AQA Chemical Changes 2

Electrolysis

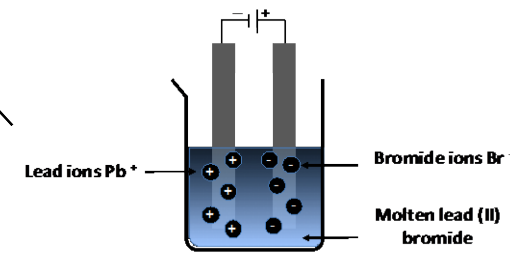
Process of electrolysis	*Splitting up using electricity*	When an ionic compound is melted or dissolved in water, the ions are free to move. These are then able to conduct electricity and are called electrolytes. Passing an electric current though electrolytes causes the ions to move to the electrodes.
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.

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.



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: $2Br^- \rightarrow Br_2 + 2e^-$

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.

Reactions of acids

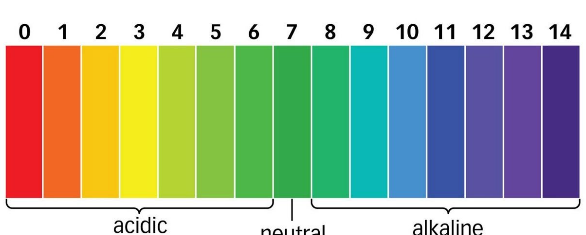
Strong and weak acids (HT ONLY)

Strong acids	*Completely ionised in aqueous solutions e.g. hydrochloric, nitric and sulfuric acids.*
Weak acids	*Only partially ionised in aqueous solutions e.g. ethanoic acid, citric acid.*
Hydrogen ion concentration	*As the pH decreases by one unit (becoming a stronger acid), the hydrogen ion concentration increases by a factor of 10.*

Soluble salts

Soluble salts	*Soluble salts can be made from reacting acids with solid insoluble substances (e.g. metals, metal oxides, hydroxides and carbonates).*
Production of soluble salts	*Add the solid to the acid until no more dissolves. Filter off excess solid and then crystallise to produce solid salts.*

The pH scale and neutralisation



You can use universal indicator or a pH probe to measure the acidity or alkalinity of a solution against the pH scale.

Acids	*Acids produce hydrogen ions (H^+) in aqueous solutions.*
Alkalis	*Aqueous solutions of alkalis contain hydroxide ions (OH^-).*

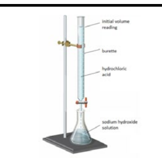
In neutralisation reactions, hydrogen ions react with hydroxide ions to produce water:

$H^+ + OH^- \rightarrow H_2O$

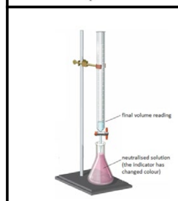
Titrations (Chemistry only)

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.

Calculating the chemical quantities in titrations involving concentrations in mol/dm³ and in g/dm³ (HT ONLY):

$$2NaOH(aq) + H_2SO_4(aq) \rightarrow Na_2SO_4(aq) + 2H_2O(l)$$

It takes 12.20cm^3 of sulfuric acid to neutralise 24.00cm^3 of sodium hydroxide solution, which has a concentration of 0.50mol/dm^3.

Calculate the concentration of the sulfuric acid in g/dm³

0.5 mol/dm^3 x (24/1000) dm^3 = 0.012 mol of NaOH

The equation shows that 2 mol of NaOH reacts with 1 mol of H_2SO_4, so the number of moles in 12.20cm^3 of sulfuric acid is (0.012/2) = 0.006 mol of sulfuric acid

Calculate the concentration of sulfuric acid in mol/ dm³

0.006 mol x (1000/12.2) dm^3 =0.49mol/dm^3

Calculate the concentration of sulfuric acid in g/ dm³

H_2SO_4 = (2x1) + 32 + (4x16) = 98g

0.49 x 98g = 48.2g/dm^3

AQA Chemical Changes 2

Electrolysis

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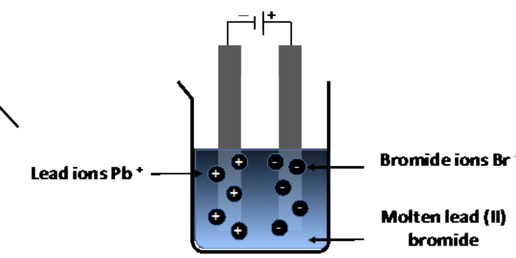

Higher tier: **You can display what is happening at each electrode using half-equations:**

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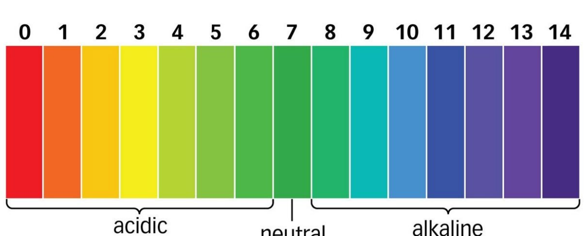
Soluble salts

	Soluble salts can be made from reacting acids with solid insoluble substances (e.g. metals, metal oxides, hydroxides and carbonates).
	Add the solid to the acid until no more dissolves. Filter off excess solid and then crystallise to produce solid salts.

