

Electricity and Chemistry

Conduction of electricity requires the presence of **MOBILE CHARGED** particles (electrons or ions). Electric current is a flow of electrons or ions

IONIC	COVALENT MOLECULAR
Do not conduct electricity in the solid state (ions held tightly in place) but do conduct when molten or in aqueous solution – ions free to move	Do not conduct electricity in any state - no free ions/electrons. Acids and ammonia dissociate in water to produce ions e.g. HCl(aq) conducts electricity.

ANION – negative ion (travels to anode)

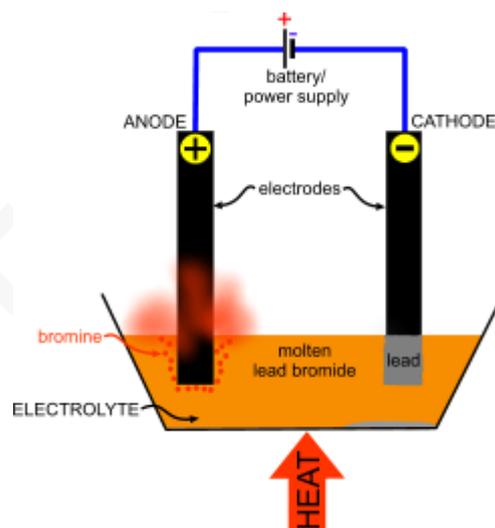
CATION – positive ion (travels to cathode)

Electrolysis is the decomposition of a compound (molten or in solution) by the passage of electricity through it. Electrolysis involves the formation of new substances (elements) from compounds

e.g. electrolysis of molten lead bromide:

product at cathode (-)	product at anode (+)
lead	bromine
$Pb^{2+} + 2e^{-} \rightarrow Pb$	$2Br^{-} \rightarrow Br_2 + 2e^{-}$
reduction	oxidation

Molten salts: A metal is formed at the cathode (negative electrode) and a non-metal is formed at the anode (positive electrode). **Electrolysis of a molten salt splits the salt up into its elements.** No other products are possible



Electrolysis of aqueous salts using inert electrodes (graphite or platinum):

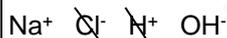
product at cathode	product at anode
metal (if below H in reactivity series) or hydrogen	halogen or oxygen

Compound	Product at ANODE (+)	Product at CATHODE (-)	Residual solution
sulfuric acid	oxygen	hydrogen	sulfuric acid
	$4OH^{-} \rightarrow O_2 + 2H_2O + 4e^{-}$	$2H^{+} + 2e^{-} \rightarrow H_2$	
Alternative	$2H_2O \rightarrow O_2 + 4H^{+} + 4e^{-}$	$2H_2O + 2e^{-} \rightarrow H_2 + 2OH^{-}$	
aqueous sodium chloride	chlorine	hydrogen	sodium hydroxide
	$2Cl^{-} \rightarrow Cl_2 + 2e^{-}$	$2H^{+} + 2e^{-} \rightarrow H_2$	

H^{+} ions which form H_2 at cathode and OH^{-} which form O_2 at anode come from the dissociation of water:



To work out the residual solution write down the formula of all ions present and then cross out those that are removed in electrolysis. e.g. sodium chloride solution:



Electrolysis of copper sulphate solution

Graphite/platinum (inert) electrodes		
anode (+)	cathode (-)	residual solution
oxygen (bubbles of gas seen)	copper (pink-brown metal formed)	sulfuric acid (H_2SO_4)
$4OH^{-} \rightarrow O_2 + 2H_2O + 4e^{-}$	$Cu^{2+} + 2e^{-} \rightarrow Cu$	
solution gets paler colour as Cu^{2+} ions removed		

Investigate electrolysis of aqueous solutions – collect gases using test tube or gas burette for quantitative work – test gases using, e.g. hydrogen with lighted splint etc.

