

OCR (A) Chemistry A-level

PAG 2: Acid-Base Titration

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2.1 Determination of the Concentration of Hydrochloric Acid

Method

Part 1 : Making a 0.10 mol dm^{-3} standard solution of NaHCO_3

1. Weigh 2.10 g of sodium hydrogencarbonate into a weighing boat then transfer to a 250 cm^3 beaker.
2. Add a small volume of distilled water to the beaker and stir until the solid completely dissolves.
3. Transfer the solution to a 250 cm^3 volumetric flask using a funnel.
4. Rinse the beaker and the glass rod with distilled water, adding the washings to the volumetric flask.
5. Fill the volumetric flask up to the graduated line using distilled water.
6. Stopper the flask and invert a few times to mix the solution.

Part 2 : Finding the concentration of HCl by titration

1. Use a pipette and pipette filler to transfer 25 cm^3 of the standard NaHCO_3 solution to a 250 cm^3 conical flask.
2. Add two or three drops of methyl orange to the flask.
3. Fill the burette with hydrochloric acid (ensuring there is no air bubble) and record the initial burette reading
4. Add the hydrochloric acid from the burette to the conical flask until the end point is reached. Add the acid dropwise as you near the end point. At the end point, the solution will change from yellow to orange in colour.
5. Record the final burette reading. The volume of HCl added is the difference between the initial and final readings.
6. Repeat until two concordant results are obtained.

Calculations

- ❖ Calculate the mean titre using the concordant results.
- ❖ Calculate the moles of NaHCO_3 present in 25 cm^3 of standard solution.
- ❖ Calculate the moles of HCl present in the mean titre, using the following neutralisation equation: $\text{HCl} + \text{NaHCO}_3 \rightarrow \text{NaCl} + \text{H}_2\text{O} + \text{CO}_2$
- ❖ Calculate the concentration of HCl.

Errors

- Some of the weighed NaHCO_3 may not be transferred from the weighing boat.
 - Use the weighing by difference technique
- Take care not to spill any solid or solution during transfer.
- Forcing all the liquid from the pipette
 - The pipette is calibrated to account for the liquid that remains in the tip.
- During the titration, swirl the conical flask when adding the acid to ensure that the reactants are well mixed.
- The colour change may not be clearly visible during the titration
 - Place a white tile underneath the conical flask.



Safety

- Hydrochloric acid – causes severe skin burns and eye damage.
- Methyl orange – toxic if swallowed.

