Ionic Theory and Electrolysis

Effect of Electricity on Matter

The observations that certain substances allow electric current to pass through them, while others do not, have been used to classify elements into **conductors** and **non-conductors (insulators),** and compounds into **electrolytes** and **non-electrolytes.**

Conductors and non – conductors

Conductors are **elements** that allow electricity to pass through them. They are metals, such as iron nail, magnesium wire, zinc rod and copper plate, and graphite(an allotrope of carbon).

Metals and **graphite** are good conductors of electricity, because their **atoms possess mobile electrons** that move freely from one atom to another, and hence, able to carry electric current along.

Non-conductors are **elements** that do not allow electricity to pass through them. They are non-metals, such as sulphur, phosphorus and diamond.

Non-metals are poor conductors of electricity, since their **atoms do not possess mobile electrons**; no flow of electrons within the atoms.

Non-metals that have intermediate properties between conductors and non-conductors are **semi-conductors.** Examples are silicon and germanium.

Electrolytes and non – electrolytes

Electrolytes are compounds in molten (or in fused) state, and in aqueous solution that conduct electricity, and are decomposed during the process.

Generally, dilute mineral acids such as HCl, HNO_3 and H_2SO_4; alkalis – NaOH and KOH; and ionic salts – NaCl and $CuSO_4$ are electrolytes.

Non – electrolytes are compounds in molten state or in solution that do not allow the passage of electricity.

Generally, covalent solids such as sugar (sucrose and glucose) and paraffin wax; and liquids such as kerosene, petrol and alcohols are non-electrolytes.

At the anode: Both SO_4^{2-} and OH^- migrate to the anode where OH^- are preferentially discharges as oxygen gas. Here, the positions of the ions in the series are more than their concentrations.

$$OH^-(aq) \rightarrow OH + e^-$$

$$OH + OH \rightarrow H_2O(l) + O$$

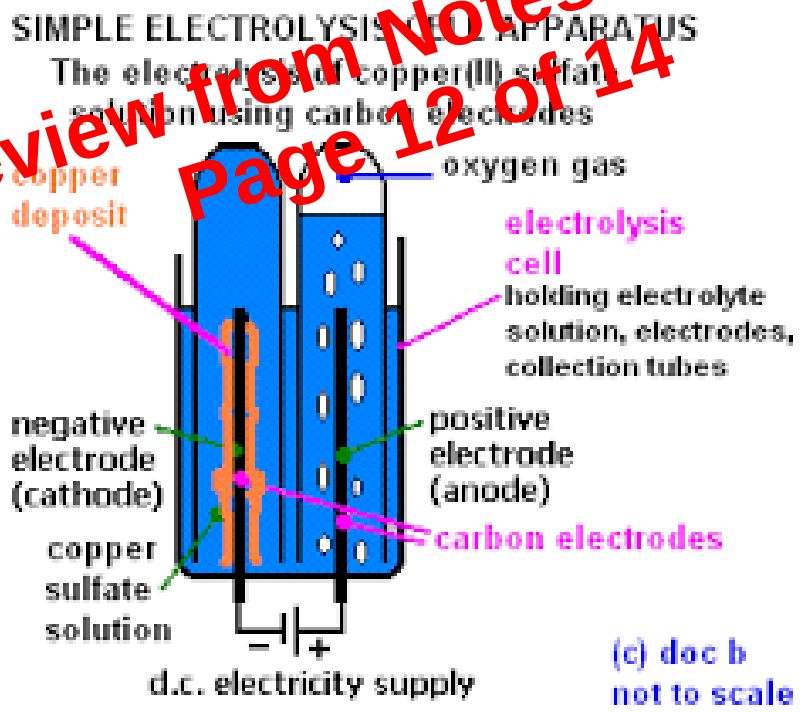
$$O + O \rightarrow O_2(g)$$

Summary:

Cathodic half-reaction $2Cu^{2+}(aq) + 4e^- \rightarrow 2Cu(s)$

Anodic half-reaction $4OH^-(aq) \rightarrow 2H_2O(l) + O_2(g) + 4e^-$

Overall reaction $2Cu^{2+}(aq) + 4OH^-(aq) \rightarrow 2Cu(s) + O_2(g) + 2H_2O(l)$



The electrolysis of aqueous copper(II) tetraoxosulphate(VI), using carbon or platinum electrodes, yields copper deposits at the cathode and oxygen at the anode.