Investigating the rate of reaction between magnesium and sulphuric acid

Background

Magnesium reacts with sulphuric acid to produce hydrogen gas and a salt

$$Mg_{(s)} + H_2SO_{4\,(aq)} \quad MgSO_{\ 4(aq)} + H_{2\,(g)}$$

A gas is produced, so the reaction rate can be followed by measuring the change in mass of the reaction system or the gas could be collected.

Practical Techniques

You will need to find out about how to make up accurate solutions.

Where to start

Plan an experiment to investigate the effect of varying the concentration of sulphuric acid on the rate of this reaction.

Possible Investigations

- Investigate the effect of other acids (including weak acids) on the rate of the reaction. You will be able to find the order of reaction for each acid and hence the rate equation for the reaction.
- Investigate the reaction at different temperatures to determine the effect of temperature on the rate and hence determine the activation enthalpy for the reaction.
- Investigate a different technique for monitoring the rate of the reaction – possibilities are –conductivity, pH.
- Investigate the effect of adding transition metal ions to the reaction

Sources of Information

- Denby D., The reaction of metals with acids, *Chemistry Review,* January 1996
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- Hacker R.G., Williams I.W., (1970) Design for an experiment: an introduction to kinetics, *Education in Chemistry*, Vol7/1
- http://users.erols.com/merosen/kinetics.htm
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- Thorpe A., Experimental error and error analysis: just how good are those results, *Chemistry Review*, November 2001

Teachers' Notes

General

This investigation is based around a very simple experiment. It is an experiment that is often carried out at GCSE level and therefore teachers must make students aware that they need to approach this investigation at the appropriate level. The practical techniques are very straightforward and students of all abilities should be able to carry out the experiments successfully. If a technically more demanding investigation is required students should investigate the other techniques suggested.

As the reaction is exothermic, students will need to design their experiment very carefully if they wish to investigate the effect of temperature on this reaction.

Chemical Principles

Reaction Kinetics, reactions of metals and acids

Essential Equipment

Burettes, pipettes, electronic balance

Essential Chemicals

magnesium, sulphuric acid,

Safety

No risk assessment has been given. It is essential that students prepare a detailed risk assessment before they start. Teachers must be satisfied that this is suitable for the proposed investigation.

Starter Experiment- Investigating the rate of reaction between

Prepare the following solution

- Sulphuric acid 2 mol dm ^{3}

You w
depend on how much of the solution is used in each experiment and how many

to a conical flask.

Expt	Sulphuric 3	3

should add measured amount of magnesium ribbon to the solution and sta
timing. You need to record the time at regular intervals until the reaction stops or