OCR B Chemistry A-Level

PAG 02: Acid-base titration

2.3 Identification of an unknown carbonate

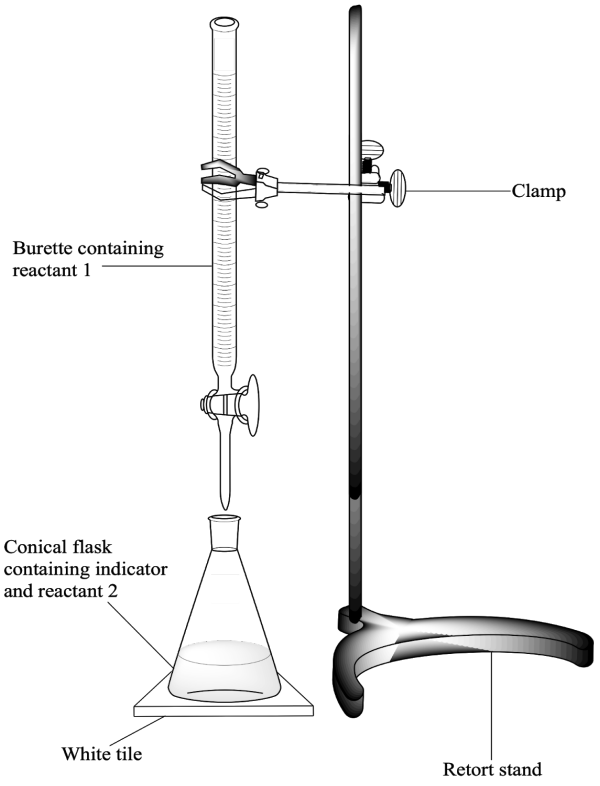
Equipment list

- Burette
- Clamp stand with boss and clamp (To support burette)
- 25 cm^3 pipette and filler
- White tile
- Funnel
- Glass rod
- Dropping pipette
- 2 x 250 cm^3 conical flasks
- Glass beakers (250 cm^3 and 100 cm^3)
- 100 cm^3 measuring cylinder
- 250 cm^3 volumetric flask and stopper
- Distilled/deionised water
- Methyl orange indicator
- Solid metal carbonate, X_2CO_3
- HCl (0.100 mol dm^{-3})

You will also need access to Methyl Orange indicator and a balance weighing to 0.01g

Method

1. Weigh the container of X_2CO_3.
2. Transfer the solid into the 250 cm^3 beaker and re-weigh the empty bottle. (Difference in mass = mass of carbonate)
3. Dissolve the solid in 100 cm^3 of distilled water.
4. Make the solution up to 250 cm^3 **by transferring the solution into a volumetric flask using a funnel and adding distilled water up to the line.**
   A volumetric flask is calibrated at a specific volume and therefore will give a more accurate volume with a lower percentage uncertainty.
5. Mix the solution thoroughly by inverting the volumetric flask multiple times.
6. Using a pipette, transfer 25.0 cm^3 of this solution into the conical flask.
7. Add a few drops of methyl orange indicator into the conical flask.
8. Fill the burette with the hydrochloric acid.
9. Carry out an initial titration as a trial:



Open the tap at the bottom of the burette and release the HCl in the conical flask until the colour change occurs. The colour change at the end-point is from yellow to orange.

10. Repeat the titration, this time accurately, to obtain two concordant values for the titre. Concordant values are titres that are within 0.1 cm^3 of each other.

Use of equipment

The use of the indicator allows you to determine when the reaction has reached **completion**. By slowly adding hydrochloric acid from the burette to the conical flask containing the metal carbonate solution, you will be able to observe a colour change when the reaction reaches the end point. The use of a burette allows greater **precision** and **control** when measuring volumes of liquids and the use of a pipette allows the **accurate** measurement and **transportation** of a small volume of liquid into another vessel.

Analysis

Reaction carried out:

$$X_2CO_{3(aq)} + 2HCl_{(aq)} \rightarrow 2XCl_{(aq)} + H_2O_{(l)} + CO_{2(g)}$$

1. Calculate the number of moles of HC*l* in the mean titre.
2. Calculate the number of moles of X_2CO_3 used in the titration (using the chemical equation above).
3. Calculate the number of moles, of X_2CO_3 present in the prepared 250 cm^3 solution.
4. Calculate the M_r of X_2CO_3.
5. Calculate the M_r of X.
6. Hence, using the periodic table, what is the identity of X?.

Risk Assessment

Hazard	Risk	Control
Solid metal carbonate, X_2CO_3	Irritant to eyes, skin etc.	Wear safety glasses, handle with care and place away from the edge of the desk.
Hydrochloric acid, HC*l*(aq), of concentration 0.100 mol dm^{-3}	Irritant to eyes, skin etc.	Wear safety glasses, handle with care and place away from the edge of the desk.

Errors

- Not all of the measured solid is added to the standard solution.
  To overcome this, use the weighing by difference technique.
- Some solid may be lost when transferring.
  Handle with care and add as much weighed solid as possible
- Titre doesn't mix properly.
  Ensure to swirl the conical flask when adding the acid.
- The colour change is not clearly visible.
  Place a white tile underneath the conical flask