

Practical work N°3 :



DETERMINATION OF THE ALKALINITY OF AN AQUEOUS SOLUTION USING A HYDROCHLORIC ACID SOLUTION. pH-METRIC MONITORING AND GRAN'S METHOD.

OBJECTIVE :

To determine the alkalinity of an aqueous solution by pH-metric titration with data analysis using the Gran method. This PW will teach you titration techniques, using a pH meter and data analysis to calculate alkalinity precisely.

EQUIPMENT USED:

- pH- meter
- Graduated burette
- Beaker and magnetic stirrer
- Aqueous solution of bicarbonate (NaHCO_3)
- Hydrochloric acid solution (HCl) of known concentration (0.1M)
- Graph paper for drawing the Gran curve

Make efforts to
become the first

EXPERIMENTAL PROTOCOL:

1. Preparation of the sample:

- Place an accurate volume (50 mL) of the solution to be titrated in a beaker.
- Set up the magnetic stirrer and start stirring to ensure homogeneity.

2. Prepare the measuring equipment:

- Calibrate the pH- meter before starting the experiment to obtain accurate measurements.

3. pH-metric titration:

- Fill the burette with the HCl solution and start adding small amounts (e.g. 0.5 mL at a time).

-At each addition of HCl solution, measure the pH of the solution obtained and record in the table below:

V _{HCl} add	pH mesured	$G = V_{HCl} * 10^{-pH}$
0		
0.5		
1		
1.5		
2		
.....		

-Continue the additions until you reach a pH well below the equivalence point (approximately pH = 4).

QUESTIONS

-Give a definition of Gran's method.

-Name some of the chemical materials you used in this practical work.

-Application of Gran's method:

-For each measurement, calculate the Gran factor, $G = V_{HCl} \times 10^{-pH}$, where V_{HCl} is the volume of HCl poured in up to the point of measurement.

-Draw the curve for $G = f(V_{HCl} \text{ poured in})$

-Extrapolate the straight line obtained to determine the volume of HCl needed to reach equivalence.

- Calculating alkalinity:

Use the volume of hydrochloric acid at equivalence to calculate the alkalinity. Alkalinity (in mol/L) can be calculated using the corresponding equation, taking into account the initial volume of solution and the concentration of HCl.

$$\text{ALCALINITY} = [\text{HCl}] \times V_{eq} / V_{(\text{NaHCO}_3)}$$

Where :

- $[\text{HCl}] = 0.1 \text{ mol/L}$ (concentration of HCl),
- V_{eq} = volume of HCl found by extrapolation,
- $V_{(\text{NaHCO}_3)}$ = initial volume of solution (50 mL).

- CONCLUSION.