OCR (A) Chemistry GCSE

PAG 8 (chemistry) / PAG C5 (combined science): Measuring Rates of Reaction

Notes

Measuring the Rate of Reaction between Mg and HCl

Aim

To investigate the effect of temperature on the rate of reaction for an acid-metal reaction.

Equipment list

- 100 cm^3 conical flask
- Bung and delivery tube
- 25 cm^3 measuring cylinder
- 50 cm^3 measuring cylinder
- Thermometer
- Clamp and stand
- Water Trough
- Water bath
- Timer

Chemicals required

- Hydrochloric acid
- 4 cm magnesium ribbons

Method

1. Set up the apparatus as shown in figure 1 below. The measuring cylinder must be filled with water and turned upside down in the water trough. The delivery tube must flow from the conical flask into this measuring cylinder.
2. Measure 50 cm^3 of hydrochloric acid into a 100 cm^3 conical flask.
3. Measure the initial temperature of the acid using a thermometer and record.
4. Note the start volume of water in the measuring cylinder.
5. Quickly add a 4 cm strip of magnesium to the conical flask and attach the bung with the delivery tube onto the flask immediately. Start the timer.
6. Monitor the volume of gas produced by looking at the change in volume of water in the measuring cylinder. Stop the timer after 30 cm^3 of gas is produced.
7. Repeat steps 2-6 with the other temperatures of HCl. To change the temperature of the hydrochloric acid, use a water bath at step 3 to heat the acid in the conical flask. Record all the results in a table.

Key points

- The equation for this reaction is: $Mg + 2HCl \rightarrow MgCl_2 + H_2$
- Hydrogen gas is produced and it can be collected in the measuring cylinder because it displaces the water from the cylinder.
- It is important that the bung is attached to the conical flask as soon as the magnesium is added so that minimal gas is lost from the beginning of the reaction.
- As the temperature of HCl increases, the rate of reaction is expected to increase as the particles have more kinetic energy so there are more frequent collisions as well as a greater proportion of successful collisions between reacting particles.

Diagram

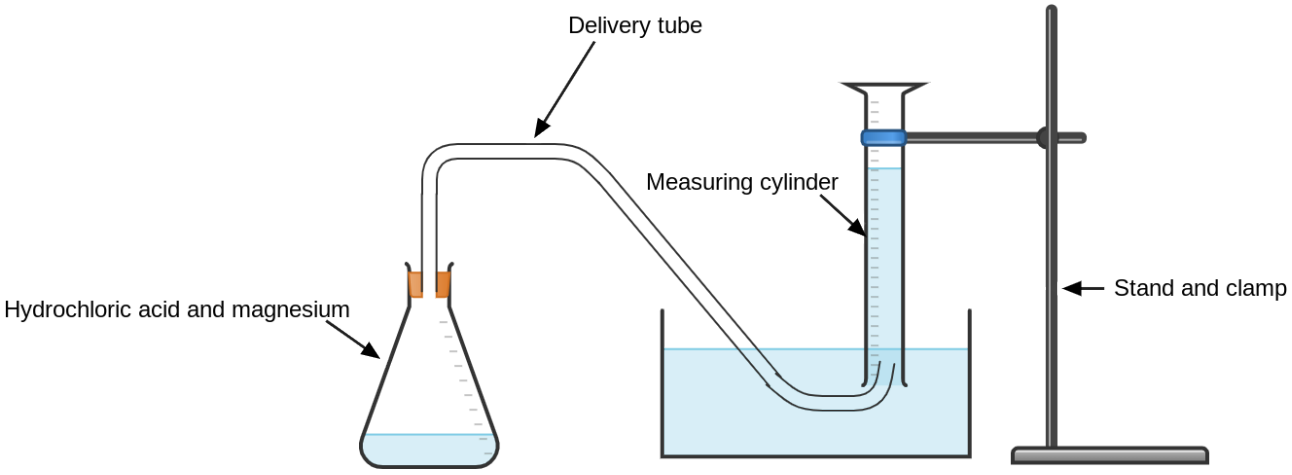

Figure 1 Experiment Setup

Chemix

Safety precautions

- Control the quantities of reactants to ensure the volume of gas produced will fit in the measuring cylinder. If a large volume of gas is produced, it could damage the equipment.
- Magnesium is flammable so ensure there are no naked flames in the laboratory.
- The hydrogen gas produced is extremely flammable so ensure there are no naked flames and keep the room well ventilated.
- Hydrochloric acid is corrosive. Although a low concentration is used in this experiment, wash hands if the skin comes into contact with this chemical.

Analysis of Results

Rate of reaction = $\frac{\text{volume of gas produced}}{\text{time}}$

The results from each test can be recorded in a table similar to the one below:

Temperature of HCl (°C)	**Time to produce 30 cm^3 of H_2 (s)**	**Rate of reaction (s^{-1})**
… (Room temperature)		
30		
40		
50		

The results should show that the rate of reaction increases as the temperature of hydrochloric acid increases.