The pH scale and neutralisation



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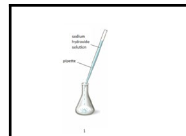
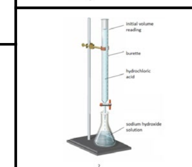
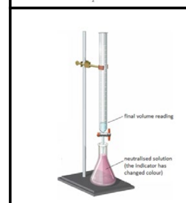
	1. Use the pipette to add 25 cm^3 of alkali to a conical flask and add a few drops of indicator.
	2. Fill the burette with acid and note the starting volume. Slowly add the acid from the burette to the alkali in the conical flask, swirling to mix.
	3. Stop adding the acid when the end-point is reached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

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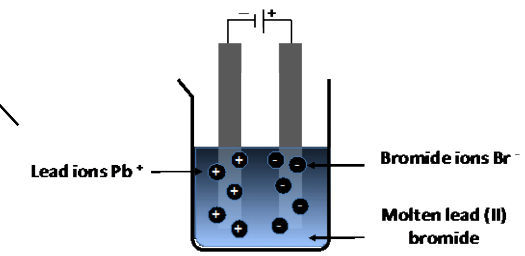
		The positive electrode is called the anode. The negative electrode is called the cathode.
		Cations are positive ions and they move to the negative cathode. Anions are negative ions and they move to the positive anode.

	The process is expensive due to large amounts of energy needed to produce the electrical current. Example: aluminium is extracted in this way.

Electrolysis



Higher tier: You can display what is happening at each electrode using half-equations:
At the cathode:
At the anode:

AQA Chemical Changes 2

Reactions of acids

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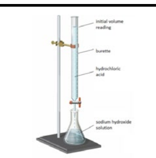
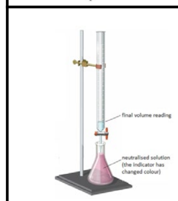
	2. Fill the burette with acid and note the starting volume. Slowly add the acid from the burette to the alkali in the conical flask, swirling to mix.
	3. Stop adding the acid when the end-point is reached (the appropriate colour change in the indicator happens). Note the final volume reading. Repeat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

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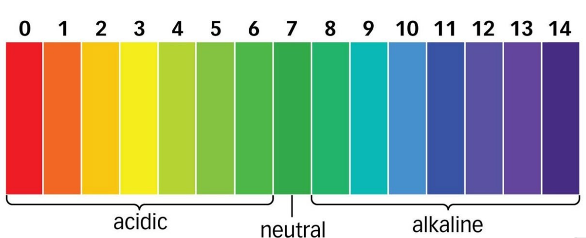

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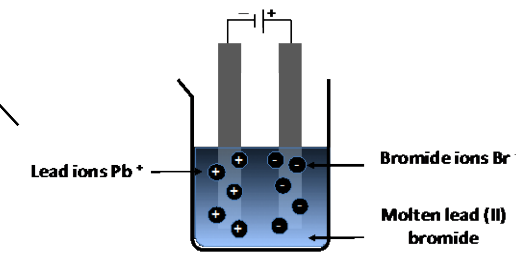
Electrolysis of aqueous solutions

Process of electrolysis		
Electrode		
Where do the ions go?		

Electrolysis

AQA Chemical Changes 2



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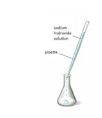
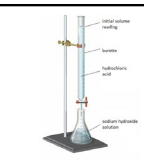
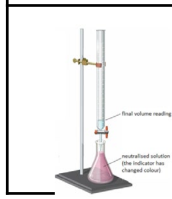
Reactions of acids

Strong and weak acids (HT ONLY)

Strong acids	
Weak acids	
Hydrogen ion concentration	

Titrations (Chemistry only)

	1.
	2.
	

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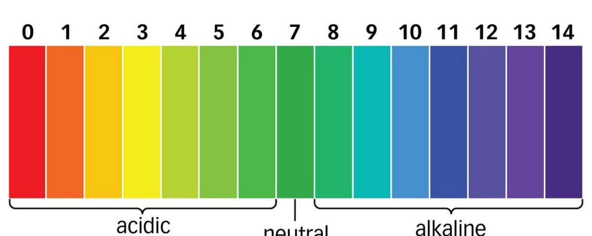

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