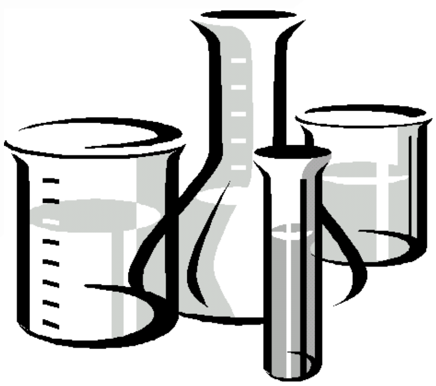
Chem Start

Pre Course Workbook



Name………………………......

Introduction

Firstly, welcome to Chemistry at Wyke.

This booklet has been prepared to help you make the transition from GCSE to A-level. There are summary notes for the topics at GCSE which will be key to A-level study and short exercises with answers provided at the back. These cover the core and additional parts of the AQA course as well as the triple award chemistry. We recognise that you will come from a variety of Science backgrounds and we have plenty of support available to help you all to have a successful time at Wyke. You might find this site useful too, http://www.chemguide.co.uk, it explains some things very well and may help you with unfamiliar sections.

At the end you will find a short exercise based on the work you will have done at Wyke Start. Answers are not provided for this exercise as this section will be marked during your first week at Wyke.

You should bring this booklet to your first lesson where we will recap on some of your GCSE work and collect the booklets to mark your Wyke Start exercise.

In your second lesson you will have an assessment based on the work you did at GCSE. This is to allow you (and us) to find out what you can remember and what you may have forgotten over the summer. We have weekly support sessions in place to assist with any areas where you may need help.

We look forward to seeing you at Wyke.

Have a good summer.

The A-level Chemistry Team

Quotes from Students

'The progress I have made from GCSE to A Level in Chemistry is more than I could have imagined and thanks to the Chemistry Department at Wyke they have made it an easy and fun transition.'

Connor - Heading to Cambridge University to study Natural Sciences

'I have enjoyed my time studying Chemistry at Wyke, it is a challenging subject that requires a lot of time and effort but gives a great deal of satisfaction upon completion.'

Dan - Heading to Bangor University to study Zoology

Atoms, Molecules and Ions.

AN ATOM is the smallest particle of an element. They cannot be split into smaller particles in chemical reactions. Iron is made of iron atoms (Fe). Sulphur is made of sulphur atoms (S)

A MOLECULE is a small group of atoms joined together.
The atoms may be the same (e.g. O_2) or different (e.g. H_2O). The chemical formula shows the number and type of atoms present. Non-metal compounds are made of molecules:

Carbon dioxide contains CO_2 molecules
Methane (natural gas) contains CH_4 molecules

AN ION is an atom or group of atoms with an electrical charge (+ or -). Metal compounds such as sodium chloride or copper sulphate contain ions.

Sodium chloride is made of Na^+ and Cl^- ions
Magnesium Oxide is made of Mg^{2+} and O^{2-} ions

Note that metals form positive ions while non-metals form negative ions.

A solid is represented by (s). e.g. $H_2O_{(s)}$ is ice.
A liquid is represented by (l) e.g. $Fe_{(l)}$ is molten iron.
A gas is represented by (g) e.g. $H_2O_{(g)}$ is steam.
A solution in water is represented by (aq). Salt dissolved in water is $NaCl_{(aq)}$.

You should remember that the common gases are diatomic (have 2 atoms in each molecule). These are Oxygen O_2; Hydrogen H_2; Nitrogen N_2; and the halogens.

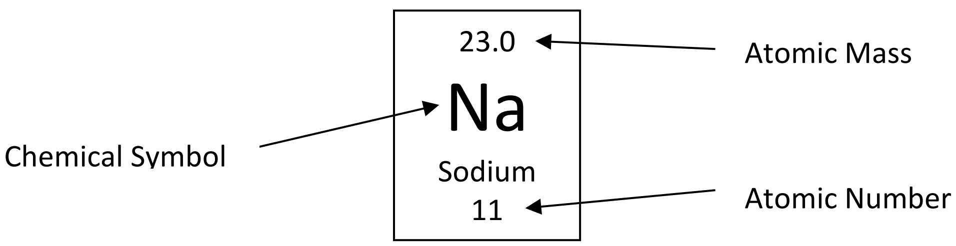
Elementary Particles

Atoms are made up of smaller particles called protons, neutrons and electrons.
The protons and neutrons cluster together in a small nucleus at the centre of the atom while the electrons orbit the nucleus.

