KNOWLEDGE

Chemistry Topic 4 Electrolysis

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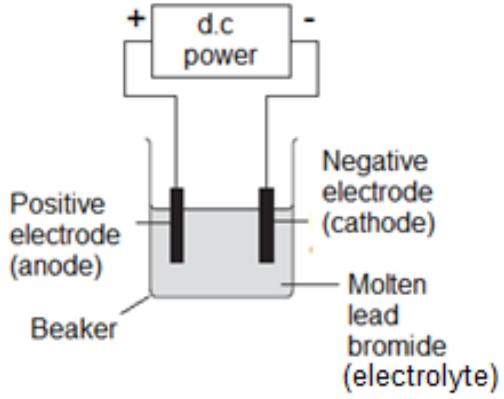
Section 1 Electrolysis key terms	
Electrolysis	The process of **splitting an ionic compound** by passing **electricity** through it.
Electrolyte	An **ionic compound** that is **molten** (melted) or **dissolved in water**. The electrolyte is broken down by electricity enabling its **ions** to and hence carry a charge. **move freely**
Electrode	An **electrical conductor** that is placed in the **electrolyte** and connected to the **power supply**.
Cathode	The **negative electrode**. The electrode attached to the negative terminal of the power supply.
Anode	The **positive electrode**. The electrode attached to the positive terminal of the power supply.
Oxidation	Loss of electrons
Reduction	Gain of electrons



Positive
Anode
Negative
Is
Cathode

Section 2a: Changes at the electrodes – Pure ionic compounds		
Electrolyte	**Cathode**	**Anode**
Molten Compound	Metal	Non-metal produced.
Molten lead bromide (diagram above)	**Lead metal** is produced $Pb^{2+} + 2e^- \rightarrow Pb$	**Bromine** is produced $2Br^- \rightarrow Br_2 + 2e^-$

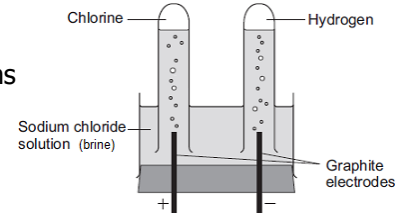
Section 2b: Changes at the electrodes – Aqueous solutions		
Electrolyte	**Cathode**	**Anode**
Dissolved compound (aqueous solution)	The **metal** if the metal is **less reactive than hydrogen**. **Hydrogen** is produced if the **metal is more reactive than hydrogen**.	**Oxygen** is produced **unless the solution contains halide ions** (chloride, bromide, iodide) when the **halogen** (chlorine, bromine, iodine) is produced.

Electrolyte	Cathode	Anode
$CuBr_{2(aq)}$	Copper	Bromine
$NaCl_{(aq)}$	Hydrogen	Chlorine
$KI_{(aq)}$	Hydrogen	Iodine
$Na_2SO_{4(aq)}$	Hydrogen	Oxygen

Electrolysis of Brine (concentrated sodium chloride solution)

In the electrolysis of brine, **three products** are formed, **hydrogen, chlorine** and **sodium hydroxide.**

Sodium chloride solution → hydrogen gas + chlorine gas + sodium hydroxide solution



At the **cathode hydrogen** gas forms
$2H^+ + 2e^- \rightarrow H_2$ (**reduction**)

At the **anode**, **chlorine** gas forms
$2Cl^- \rightarrow Cl_2 + 2e^-$ (**Oxidation**)

Sodium ions stay in solution (as sodium is more reactive than hydrogen) and **combine with hydroxide ions** to form sodium hydroxide.
$Na^+ + OH^- \rightarrow NaOH$

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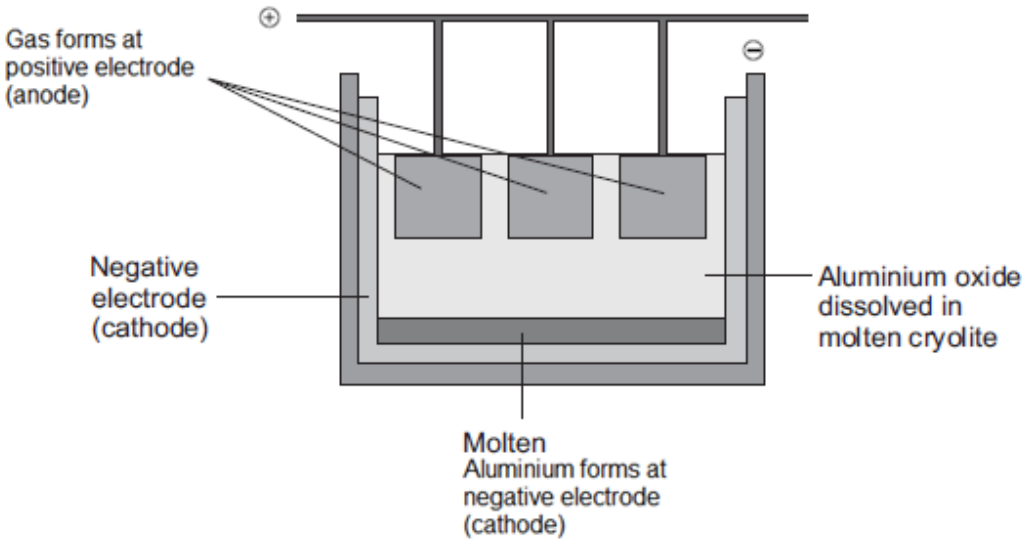
Section 3a: The extraction of Aluminium by electrolysis	
Bauxite	You get aluminium oxide from the ore called **Bauxite**, the ore is mined by **open cast mining**.
Cryolite	**Aluminium oxide** is **dissolved in cryolite** to **lower its melting point**. This **saves money on energy costs**.
Graphite	The **electrodes** are made from **graphite** (carbon) as graphite can conduct electricity (due to it having delocalised electrons between it's layers.)
Cathode	Positive **Al^{3+} ions move to the cathode**. Aluminium is produced (reduction). **$Al^{3+} + 3e^- \rightarrow Al$**
Anode	Negative **O^{2-} ions move to the anode**. Oxygen is made (oxidation). **$2O^{2-} \rightarrow O_2 + 4e^-$** The anode **wears away** gradually as the **carbon graphite anode reacts with oxygen to form carbon dioxide**.



Section 3b: Uses of Aluminium

Aluminium is a very important metal, the uses of its metal or alloys include:

- Pans
- Overhead power cables
- Aeroplanes
- Cooking foil
- Drink cans
- Window and patio door frames
- Bicycle frames and car bodies