

## C6 Chemical synthesis – Revision

Complete these sheets as you watch the power point slides

Chemical synthesis is when chemical products are made for a variety of uses. These uses include:

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**Fine chemicals.** These are made in relatively ..... quantities and are typically high in ..... They include flavourings, ..... and ..... They are made to a high level of .....

**Bulk chemicals.** These are made in ..... amounts. They are ..... and are often used to make other chemicals or to ..... other materials. Examples are ..... and .....

### Formulae:

Chlorine = ..... Hydrogen = ..... Nitrogen = ..... Oxygen = .....

Hydrochloric acid = ..... Nitric acid = ..... Sulfuric acid = .....

Sodium hydroxide = ..... Magnesium hydroxide = .....

Sodium chloride = ..... Magnesium oxide = ..... Potassium chloride = .....

Calcium chloride = .....

Magnesium carbonate = ..... Magnesium sulphate = .....

Sodium carbonate = ..... Calcium carbonate = .....

H ONLY : Complete the table.

Compound	Positive ion	Negative ion	Formula
sodium chloride	Na <sup>+</sup>	Cl <sup>-</sup>	
magnesium chloride	Mg <sup>2+</sup>	Cl <sup>-</sup>	
calcium oxide	Ca <sup>2+</sup>	O <sup>2-</sup>	
aluminium oxide	Al <sup>3+</sup>	O <sup>2-</sup>	
magnesium sulfate	Mg <sup>2+</sup>	SO <sub>4</sub> <sup>2-</sup>	

H ONLY

If magnesium forms Mg<sup>2+</sup> ions, and sulphate forms SO<sub>4</sub><sup>2-</sup> ions.

What are the charges on the ions in the following salts :

1. Magnesium oxide ( $MgO$ ). Oxide ions = .....
2. Magnesium chloride ( $MgCl_2$ ). Chloride ions = .....
3. Magnesium nitrate ( $MgNO_3$ ). Nitrate ions = .....
4. Sodium sulphate ( $Na_2SO_4$ ). Sodium ions = .....
5. Aluminium sulphate  $Al_2(SO_4)_3$ . Aluminium ions = .....
6. Calcium sulphate ( $CaSO_4$ ). Calcium ions = .....

Hazard symbols.

For each symbol, write down what they mean.

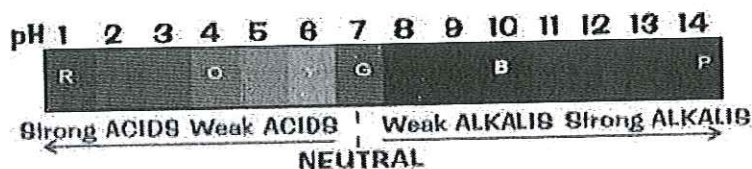


Solid acids include ..... acid and .....acid.  
 Liquid acids include .....acid and .....acid  
 Gaseous acids include .....

Three common alkalis are:

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The pH scale.



pH 1-3 = .....  
 pH 4-6 = .....  
 pH 7 = .....  
 pH 8-10 = .....  
 pH 11-14 = .....

Complete the table with the indicator colours.

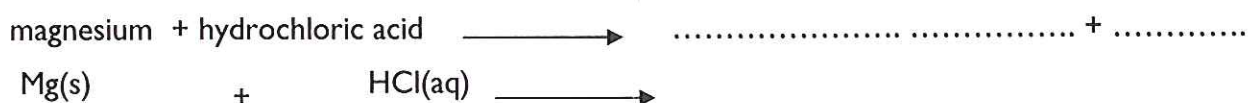
Indicator	colour in acid	colour in neutral	colour in alkali
litmus			
phenolphthalein			
universal			

There are four ways of producing soluble salts by reactions with acids.

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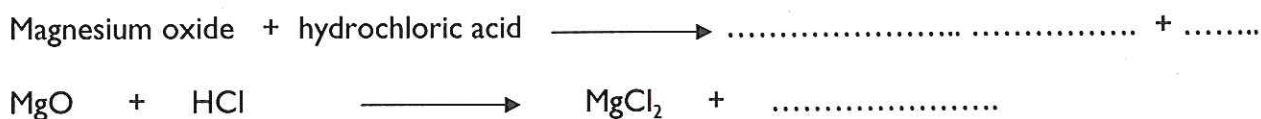
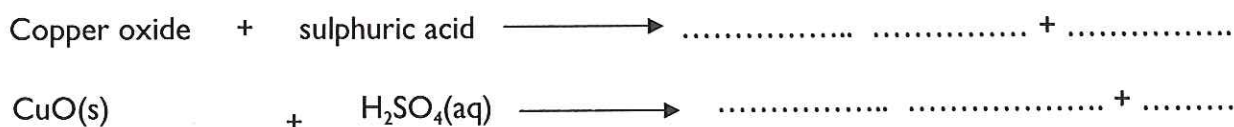
1. Metal and acid

