of the calibration buffers. One, two or three calibration buffers may be used to calibrate.

Other pH calibration buffers sets may be used.

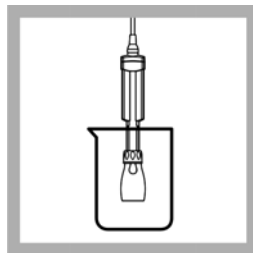


6. Calibrate the pH meter and electrode as directed in the instructions in the meter or probe manual.

Make sure that the calibration slope is acceptable (typically  $-58 \pm 3$  mV per pH unit at  $25^\circ\text{C}$ ).



7. Rinse the electrode in deionized water and blot dry prior to sample measurement. Rinse the electrode between measurements to minimize contamination.



8. Put the electrode in the sample and press **READ**. For faster response, stir at a slow to moderate rate.

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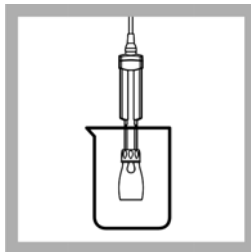
## Sample pH measurement (calibration required) (continued)

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9. When the measurement is stable, store or record the pH and temperature values.

For HQd meters, data is stored automatically when Press to Read or Interval is selected in the Setup Measurement Mode. When Continuous is selected, data will only be stored when the key under **STORE** is pressed. For **sens<sup>ion</sup>** meters, the STORE key must be pressed.



10. Store the pH electrode in pH storage solution when not in use. See [Sample collection, preservation, general storage and cleaning](#) for more details.

## Low Ionic Strength (LIS) or high purity water measurements

Low ionic strength solutions have very low buffering capacity and readily absorb carbon dioxide from the air. When a sample absorbs carbon dioxide from the atmosphere, carbonic acid forms. Carbonic acid decreases the sample pH and increases conductivity, causing inaccurate readings. One solution to this problem is to test the sample in a low volume, airtight sample chamber such as a Low Ionic Strength (LIS) Chamber. Use refillable or platinum series electrodes for measurement of pH in LIS or high purity waters.

### Initial use

1. Before measuring an LIS sample, soak the electrode in a solution similar to the sample in ionic strength and pH for 10 to 15 minutes.
2. Rinse the electrode with deionized water from a wash bottle.
3. Blot excess liquid with a soft paper towel.
4. Put the electrode in the sample.

#### **Between uses**

Between uses, in intervals of up to a two hours, the electrode can be stored in the sample (if the sample is not an extreme pH), or in a neutral LIS solution such as tap water. Rinse the electrode before use to prevent sample contamination.

**Important Note:** *If pH electrodes are stored in LIS samples for a long period of time, the electrode life may be shortened.*

After measuring the LIS samples, put electrode back into the electrode storage solution or 3 M KCl.

### **Sample collection, preservation, general storage and cleaning**

- Collect samples in clean plastic or glass bottles. Fill completely and cap tightly.
- Analyze samples immediately, preferably in the field.
- Storage of an electrode is based on how long the electrode will be stored, how quickly the electrode needs to be used and the type of sample being measured. For general storage, use the Hach storage solution or a 3 M Potassium Chloride (KCl) solution.
- A contaminated glass bulb or fouled electrode may cause slow response times. Do not clean the bulb too often because the bulb life may shorten.
- To clean an electrode with general contamination, immerse the electrode tip in 0.1 N hydrochloric acid (HCl). Then, immerse the electrode in 0.1 N sodium hydroxide (NaOH) and again in 0.1 N hydrochloric acid, each for a 2-minute period. Rinse with deionized water and soak in deionized water for at least 15 minutes.
- To clean an electrode contaminated with oils and fats, immerse the electrode tip in a detergent solution. Use a soft brush or ultrasonic bath if necessary. Avoid scratching the glass bulb.

### **Interferences**

- Acid error is negligible.
- Sodium error, usually present in alkaline solutions, is low but increases at pH values higher than pH 11.

For more detailed information, refer to the meter or electrode manual.

### **Accuracy check**

#### **Check electrode response**

An electrode is responding properly if its calibration slope meets the slope specifications of the electrode (typically  $-58 \pm 3$  mV at 25 °C).

#### **Check calibration accuracy**

Return the electrode to a calibration buffer and measure the pH to test the system. Rinse and recondition the electrode before measuring subsequent samples.

