



pH Meter

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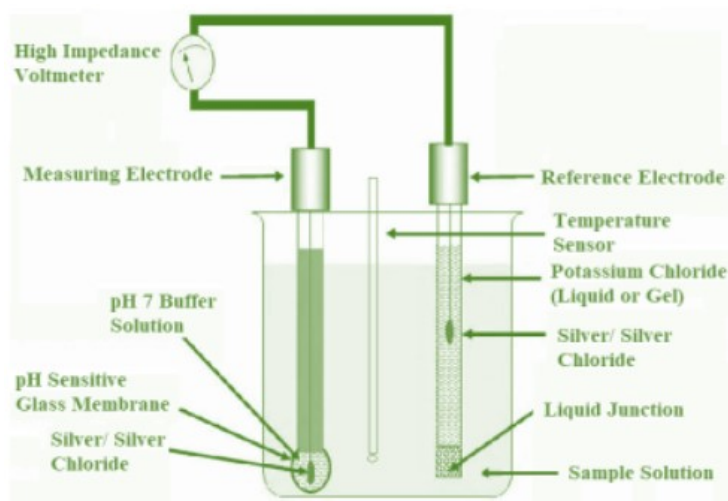
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Abstract

In this SOP, the principle of operation thermocouples are documented. The thermocouple readers available in the lab are listed.



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¹ Footnote 1 etc.

² Footnote 2 etc.

1 pH Meter Principle of Operation

1.1 Definition of pH [1]

pH is short for power of hydrogen or potential of hydrogen. It is a logarithmic scale that measures the concentration of H^+ ions (protons) in an aqueous solution. Some reactions require the pH of the reacting solution to be maintained within a narrow range. Thus, the accurate determination of pH values are of great importance. pH is defined as:

$$pH = (-a_{H^+})$$

Here a_{H^+} is the concentration of H^+ ions in moles per litre of solution. Water is considered neutral and has a pH value of 7. This is because at room temperature (25°C) a fraction of water molecules naturally dissociates and results in a solution with 10^{-7} moles of H^+ ions per litre. pH value of less than 7 indicates an acidic solution, value greater indicates an basic solution. pH value of a solution is dependent on temperature.

1.2 Electronic Measurements of pH [2]

The most common method of measuring the pH value of a solution is by measuring the electric potential (i.e. voltage) between a pH electrode and a reference electrode. The two are often integrated into a pH probe as detailed below:

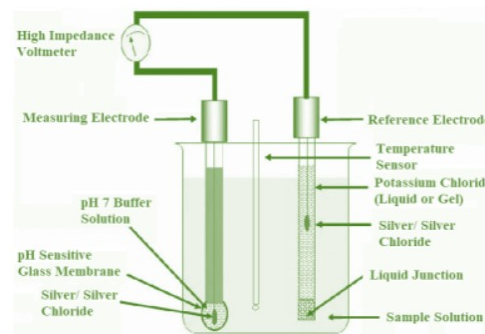


Figure 1: Schematic of pH probe

The pH electrode is a type of ion-selective electrode. There is a glass membrane that separates the inside of the pH electrode from the outside testing solution. It is lined with a hydrated gel. Inside the electrode is a buffer solution at a fixed pH and a Ag/AgCl electrode. There is an additional Ag/AgCl reference electrode filled with an electrolyte and connected to the solution under test via a permeable liquid junction. During operation, the H^+ ions in the solution under test attach to the outer surface of the glass bulb. This creates a difference in potential difference between the two electrodes that can be measured by an amplifier with high input impedance. The pH can be calculated using the Nernst equation. [3][4][5]

1.3 Calibration Requirements

The principle of operation means that the pH meter should be calibrated before use. This is achieved by using a reference buffer solution.

2 pH Meter in CaYPT Lab

2.1 Thermocouples

1. The CaYPT lab operates one Dr.meter PH100 pH meter:
 - Official product page: <https://drmeter.com/products/ph100-phmeter>
2. User Manual:
 - https://cdn.shopify.com/s/files/1/0120/9853/5483/files/ph100_Meter_Manual.pdf?2582
 - Order Link: https://www.amazon.ca/dp/B00ST3VTQ4/ref=emc_b_5_t

3 General Procedure of Operation

pH measurement:

1. remove protective cover
2. Rinse the electrode in distilled water and dry it
3. Place the electrode into the solution under test
4. Wait for the pH value to stabilize and record the value
5. Rinse the electrode with distilled water
6. Re-attached the protective cover

Precautions:

1. Make sure to store the pH meter electrode under moist conditions. Keep the storage sponge wet at all times.
2. If the meter response is abnormal, consult the user manual for procedures to restore the electrolyte solution. You will need to make a 3.3M KCl solution.
3. Do not use the pH meter with acidic fluoride solution like hydrofluoric acid (HF). The glass bulb can be dissolved in HF.

[?][?][?][?][?]

References

- [1] *pH*. <https://en.wikipedia.org/wiki/PH>.
- [2] Laxmi Ashrit. *pH Measurement – Working Principle, Applications and Advantages*. <https://electricalfundablog.com/ph-measurement-working-principle-applications/>.
- [3] *Glass Electrode*. https://en.wikipedia.org/wiki/Glass_electrode.
- [4] *pH Meter*. https://en.wikipedia.org/wiki/PH_meter.
- [5] *Nernst Equation*. https://en.wikipedia.org/wiki/Nernst_equation.