Metal + acid → salt + hydrogen



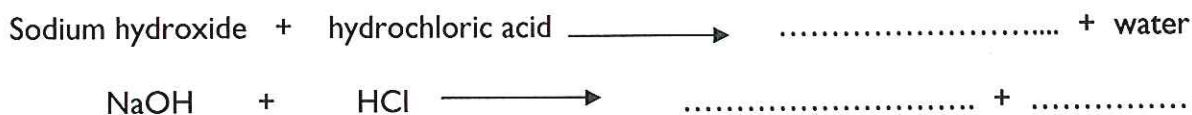
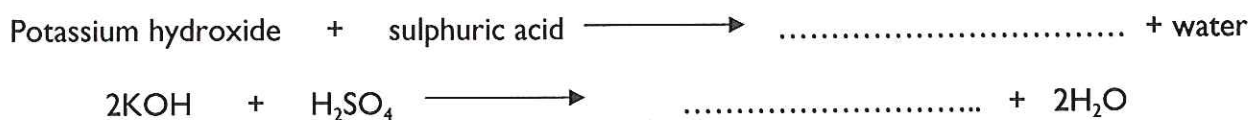
2. Metal oxide and acid.

Metal oxide + acid → salt + water



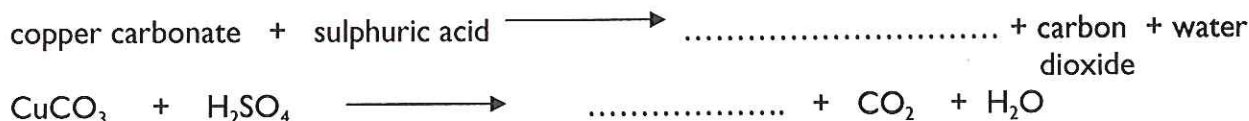
3. Metal hydroxide and acid

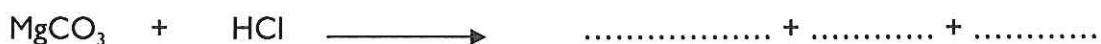
Metal hydroxide + acid → salt + water



4. Metal carbonate and acid

Metal carbonate + acid → salt + carbon dioxide + water





Reacting an acid with an alkali to form a salt is an example of a  
 ..... reaction.

During a neutralisation reaction ..... ions from the acid react with .....  
 ions from the alkali. When the numbers of ..... ions and ..... ions exactly  
 match, then a salt and water are formed in solution with a pH of .....

Acidic substances.

Dissolve in water to form aqueous..... ions ..... Have a pH of ..... than 7.

Can be either solids, liquids or gases.

Form salts with metals and metal compounds.

Alkaline compounds.

Dissolve in water to form aqueous ..... ions..... They form solutions with a  
 pH ..... than 7.

Complete the table to give the names of the salts.

acid	alkali	salt
HCl	NaOH	
H <sub>2</sub> SO <sub>4</sub>	KOH	
HCl	Ca(OH) <sub>2</sub>	
H <sub>2</sub> SO <sub>4</sub>	Mg(OH) <sub>2</sub>	

You need to be able to identify the stages in the chemical synthesis of an inorganic compound.

- choosing the reaction or series of reactions
- risk assessment (chemical and procedural)
- working out the quantities of reactants involved ( H ONLY)
- carrying out the reaction in suitable apparatus in the right conditions (such as temperature, concentration, or the presence of a catalyst)
- separating the produce from the reaction mixture
- purifying the product
- measuring the yield and checking the purity of the product.

Complete the table to describe the purpose of the techniques.

Technique	Purpose
Dissolving	
Crystallisation	
Filtration	
Evaporation	
Drying	
Titration	

There are ..... main grades of chemicals.

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..... is the most ..... ( and most ..... ) It is this grade of chemical that is needed in ..... and ..... eg .....  
Laboratory grade is ..... grade.  
..... grade is ..... grade purity – eg. salt for .....

For the equation below. Identify how many atoms of each element are present as reactants.



Copper (Cu) = ..... Carbon (C) = ..... Oxygen (O) = .....

Hydrogen (H) = ..... Sulfur (S) = .....

Give the relative atomic mass of the following.

$^{17}_{35.5}\text{Cl}$  = .....

$^{11}_{23}\text{Na}$  = .....

Calculate the formula mass of  $\text{CaCO}_3$ .

Calculate the formula mass of  $\text{MgCl}_2$ .

