Required Practical – Electrolysis

Background

The literal translation of “electrolysis” is splitting up by using electricity. Electrolysis has many applications including purifying metals such as copper and extracting reactive metals from their ores such as aluminium, sodium and potassium. Electrolysis can be used to electroplate items such as copper, silver and gold plated accessories.

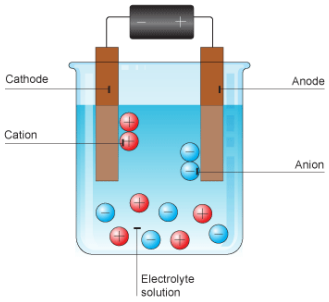
In this investigation you will use a low voltage power supply and carbon rod electrodes to pass a current through four different salt solutions. You will identify the element formed at the positive and negative electrode in each case.

Scientific Background

When an ionic compound undergoes electrolysis the positive and negative ions are attracted to the oppositely charged electrode where they may be oxidised (lose electrons) or reduced (gain electrons) to become the element again.

If, however, the products of the electrolysis are very reactive, or if the ion is very stable, then the water solvent will be oxidised or reduced to give hydrogen or oxygen gas at the electrode in preference.

Set-up



This diagram shows how your cell will be set up. Both your anode and cathode will be made of carbon rods and the electrolyte solution will be one of the four you are testing. Do not be tempted to mix your solutions together.

Method

1. Pour copper (II) chloride solution into the electrochemical cell (beaker or gas voltameter) to about 50cm^3. You may need more if using a gas voltameter.
2. Add the lid and insert carbon rods through the holes. **The rods must not touch each other.**
3. Attach crocodile leads to the rods. Connect the rods to the **dc (red and black)** terminals of a low voltage power supply.
4. Select 4v on the power supply and switch on.
5. Make and record your observations for 5 minutes.
6. Clean out the equipment carefully and repeat the investigation with solutions of copper (II) sulfate, sodium chloride and sodium sulfate.

Observations

Use the following guide to test any gases made (this looks like bubbling at one or both of the electrodes).

	Positive Electrode	Negative Electrode
Hydrogen		Any gas produced here is hydrogen
Oxygen	Does not turn blue litmus paper white (bleached)	
Chlorine	Turns blue litmus paper white (bleached)	

When you examine the electrodes at the end of the 5 minutes, is there evidence of a metal coating?

Results table

solution	Positive electrode (anode)		Negative electrode (cathode)	
	Observations	Element formed	Observations	Element formed
copper(II) chloride				
copper(II) sulfate				
sodium chloride				
sodium sulfate				

PREDICTED RESULTS

solution	Positive electrode (anode)		Negative electrode (cathode)	
	Observations	Element formed	Observations	Element formed
copper(II) chloride	Bubbles of gas that bleach litmus paper	Chlorine gas	Coating of pinkish metal on the electrode	Copper
copper(II) sulfate	Bubbles of gas do not bleach litmus paper	Oxygen gas	Coating of pinkish metal on the electrode	Copper
sodium chloride	Bubbles of gas that bleach litmus	Chlorine gas	Bubbles of gas	Hydrogen
sodium sulfate	Bubbles of gas do not bleach litmus paper	Oxygen gas	Bubbles of gas	Hydrogen