The main properties of the particles are:

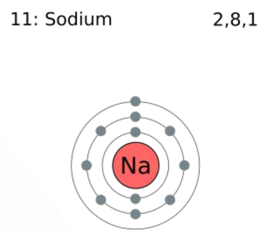
Particle	Mass	Charge
PROTON	1	+1
NEUTRON	1	0
ELECTRON	Very Small	-1

Every element has an atomic number, which is the number of protons in the nucleus.
Atoms are neutral, so that the number of electrons is the same as the number of protons.
The mass of an atom is almost entirely made up of protons and neutrons, which have the same mass as each other (the mass of electrons can be ignored).



Electron Structure

The electrons orbit the nucleus in 'shells'. These can hold the following numbers of electrons:
The innermost shell can contain up to 2 electrons
The next shell can contain up to 8 electrons
The next shell can contain up to 8 electrons (although this can be expanded up to 18)



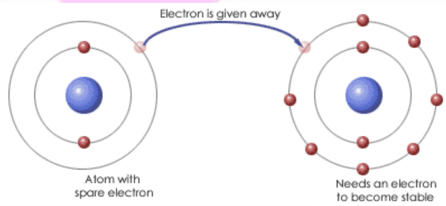
Fluorine has atomic number 9. Its electronic structure is 2.7
Sodium has atomic number 11. Its electronic structure is 2.8.1
Calcium has atomic number 20. Its electronic structure is 2.8.8.2

Ionic and Covalent Bonding

Elements have a tendency to change their electronic structures to become more like noble gases and therefore more stable. They can do this by losing, gaining or sharing electrons.

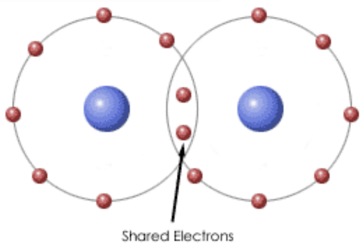
Ionic Bonding

1. Ionic bonding takes place between a metal and a non-metal.
2. The metal atoms lose their outer shell electrons to form positive ions.
3. The non-metal atoms gain these electrons to fill their outer shells and form negative ions
4. The positive and negative ions attract each other in a lattice



Covalent Bonding

1. Covalent bonds are formed between 2 non-metallic elements.
2. The atoms share electrons in order to complete their outer shells.
3. The atoms all attain noble gas structure (complete outer shells).
4. The new particles formed are neutral molecules.



Exercise 1 - Atomic Structure and Bonding

1. Complete the following table:

Particle	Mass	Charge
PROTON		
NEUTRON		
ELECTRON		

2. An element appears in the periodic table as:

27.0
Al
Aluminium
13

a) What is the mass number of this element? ____________________
b) How many electrons does this element have? ____________________
c) How many neutrons does this element have? ____________________
d) What is the electronic structure of this element? ____________________

Structures of Substances

There are 4 main structures which substances can have. These are known as:
SIMPLE MOLECULAR, GIANT COVALENT, GIANT IONIC and GIANT METALLIC

Simple Molecular

Simple molecular substances have small molecules, such as H_2O or CO_2 . The atoms in these molecules are held together by strong forces called covalent bonds, but there are only very weak forces between the molecules. This means:

1) They have low melting and boiling points (many are liquids or gases).
2) They tend to be soft and/or have little strength.
3) They do not conduct electricity

Simple molecular substances are nearly always non-metallic elements or their compounds.
e.g. Water (H_2O), Iodine (I_2), Carbon dioxide (CO_2), Sugar ($C_{12}H_{22}O_{11}$).

Giant Covalent Substances

In these substances, strong covalent bonds join atoms together in large numbers to make giant structures. Sand (silicon dioxide), diamond and graphite (both forms of carbon) are examples.
Diamond has a 3 dimensional structure where each carbon is bonded to 4 others. Diamond is extremely hard, does not dissolve and does not conduct electricity.
Graphite has a layer structure. In each layer the carbons are bonded to 3 other carbon atoms. The layers can slip over each other making graphite soft and slippery (it is used in pencil leads)
Silicon Dioxide is similar to diamond in the arrangement of its atoms.

Metals

Metals have atoms in layers. These layers can slide over each other so that metals can be bent or shaped. Metals are also strong and hard. Metallic bonding involves positive ions in a sea of delocalised electrons.

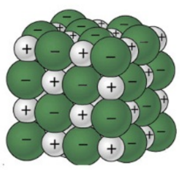
Giant Ionic Structures

Compounds of metals, such as sodium chloride (NaCl) or copper sulphate ($CuSO_4$) are made up of positive metal ions (e.g. Na^+) and negative non-metal ions (e.g. Cl^-).
The ions are arranged in a regular lattice so positive and negative ions are arranged alternately in 3 dimensions.

