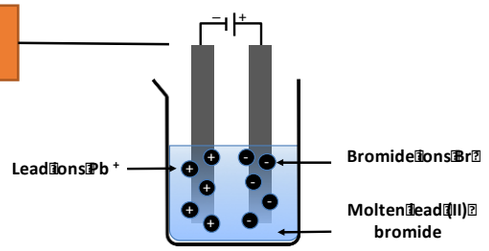
EDEXCEL TOPIC 3: CHEMICAL CHANGES 2

Electrolytic processes

Process of electrolysis	***Splitting up using electricity***	When an ionic compound is melted or dissolved in water, the ions are free to move. These are then able to conduct electricity and are called electrolytes. Passing an electric current though electrolytes causes the ions to move to the electrodes.
Electrode	***Anode Cathode***	The positive electrode is called the anode. The negative electrode is called the cathode.
Where do the ions go?	***Cations Anions***	Cations are positive ions and they move to the negative cathode. Anions are negative ions and they move to the positive anode.



Higher tier: You can display what is happening at each electrode using half-equations:
At the cathode: $Pb^{2+} + 2e^- \rightarrow Pb$
At the anode: $2Br^- \rightarrow Br_2 + 2e^-$

Extracting metals using electrolysis

- ***Metals can be extracted from molten compounds using electrolysis.***
- ***This process is used when the metal is too reactive to be extracted by reduction with carbon.***
- ***The process is expensive due to large amounts of energy needed to produce the electrical current. Example: aluminium is extracted in this way.***

Oxidation Is Loss, Reduction Is Gain

Electrolysis of aqueous solutions

The ions discharged when an aqueous solution is electrolysed using inert electrodes depend on the relative reactivity of the elements involved.

At the negative electrode	Metal will be produced on the electrode if it is less reactive than hydrogen. Hydrogen will be produced if the metal is more reactive than hydrogen.
At the positive electrode	Oxygen is formed at positive electrode. If you have a halide ion (Cl^-, I^-, Br^-) then you will get chlorine, bromine or iodine formed at that electrode.

Acids

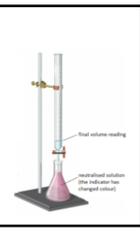
Making pure, dry soluble salts

Step 1	***Add insoluble reactant (e.g. metal oxide) to acid***	Add until there is an excess of insoluble reactant.
Step 2	***Filter the solution***	Collect the filtrate in a conical flask and dispose of the residue.
Step 3	***Crystallisation***	Heat the filtrate using a Bunsen burner to evaporate the water from the solution.
Step 4	***Evaporation***	Leave the evaporating basin with the heated filtrate to evaporate any remaining water and make pure, dry soluble salts.

Solubility	***Sodium, potassium and ammonium***	All common sodium, potassium and ammonium salts are soluble e.g. sodium chloride and potassium fluoride.
	Nitrates	All nitrates are soluble e.g. potassium nitrate.
	Sulfates	Common chlorides (e.g. sodium chloride) are soluble, expect those of silver and lead.
	Carbonates and hydroxides	Common carbonates and hydroxides are insoluble except those of sodium, potassium and ammonium.

Titrations

Titrations are used to work out the precise volumes of acid and alkali solutions that react with each other.

	1. Use the pipette to add 25 cm^3 of alkali to a conical flask and add a few drops of indicator.
	2. Fill the burette with acid and note the starting volume. Slowly add the acid from the burette to the alkali in the conical flask, swirling to mix.
	3. Stop adding the acid when the end-point is reached (the appropriate colour change in the indicator happens). Note the final volume reading. Repeat steps 1 to 3 until you get consistent readings.

Using copper	***Copper is a very good electrical conductor***	Much of the copper available isn't pure enough for this use so it is purified using electrolysis.
Copper sulfate solution	***The anode is made of impure copper and the cathode is made of pure copper***	Both electrodes are placed in copper sulfate sultion. Copper ions (Cu2+) leave the anode and are attracted to the cathode.
Electrodes	***The cathode of pure copper builds up***	The anode decreases in size. The impurities left behind form a sludge.