CC8: Acids and alkalis knowledge organiser

Lesson 1 Acids, alkalis and indicators

Acids contain Hydrogen ions - H^+
The common acids that you will come across at GCSE are

Hydrochloric acid	HCl	(H^+)
Sulphuric acid	H_2SO_4	($2H^+$)
Nitric acid	HNO_3	(H^+)

These are all acids as they produce hydrogen ions H+ in solution

How acidic a solution is depends on the concentration of hydrogen ions and this can be measured using the pH scale either using an indicator or a pH meter
An indicator is a substance which changes colour in acid/alkali

pH	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Colour of Universal Indicator	Highly acidic			weakly acidic			neutral	weakly alkaline			Highly alkaline			
	Red		orange		yellow		green		purple			blue		

Universal indicator is not good for doing titrations. For this you need either Phenolphthalein or methyl orange

Indicator	Colour in acid	Colour in alkali
Phenol phthalein	colourless	pink
Methyl orange	red	yellow

Lesson 9 Acids and metals

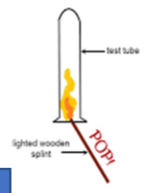
Acids can be neutralised with metals. If the metal is reactive enough hydrogen gas is produced as well as a solution of the salt.

metal + acid → salt + hydrogen **MASH**

magnesium + hydrochloric acid → magnesium chloride + hydrogen

$Mg + 2HCl \rightarrow MgCl_2 + H_2$

The test for hydrogen gas is that it makes a squeaky pop when a lit splint is added



Lesson 10 Acids and metal carbonates

Acids can be neutralised with metal carbonates. Like metal oxides, these are also bases **BUT** In this case carbon dioxide gas is produced as well as salt and water.

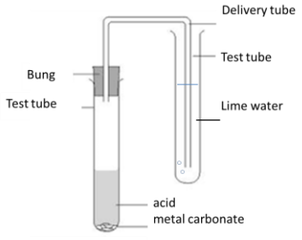
metal carbonate + acid → salt + water + carbon dioxide

calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide

$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$

The test for carbon dioxide gas is that lime water turns milky when carbon dioxide is bubbled through it

NOTE:
A salt can be produced using a Metal Carbonate using the same method as in Lesson 3



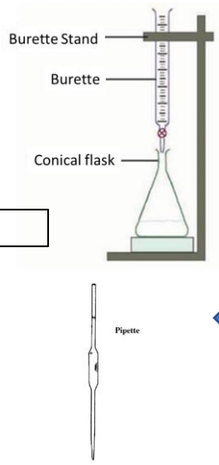
Lesson 8 Titration

To make a salt from an acid and an alkali you need to use a titration

- Using a **pipette** transfer a known volume of alkali into a **conical flask**
- Add a few drops of **indicator**
- Add acid from a **burette** slowly until you are near to the indicator changing colour (end point)

Not universal indicator

- Add the acid drop-wise until the indicator changes colour. Record the volume of acid.
- Repeat the experiment with no indicator.
- Evaporate the water from the solution to leave the salt



Lesson 11 Precipitation reactions and Solubility

Salts that are insoluble can be made using precipitation reactions. In a precipitation reaction the metal and non-metal part of two compound swap round to give two new compounds. If one of these is insoluble it forms a precipitate.

Lead nitrate + potassium iodide → lead iodide + potassium nitrate

$Pb(NO_3)_2 (aq) + 2KI (aq) \rightarrow PbI_2 (S) + 2KNO_3 (aq)$

To prepare an insoluble salt from a precipitation reaction:

1. mix the two solutions together
2. filter off the precipitate (salt)
3. dry

Solubility Rules:

Soluble in water	Insoluble in water
all common sodium, potassium and ammonium salts	
all nitrates	
most chlorides	silver, lead chlorides
most sulfates	lead, barium, calcium sulfates
sodium, potassium and ammonium carbonates	most carbonates
sodium, potassium and ammonium hydroxides	most hydroxides

Lesson 3,4 and 5 Bases + CORE PRACTICAL

A base is a metal oxides e.g. CaO
Bases can neutralise acids to give salt and water only

General equation **base + acid → salt + water**

Hydrochloric acid HCl	Makes Chlorides
Sulphuric acid	Makes Sulphates
Nitric acid	Makes Nitrates

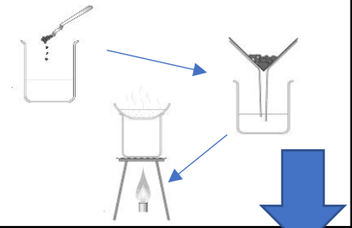
The salt that is made depends on the acid used and the base

Word equation copper oxide + sulphuric acid → copper sulphate + water

Symbol equation $CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$

A salt can be made by the reaction of an acid and a base. For example you can make copper sulphate by reacting copper oxide with sulphuric acid

- Add excess base to acid to neutralise all the acid
- Filter off the excess base
- Evaporate the water from the solution to get crystals of the salt



Lesson 6 and 7 Alkalis & Neutralisation + CORE PRACTICAL

An alkali is a base that is soluble in water = ALL metal hydroxides e.g. NaOH
Alkalis produce hydroxide ions (OH-) when dissolved in water
Since alkalis are bases they react with acid to give salt and water

acid + alkali → salt + water

Hydrochloric acid + sodium hydroxide → sodium chloride + water

$HCl + NaOH \rightarrow NaCl + H_2O$

A reaction in which the hydrogen ions from the acid are removed is a neutralisation reaction. In this case the hydrogen ions from the acid (H+) react with hydroxide ions from alkali (OH-) to make water

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

Summary – Acids and making salts

To make soluble salts neutralise acids use one of the 3 methods. Use a different method if starting with an insoluble base or an alkali

base + acid → salt + water
(Lesson 3 – Oxides OR Lesson 5 - Hydroxides)
metal + acid → salt + hydrogen
(Lesson 6)
metal carbonate + acid → salt + water + carbon dioxide
(Lesson 7)

To make an insoluble salt use a precipitation reaction and use solubility rules
You need to able to:

- Know the names and formulas of common acids
- Know the colour changes for indicators in acid and alkali (not just UI)
- Write word and symbol equations for the neutralisation reactions
- Describe methods for making soluble and insoluble salts
- Explain what happens in neutralisation reaction
- Write ionic equations for neutralisation reactions **(HIGHER)**