

T16 pH Meter

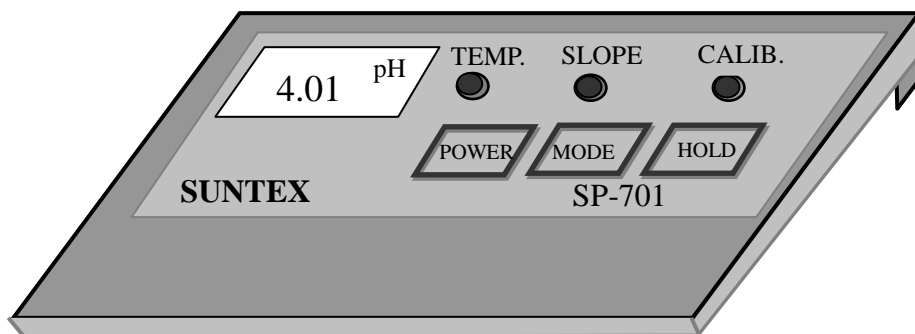


Figure T16-1 pH meter (SUNTEX SP-701)

A pH-meter is an instrument used to measure the pH value of a solution. The instrument consists of three parts. The first part is a reference electrode, whose potential is a fixed value. The second part is the indicator electrode, whose potential changes when the concentration of H^+ varies. In a modern pH-meter, the two electrodes are combined into a pH electrode. The third part is a voltmeter, which is used to measure the potential difference between the two electrodes. When the electrodes are immersed into the analyte solution, the pH-meter automatically converts the measured cell potential (E_m) to a reading of the pH value. If temperature (T) is kept constant while obtaining a set of measurements, E_m and pH have a linear relationship according to equation T16-1, and the slope of the straight line is mT .

$$E_m = mT(\text{pH}) + K \quad (\text{T16-1})$$

We usually calibrate a pH-meter before measurements by using two standard-pH buffer solutions at constant temperature. The first standard solution (usually pH 7.00) is used to set the absolute value of the pH-meter reading, while the second standard solution (usually pH 4.00) is used to calibrate the slope, as shown in Fig. T16-2.

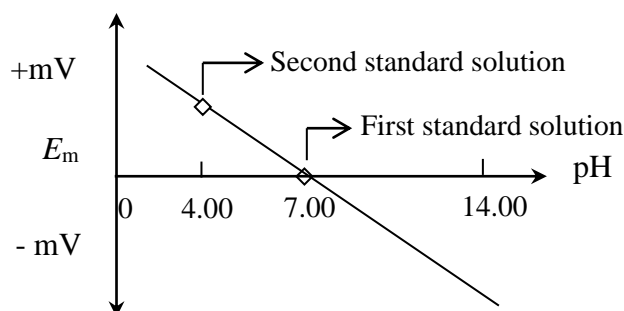


Figure T16-2 The relationship between measured cell potential and pH value

Operation

I. Preparation of pH meter:

1. Press the «**POWER**» key. Allow pH meter to warm up for 10 minutes.
2. Remove the electrode cap by rotating it. Place the electrode and thermoprobe on holder.
3. Use wash bottle to rinse the electrode with DI water thoroughly.
4. Blot dry with a tissue.
5. Press the «**HOLD**» key to freeze the display, and keep the electrode in DI water when not in use.

II. Calibration of pH meter:

1. Collect pH 7.00 and 4.00 standard buffer solution.
2. Lower the pH electrode and thermoprobe carefully into pH 7.00 buffer solution.
3. Press the «**MODE**» key, switch to “Temp” function, and check if the temperature shown is close to room temperature.
4. Switch to “pH” function.
5. Rotate «**CALIB**» knob until the display shows ‘7.00’. Press the «**HOLD**» key.
6. Rinse thermoprobe and electrode with DI water, then blot dry with tissue. Lower them in pH 4.00 standard buffer solution when the work is to be done in the acid range.
7. Unlock the «**HOLD**» key; rotate the «**SLOPE**» knob until it shows ‘4.00’. Press the «**HOLD**» key.
8. Rinse the electrode and immerse into DI water; accomplish the standardization.
9. When the work is in the alkaline range, use a pH 10.00 standard buffer instead of 4.00, and rotate the «**SLOPE**» knob until it shows ‘10.00’.
10. The pH values of standard pH buffer solutions may vary with temperature. Check it according to Table T16-1.

III. pH determination:

1. Place the beaker of solution to be tested beneath the electrode. Lower the electrode and thermoprobe carefully into the solution.
2. Unlock the «**HOLD**» key, read the pH of the solution directly from the meter. Record the value.
3. When the determination is complete, rinse the electrode and thermoprobe with DI water, store the electrode in DI water, and turn off the meter.

IV. Note:

1. Always place the electrode on the holder; do not place it in the beaker directly to avoid breaking. The pH electrode is fragile and expensive.

2. Always keep the electrode in DI water when not in use.
3. When testing, both thermoprobe and the electrode should be placed into solution for temperature of solution may affect the measured cell potential.
4. The salt bridge of electrode should be fully immersed in the test solution.
5. When using a magnetic stirrer, position the electrode properly so that the stirring bar will not strike the electrode.
6. Rinse the electrode with DI water and blot dry with tissues when changing the test solution.
7. Immerse the electrode in 3 M KCl solution when not in use for a long period of time.

References

1. Shugar, G. J.; Shugar, R. A.; Bauman, L.; Bauman, R. S. *Chemical Technicians' Ready Reference Handbook*; 2nd ed.; McGraw-Hill Book Co.: New York, 1981.
2. Manual of SP-701 pH meter °

Table T16-1 pH values of standard buffer solutions at various temperatures

Temperature (°C)	pH value of standard buffer		
	pH 4.00 buffer	pH 7.00 buffer	pH 10.00 buffer
5	3.99	7.08	10.22
10	3.99	7.06	10.16
20	3.99	7.01	10.05
25	4.00	7.00	10.00
30	4.01	6.99	9.95
40	4.03	6.98	9.88
50	4.05	6.97	9.84
60	4.08	6.98	9.79