

**AM5023- PHYSIOLOGICAL MEASUREMENTS AND  
INSTRUMENTATION LABORATORY**

**BIOSENSORS LABORATORY REPORT**

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# PHYSIOLOGICAL pH MEASUREMENT

## Aim:

To understand the concept of blood pH and its importance.

Background: Blood pH is very tightly maintained between 7.36 and 7.44. An increase or decrease in blood pH results in physiological conditions known as alkalosis and acidosis respectively. Various acids are produced in our body during metabolism and it is important to remove/convert them efficiently to maintain a homeostatic balance of pH.



CA - Carbonic anhydrase

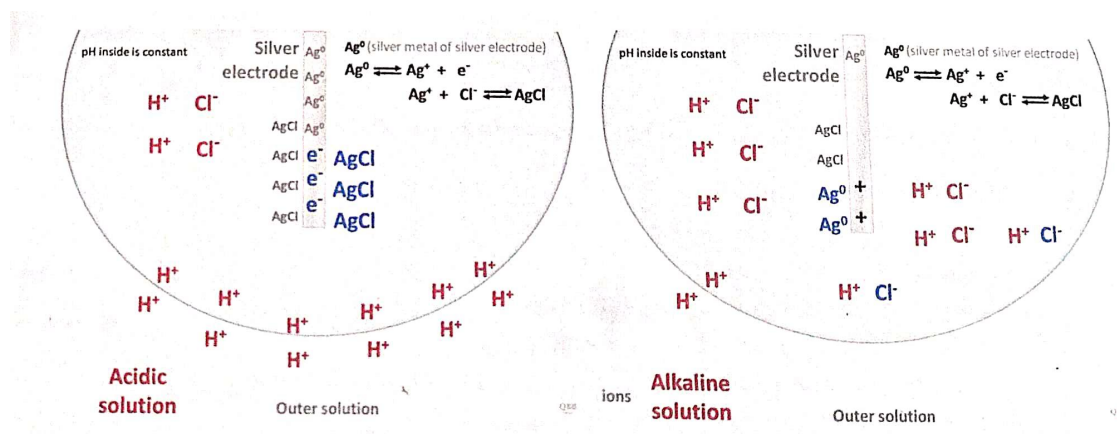
The CO<sub>2</sub> levels are maintained in the lungs whereas the HCO<sub>3</sub> levels are maintained in the kidneys. The lungs can help regulate blood pH rapidly through the process of exhaling CO<sub>2</sub> whereas the kidneys regulate the pH of the blood by excreting acids in urine. They also produce and regulate bicarbonate, which helps maintain a healthy blood pH.

## Objective:

To measure the pH of an unknown sample using a pH meter

## Working Principle:

The pH probe consists of 2 electrodes (reference and glass electrode). Both electrodes have silver wire coated with silver chloride. The glass electrode is filled with 0.1 N HCL whereas the reference electrode is filled with saturated KCL. The bottom part of the glass electrode has a thin circular glass bulb (which comes in contact with the sample) that specifically binds H<sup>+</sup> ions from both sides (without making them cross). The voltage across these 2 electrodes is measured via a voltmeter (Note: The voltage across the reference electrode is always constant).



The concentration of  $H^+$  ions in the outer solution affects the binding of  $H^+$  ions in the inner hydration layer. This binding or release of  $H^+$  ions in turn affects the oxidation/reduction of silver ions. The oxidation/reduction events cause electrons either to be gained or lost by the electrode which changes the voltage of the electrode.

### Apparatus required:

Kim wipes, Glass containers, deionized water, pH Meter, water waste beaker

### Procedure:

1. Switch on the main power supply to the instrument.
2. Press the ON/OFF switch to display "MEAS" pH and temp mode on the screen.
3. Allow the instrument to stabilize for at least 15 min before performing daily calibration.
4. Calibrate the instrument with the standard buffer solution, pH 4, 7 and 10.
5. Press the CAL/MEAS button. "CAL" mode and pH 7, 10, and 4 will be displayed on the screen.
6. Always start with neutral pH standard buffer pH 7, remove the pH electrode from the storage solution, and rinse it with purified DI water 2-3 times. Clean the excess water on the pH electrode by wipe with tissue paper and inserting the pH electrode into the solution.
7. Stir the standard pH 7 solution with a pH electrode and keep the pH electrode in the solution.
8. Allow the instrument to stabilize the pH and press the "Enter" button to calibrate the pH 7 buffer.

9. Remove the pH electrode and rinse with DI water. Clean the excess water on the pH electrode by wipe with tissue paper
10. In the instrument, pH 4 or pH 10 will be displayed. Insert the pH electrode in either pH 4 or 10 standard buffer to calibrate the instrument for the same pH 7 buffer. Follow the steps steps 5 to 7.
11. Once the instrument is calibrated with pH 4, 7 and 10 standard buffer the instrument is automatically set to measurement "MEAS" mode. Now the instrument is ready to measure the sample buffer solution for pH adjustment.
12. Insert the pH electrode into the buffer solution to check the pH. Stir the buffer solution with the pH electrode and keep the pH electrode and allow it to stabilize the pH, the instrument will display ready on the screen, record the pH.
13. Remove the pH electrode and rinse with DI water. Clean the excess water on the electrode by wipe with tissue paper between measurements.
14. After completion of the pH measurement insert the pH electrode in the storage solution.
15. Switch OFF the instrument and clean the workspace.

### **Results and Observation:**

1. Successfully performed calibration using standard solutions of pH- YES/NO
2. The pH of the unknown sample is **7.21**

### **Precautions:**

1. The glass electrode is extremely fragile so it to be handled with care.
2. Use of gloves is mandatory while operating the pH meter.
3. Handle buffer solutions with care. The solutions may cause eye and skin irritation. And maybe harmful if swallowed or inhaled.
4. Buffers should always be read at accurate pH
5. Do not immerse electrodes in the buffer solutions before rinsing the electrodes thoroughly with deionized water.
6. Do not mix buffers with other solutions or contaminate with samples.