Investigating Electrolysis

Background

When electricity is passed through a solution of an electrolyte chemical reactions occur at the electrodes. This process is known as electrolysis. There are relationships that exist between the amount of electricity passed through a solution and the amount of a chemical that is produced at the anode and cathode. There are also other factors that affect the amount of product that is produced such as the type of electrode used, the distance between the electrodes and the temperature of the solution.

Practical Techniques

You need to be able to set up an electrical circuit and use an ammeter.

Where to start

You should start with a solution of sodium chloride (1 mol dm^{-3})

You need to design and set up apparatus that will allow you to pass electricity through the sodium chloride solution. You also need to be able to measure the amount of electricity that passes.

You should carry out some initial experiments to determine the relationship between the amount of current that passes through the solution and the following factors; concentration, temperature, distance between the electrodes and amount of electrode that is immersed in the solution.

You can use these initial experiments to familiarise yourself with the apparatus and to decide on the set of conditions that you should use in your subsequent experiments.

Possible Investigations

- Investigate the products that are produced during the electrolysis. The product formed at the anode is either chlorine or oxygen (depending on the concentration of the solution) and the product formed at the cathode is hydrogen. You can investigate how the amount of product produced is affected by the various factors mentioned above. You might be able to collect the hydrogen and oxygen but the not the chlorine as it dissolves readily in water. You can determine the amount of chlorine produced by adding acidified iodide ions (which react with the chlorine to produce iodine) and then estimate the amount of iodine by titration with sodium thiosulphate solution.

Investigate the relationship between the amount of electricity passed and

Faradays Laws of electrolysis.

- as sulphuric acid, sodium hydroxide. Can you determine the extent of the reactions by

Investigate the electrolysis of copper sulphate solution or silver nitrate re the change in mass of the electrodes to determine the amount of product made. You can investigate the amount of

Sources of Information

Hill G. C. and Holman J., (2001), *Chemistry in Context Laboratory Manual* , Nelson Thornes

Chemistry in the Marketplace Jovanovich, London

School Chemistry Experiments Education.

od, C.A. (2001) *Advanced Higher Chemistry*

- Thorpe A., Assessing the risks in practical work, *September 2000*
- Thorpe A., Experimental error and error analysis: just how good are those results, *Chemistry Review*, November 2001
- Thorpe A, Making a standard solution, *Chemistry Review,* November 2002
- http://chem.lapeer.org/Chem2.Docs/chlorine.html

Teachers' Notes

General

This can sometimes be quite a difficult investigation to get set up and running well. However more able students can often make good progress and should be encouraged to persevere.

Chemical Principles

Electrolysis, quantitative chemistry, redox

Essential Equipment

Ammeters, electrical apparatus

Essential Chemicals

Sodium chloride

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.