Edexcel International Chemistry A-level

Practical 1

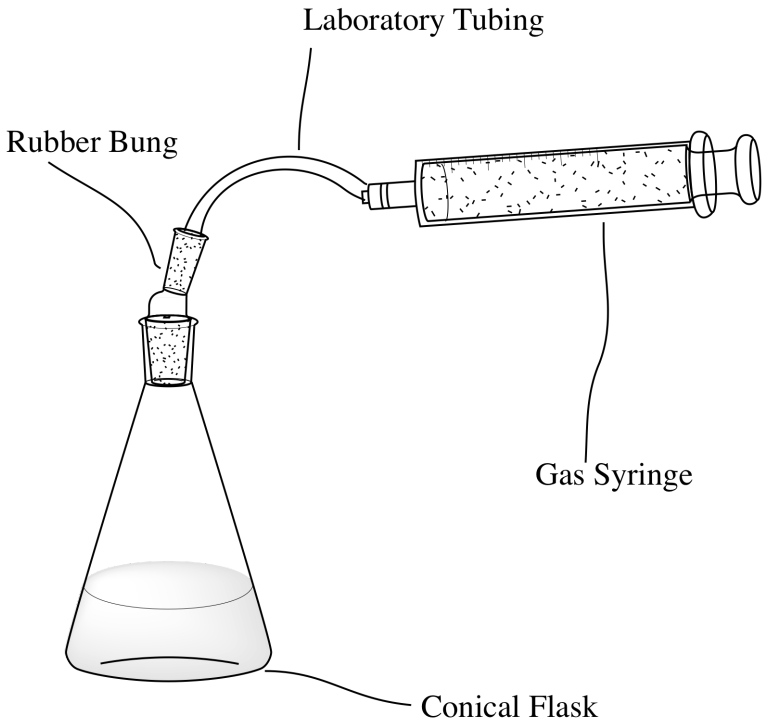
Finding the Molar Volume of a Gas

The **molar volume of any gas is the same** at given conditions of pressure and temperature (Avogadro's law).

Method

1. Set up the equipment as shown in diagram below.
2. Measure out 30 cm^3 (excess) of ethanoic acid into the conical flask.
3. Place 0.05g of the calcium carbonate marble chips to a test tube and weigh it accurately, recording the combined mass of the test tube and calcium carbonate.
4. Pour the calcium carbonate into the conical flask containing the ethanoic acid and quickly replace the bung.
5. Measure and record the volume of carbon dioxide gas produced using the gas syringe.
6. Reweigh the test tube and calculate the actual mass of calcium carbonate that was added to the conical flask.
7. Repeat, increasing the mass of the marble chips by around 0.05g each time, up to a mass of 0.40g.

Apparatus set-up



Key points

- Overall equation:

$$CaCO_3 + 2CH_3COOH \rightarrow Ca(CH_3COO)_2 + CO_2\,(g) + H_2O$$

- **Don't use too much $CaCO_3$** so you don't produce more gas than the measuring cylinder can fit.

- A **weak acid** is used so that the reaction is **slower**, meaning there is less gas loss between adding the marble chips and attaching the bung.
- An **alternative method** could involve attaching marble chips on a string to the bung, sealing the test tube with a bung, and then tipping the test tube so that the acid comes to the contact with the marble chips. This could reduce the loss of gas.

Errors

- If using syringe, plunger may not be free moving. It may need a **lubricant**.
- CO_2 is **slightly soluble** in water, so the exact volume is not measured.
- Some **gas escapes** in between the addition of marble chips and sealing the test tube.
- Bung may not be **airtight**.
- **Transferring** the solid. It is important to weigh the tube containing marble chips before the addition and reweigh after the addition. This method is '**weighing by difference**' and ensures the amount of $CaCO_3$ that ends up in the reaction mixture is known.