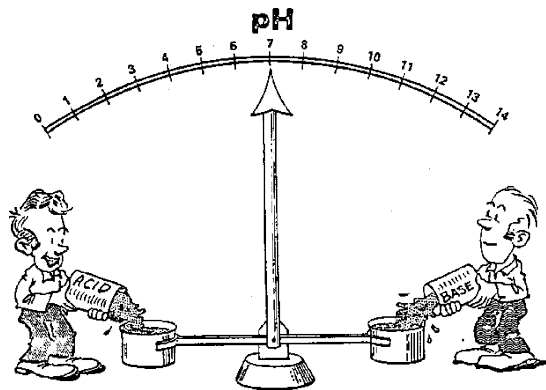


## CB102 : Experiment 4 : To Prepare buffer solutions and to test their resistance to pH change:

### I- INTRODUCTION

The oxford dictionary defines the term buffer as “A person or thing that reduces a shock or that forms a barrier between incompatible or antagonistic people or things”. In chemistry, the term buffer refers to “a substance capable in solution of neutralizing both acids and bases and thereby maintaining the original acidity or basicity of the solution”.



**Objective:** The aim of this experiment is to prepare some useful buffer solutions that are frequently used in chemistry and biology and to test their pH resistance.

**NOTE:** Each group is required to prepare only one of the following two types of buffers (either A. Citrate buffer or B. Phosphate buffer).

### II- PRELIMINARY WORK

Read carefully the procedure, and make the necessarily preliminary calculations for all the standard solutions.

### III- PROCEDURE

#### A: Chemicals required for citrate buffer:

- Citric acid monohydrate
- Trisodium citrate dehydrate

#### B: Chemicals required for Phosphate buffer:

- Sodium phosphate, dibasic
- Sodium phosphate, monobasic

- 0.1M HCl standard solution

- 0.1M NaOH standard solution



**Apparatus and laboratory glassware required : See appended.**

**To be prepared [Note: either (a) or (b)]:**

#### (a) Preparation of citrate buffer:

By weighing appropriate amounts of each salt, prepare 100.0 mL of two standard solutions :

- 0.1M Citric acid monohydrate ( $C_6H_8O_7 \cdot H_2O$ , MW = 210.14)
- 0.1M Trisodium citrate dihydrate ( $C_6H_5O_7Na_3 \cdot 2H_2O$ , MW = 294.12)

Leave the two solutions for 10 minutes to attain room temperature.

#### (b) Preparation of phosphate buffer:

By weighing appropriate amounts of each salt, prepare 100.0 mL of two standard solutions :

- 0.1M sodium phosphate, dibasic ( $Na_2HPO_4$  MW = 141.96)
- 0.1M sodium phosphate, monobasic ( $NaH_2PO_4$  ; MW = 156.01).

Leave the two solutions for 10 minutes to attain room temperature.

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**How to use a pHmeter ?** Never leave the probe dry out. If not used, keep it in the beaker with distilled water

. Put a waste beaker underneath the electrode. Rinse the electrode with distilled water, remove smoothly the excess of water with a tissue paper and place it in the solution you wish to pH. Repeat the procedure for any new solution.

### Procedure:

Into a 50 ml beaker, using a pipette, prepare 25.0 ml each of 0.1M citrate buffer (or phosphate buffer), by mixing the above standard solutions in the ratio as given in the table below. Take it into a 50 mL beaker to measure the pH of each of the buffer solutions using the pH meter and tabulate the obtained values as below. Preserve any of the two buffer solutions you have prepared, for further testing and label as buffer 1 and 2 (remember the compositions). Make a note of the room temperature.

Amount standard solution 1 (ml)	Amount of standard solution 2 (ml)	pH
20.0	5.0	--
15.0	10.0	--
10.0	15.0	--
5.0	20.0	--

### To test the resistance of buffers towards addition of acid and base.

Measure the pH once again of 25 ml of buffer solution 1 using the pH meter. To buffer solution 1 add 5 drops of 0.1M HCl, mix well and measure the pH, repeat by adding a further 5 drops of acid and measuring the pH each time until you have added a total of 25 drops of 0.1M HCl. Do the same with buffer solution 2 by adding drops of supplied 0.1M NaOH solution.

### Blank measurements using distilled water:

Repeat the above measurements by taking 25 ml of distilled water instead of the buffer solution and measure the pH and after each adding of acid or base to it in steps of 5 drops each time.

**Graph:** Compare the obtained results by plotting the measured pH for pure water and buffer solution as a function of drops of HCl added. Do the same for NaOH added.

**Conclusions:** Write appropriate conclusions from your observations and answer the following questions:

What causes buffering action in these solutions?

### **APPENDED : apparatus and glassware required :**

- Pipet pump
- pH meter
- Wash bottle
- 500 mL beaker
- two 250 ml beakers
- two 5 ml pipette
- two 50 ml beaker
- 25 ml beaker for pH measurement
- two clean plastic droppers
- two 100 ml volumetric flask