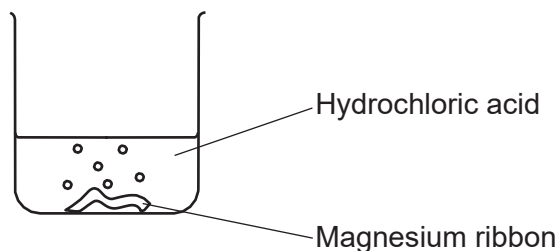# GCSE Chemistry A (Gateway Science)

**J248/02** C4-C6 and C7 Foundation (Foundation Tier)

Question Set 28

1 A student investigates the reaction between magnesium and dilute hydrochloric acid, HCl.

The student adds magnesium ribbon to hydrochloric acid in a beaker, as shown in the diagram.

Hydrochloric acid

Magnesium ribbon

Magnesium chloride, MgCl_2, and hydrogen gas are made.

(a) Write the **balanced symbol** equation for this reaction.

[2]
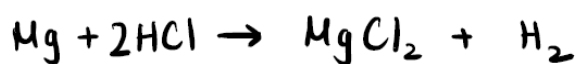
$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

(b)* The student measures the time it takes for all the magnesium to react. This is the reaction time.

The student does five experiments.

This is the student's prediction:

"The smaller the volume of acid and the smaller the mass of magnesium, the shorter the reaction time."

Look at the student's results.

Experiment	Mass of magnesium used (g)	Volume of acid used (cm^3)	Concentration of acid (mol/dm^3)	Reaction time (s)
1	0.05	25	1.0	30
2	0.05	50	1.0	30
3	0.05	50	2.0	15
4	0.10	25	1.0	30
5	0.10	50	2.0	15

Describe and explain whether the student's results support his prediction.

Include ideas about the reacting particle model in your answer.

[6]

- When only mass of Mg is halved (experiment 1 & 4), the reaction time did not change (shorten) because surface area is limiting
- When only volume of acid is changed / halved (experiment 1 & 2), the reaction time did not change because surface area is limiting
- Already maximum number of particles are reacting on the surface area of Mg ribbon
- However when concentration of acid is doubled, the reaction time shortened by a half because more particles are available to react thus the number of collisions increases and the rate of reaction is also increased.

(c) The student repeats experiment **1**. This time he uses acid at a **lower** temperature.

Explain, using the reacting particle model, **what happens to the rate of reaction** and **predict the reaction time** for this reaction.

[3]

Lower temperature means particles would have less kinetic energy and the collision would occur more slowly. This reduces the rate of reaction thus the reaction time would be longer.

(d) During chemical reactions, reactants are used up and the rate of reaction **decreases**.

Explain, in terms of particles, why the rate of reaction decreases.

[2]

When the reactants get used up, their concentration decreases. Hence, less number of particles is available and the rate of successful collisions would reduce. As a result the rate of reaction is decreased.

Total Marks for Question Set 28: 13