Calculate the formula mass of sulphuric acid  $\text{H}_2\text{SO}_4$ .

Calculate the percentage yield of magnesium chloride. (theoretically 9.5g was expected, yet only 7.4g was produced)

Give three possible reasons why actual yield is lower than theoretical yield.

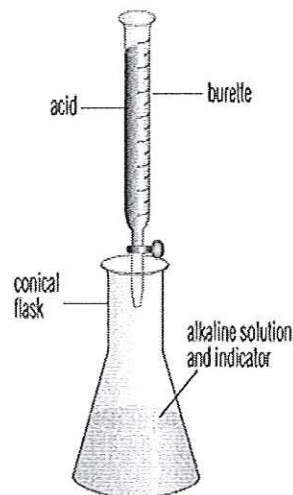
1. ....
2. ....
3. ....

## Titrations.

An acid-base titration is used to find out the concentration of an acid or base by exactly neutralising the acid or base with an acid or base of known concentration.

How to carry out an acid alkali titration:

1. Open tap on burette to let ..... run into the conical flask.
2. Stop the tap at the 1<sup>st</sup> sign of colour .....
3. Note the volume of ..... (This is approximate)
4. Repeat, but add ..... by ..... near the volume noted for greater accuracy. Record exact volume of acid needed for colour change to neutral.



Calculating concentrations using titration results.

In a titration, 50cm<sup>3</sup> of 2M sodium hydroxide was neutralised by 30cm<sup>3</sup> of hydrochloric acid.  
What is the concentration of hydrochloric acid?

1. Write balanced equation.
2. Use the big numbers in front of the formula (if any) to work out the proportion of alkali (NaOH) to acid (HCl).
3. Find out how many moles of sodium hydroxide (NaOH) are present.
4. Calculate acid concentration.

Concentration = (moles x 1000) ÷ volume.

Why is it important to control the rate of a chemical synthesis?

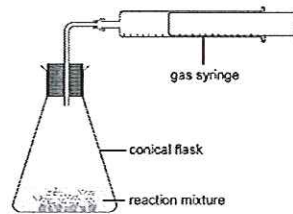
If it is too fast .....

If it is too slow .....

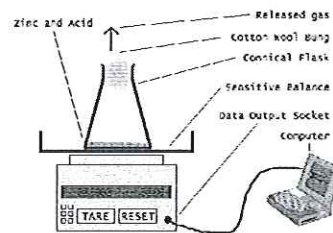
.....  
What is meant by the 'rate of a chemical reaction'?

.....  
The rate of reaction can be measured in different ways.

1. ....

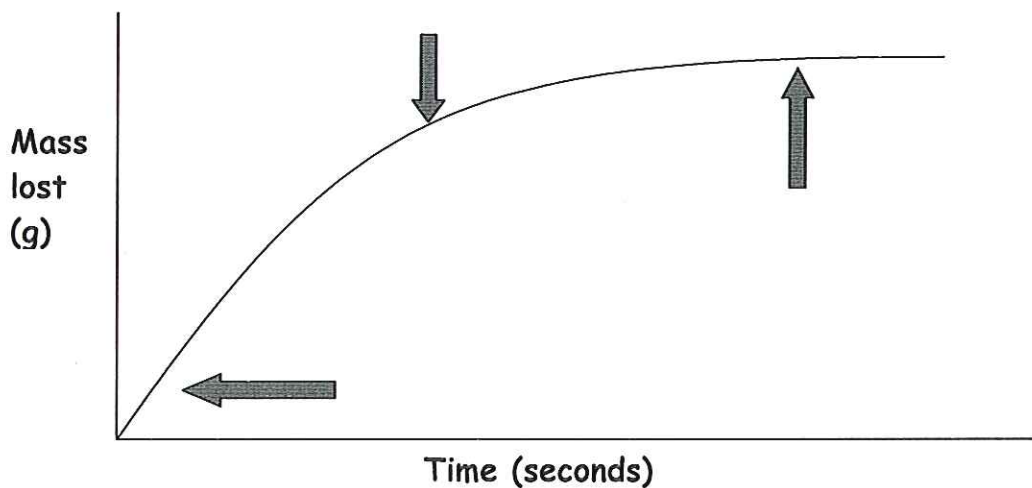


2. ....



3. By observing a colour change or precipitate.

Label the graph to describe what happens during a chemical reaction.



Reaction rates vary with:

- >
- >
- >

To increase the rate of reaction there needs to be .....

Increasing surface area causes rate of reaction to .....

This is because .....

Increasing concentration causes reaction rate to .....

This is because .....

A catalyst .....up a reaction while .....being ..... up in the process.

They are .....