Concentration and Reaction Rate

Introduction:

Magnesium is a light, shiny gray metallic element, symbol Mg, atomic number 12, found in group two in the periodic table. It is quite reactive giving vigorous reactions towards acids. It is one of the alkaline earth metals, and the lightest of the commonly used metals.

Hydrochloric acid, HCl, is a solution of hydrogen chloride (a colourless acidic gas) in water. The concentrated acid is about 35% hydrogen chloride and is corrosive. The acid is a typical strong, it forms only one series of salts, the chlorides. Like most acids, it releases hydrogen ions when it is added to water and certain metals, and has a pH of less than 7. Hydrochloric acid is a common laboratory acid.

Putting magnesium into hydrochloric acid. It fizzes and dissolves.

Note: Magnesium + Hydrochloric acid = Magnesium Chloride + Hydrogen

Mg + 2HCl = MgCl + H

Aim: To find out the effect of concentrations of acid, in the reaction between dilute hydrochloric acid and magnesium ribbons. The rate of a chemical reaction is a measure of how fast the reaction takes place.

Apparatus and Materials:

- Beaker
- Graduated Cylinder
- Magnesium Ribbons
- Stop Watch (Timer)
- Conical Flask
- Dilute Hydrochloric acid of different concentrations.

Procedure:

As written in the handout attached.

Results:

Concentration/ mol dm^{-3}	Time/ sec
0.5	350
0.8	92
1.0	63
1.2	43
1.5	41
2.0	15

Conclusion:

Looking at the set of results obtained, you can clearly see that they all follow a pattern. This pattern suggests that the reaction rate

increase when the concentration of the acid increases. The is because if you increase the concentration of the acid, you are introducing more particles into the reaction which will in turn produce a faster reaction because there will be more collisions between the particles which is what increases the reaction rate.

If our experiment was more accurate we would have concluded that if we double the concentration of the acid the reaction rate would also double.

Discussion:

We should always ensure a safe experiment and working environment. We should have at least 1 m^2 of working space. We should also wear safety goggles at all times when using acids.

To make this experiment a fair test, we should use the same amount of acid for all experiments, only changing the concentrations. We should also use the same size of magnesium ribbon and weight. We have to start the stop watch when the magnesium touches the acid and stop it when the magnesium stops fizzing for each experiment. Lastly, always wash out the test tubes when an experiment had finished so the different concentration wouldn't get mixed together causing strange results.

It was sometimes quite difficult to stop timing on the exact moment that the fizzing stops. It would be more accurate to carry out each of the 6 experiments three or more times and find the average time. We should use a pipette to pour the acid into the measuring cylinder as to be accurate. We used to measure and record the results in seconds instead of minutes in order to obtain more precise results.

To improve our results further more, we could have dried the flask and the beaker after they are washed to prevent diluted acids. The size and weight of the magnesium would have affected the rate of reaction. The experiment could be improved by measuring, adjusting and weighing the magnesium ribbons so they all are the same size and weight. The magnesium ribbon is covered with a whitish deposit. This deposit was magnesium oxide where the magnesium had reacted with the air. I would imagine that some pieces had a little of this oxide. The pieces of magnesium ribbon that did not have much oxide on them reacted faster than those with a little more. To improve my results, I could clean the magnesium oxide more efficiently using some more sandpaper.

Other errors can be:

- When the reaction takes place bubbles of H^2 are given off ,which might stay around the magnesium which therefore reduces the surface area of the magnesium and so the acid cannot react properly so this effects the results.

Answers to question 1 and 2 found in handout:

<u>1a.</u> The 2 molar concentration of acid cause the Mg ribbon disappear fastest.

<u>1b.</u> The acid is used in excess to ensue that all the Mg reacted.

1c. 30 seconds.
1d. To show that the gas produced by the reaction is Hydrogen, we hold a lighted splint to the test tube of hydrogen, the gas burns with a squeaky pop.
1e. The chemical left in the flask after the reaction is over is Magnesium Chloride (MgCl).

2. Complete the table:

Volume of diute hydrochloric acid/cm^3	**Volume of Water/cm^3**	**Concentration/ mol dm^{-3}**
60	0	2
50	10	1.66
40	20	1.34
30	30	1
20	40	0.66
10	50	0.34