### **Method performance**

The accuracy of a pH measurement depends on many factors associated with the overall pH system, including the pH meter, choice of electrode and pH standards or buffers used during pH calibration. Refer to the appropriate electrode and meter manual to determine method performance.

## Summary of method

pH is a measure of the hydrogen ion activity in a solution and is defined as:

$$-\log_{10} aH^+$$

### Where

$aH^+$  is the activity of the hydrogen ion.

A Combination pH Electrode responds to the hydrogen ion concentration (activity) by developing an electrical potential at the glass/liquid interface. At a constant temperature, this potential varies linearly with the pH of the solution being measured.

Water with relatively high conductivity typically has a fairly high buffer capacity. Slight pH changes due to absorption of carbon dioxide are usually not significant. If the sample conductivity is not known and high accuracy is desired, follow either the LIS or high purity water methods.

## Consumables and replacement items

### Required apparatus and reagents

Description	Quantity	Unit	Catalog number
<b>HQ meters and probes (select one meter and probe combination)</b>			
HQ40d meter	1	each	HQ40d53000000
HQ30d meter	1	each	HQ30d53000000
HQ11d meter	1	each	HQ11d53000000
pH Gel Probe, standard, with 1 m cable	1	each	PHC10101
pH Gel Probe, standard, with 3 m cable	1	each	PHC10103
pH Liquid Probe, standard, with 1 m cable	1	each	PHC30101
pH Liquid Probe, standard, with 3 m cable	1	each	PHC30103
pH Gel Probe, rugged, with 5 m cable	1	each	PHC10105
pH Gel Probe, rugged, with 10 m cable	1	each	PHC10110
pH Gel Probe, rugged, with 15 m cable	1	each	PHC10115
pH Gel Probe, rugged, with 30 m cable	1	each	PHC10130
<b>sension meters and probes (select one meter and probe combination)</b>			
<i>sension</i> 1	1	each	5170000
<i>sension</i> 3	1	each	5175000
Electrolyte cartridge, potassium chloride	1	2/pkg	2546902
Gel Filled pH electrode	1	each	5193500
Refillable pH electrode, platinum series electrode (5191000 as #1); flat Platinum series electrode (5195000 as #4)	1	each	5194000
<b>For LIS and high purity water measurements</b>			
Low Ionic Strength (LIS) Chamber	1	each	5189900

## Recommended standards

Description	Unit	Catalog number
Hach Solutions <sup>1</sup>		
pH Color buffer solution kit (NIST), 500 mL, includes:	each	2947600
pH 4.01 +/- 0.02 pH buffer (NIST)	500 mL	2283449
pH 7.00 +/- 0.02 pH buffer (NIST)	500 mL	2283549
pH 10.01 +/- 0.02 pH buffer (NIST)	500 mL	2283649
Powder pillows <sup>1</sup>		
pH 4.01 +/- 0.02 pH buffer powder pillow (NIST)	50/pkg	2226966
pH 7.00 +/- 0.02 pH buffer powder pillow (NIST)	50/pkg	2227066
pH 10.01 +/- 0.02 pH buffer powder pillow (NIST)	50/pkg	2227166
Radiometer Analytical (IUPAC Series certified pH standards):		
pH 1.679 ± 0.010 at 25 °C	500 mL	S11M001
pH 4.005 ± 0.010 at 25 °C	500 mL	S11M002
pH 7.000 ± 0.010 at 25 °C	500 mL	S11M004
pH 10.012 ± 0.010 at 25 °C	500 mL	S11M007
pH buffer 1.09, technical	500 mL	S11M009
pH buffer 4.65, technical	500 mL	S11M010
pH buffer 9.23, technical	500 mL	S11M011
Refill Solution and Storage:		
pH Filling Solution (for PHC301), 3M KCl, saturated with AgCl	30 mL	2841700
pH Electrode Storage Solution	500 mL	2756549

<sup>1</sup> Larger quantities are available

## Optional reagents and apparatus

Description	Unit	Catalog number
Sample bottle, general purpose with Screw-cap, polypropylene, 500-mL	each	2758101
Sample bottle, cleaned and certified, HDPE, suitable for EPA reporting, 500-mL	each	2758201
<i>sensio</i> n 2 meter	each	5172511
<i>sensio</i> n 4 meter	each	5177500



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