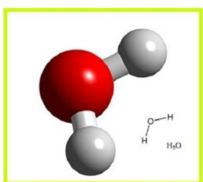
1) They have high melting and boiling points.
2) They are hard but brittle (shatter easily)
3) They conduct electricity *only when melted or dissolved in water.*
4) Many ionic substances are soluble in water.

Exercise 2 - Bonding

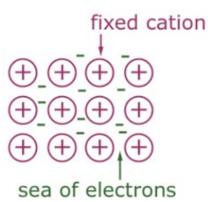
What type of bonding is represented by the following diagrams:



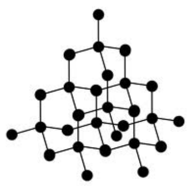
a) _______________



b) _______________



c) _______________



d) _______________

Calculations Summary

Formula masses (A_r and M_r)

The A_r is the relative atomic mass from the periodic table. The A_r values of the atoms in a formula are added to get the formula mass or M_r

H_2SO_4 = 2 x 1 + 32 + 4 x 16 = 98

$Mg(NO_3)_2$ = 24 + (14 + 3 x 16) x 2 = 148

Percentage Calculations

If you need to find the percentage of an element E in a compound, you use formula

$$Percentage\ of\ E = \frac{A_r\ of\ E\ \times No.of\ atoms\ of\ E}{M_r\ of\ compound} \times 100$$

e.g. Find the percentage of nitrogen in ammonium nitrate (NH_4NO_3)

a) M_r of N = 14
b) No. of N atoms = 2
c) M_r of ammonium nitrate = 14 + 4 x 1 + 14 + 3 x 16 = 80

$$Percentage\ of\ N = \frac{14\ \times 2}{80} \times 100 = 35\%$$

Atom Economy

This is given as:

$$Atom\ Economy = \frac{Mass\ of\ all\ molecules\ of\ Useful\ Product}{Mass\ of\ all\ molecules\ of\ reactants} \times 100$$

Eg. Atom economy for making iron from the equation

$Fe_2O_3 + 3CO = 2Fe + 3CO_2$

(Mr : Fe_2O_3 =160, CO = 28, Fe = 56, CO_2 =44)

Mass of useful product (iron atoms) = 2 x 56 = 112
Mass of all reactants = 160 + (3x28) = 244

$$Atom\ Economy = \frac{112}{244} \times 100 = 45.9\%$$

Percentage Yield

To find the percentage yield, divide the mass obtained in an experiment by the maximum mass which could have been obtained and multiply by 100.

e.g. the maximum mass of alcohol which could be obtained by fermenting some sugar is 4.6g of alcohol. The actual mass obtained in an experiment was 3.5g. Find the % yield.

$$\%Yield = \frac{3.5}{4.6} \times 100 = 76\%$$

Exercise 3 - Calculations

1. Use a periodic table to calculate the relative atomic mass, M_r, of the following:

a) H_2O ______________ b) HNO_3 _______________

c) $Mg(OH)_2$ _______________ c) $(NH_4)_2SO_4$ _______________

2. Use a periodic table to calculate the following percentages:

a) N in NH_3 _______________ b) C in CH_3COOH ______________

c) O in $Ba(OH)_2$ ______________ d) Fe in $Fe_2(SO_4)_3$ _______________

3. Calculate the atom economy for the production of sodium chloride in the following reaction:

$$HCl + NaOH \rightarrow NaCl + H_2O$$

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4. Calculate the atom economy for the production of copper sulphate in the following reaction:

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

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5. The expected mass in a synthesis of aspirin was 2.61g. The actual mass produced was 1.03g. Calculate the percentage yield.

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Rates of Reaction

There are 4 main ways of controlling the rate of a reaction:

Catalysts

Catalysts are substances which increase the rate of chemical reactions without being chemically changed. They do this by providing a different route for the reaction with a lower activation energy. Enzymes are biological catalysts.

Examples of catalysts are:

NAME	PURPOSE
Aluminium Oxide	Cracking of Oil
Iron	Manufacture of ammonia

Catalysts are very valuable in chemical industry, since they can be reused and they provide a much cheaper way of speeding up a reaction than heating, so providing cheaper goods.

Temperature

Another way of controlling the rate of a reaction is by temperature. A rise of 10°C will roughly double the rate of a reaction. This is because at higher temperature, the particles move faster, they therefore collide more often and with more energy. This makes the reaction faster.
Cooling down a reaction will make it slower, this means that food will deteriorate more slowly at low temperatures (e.g. in a fridge or freezer)
Remember that raising temperature does not make any difference to the amount produced, only to the speed of the reaction.

Concentration

The concentration of a solution is the amount of substance dissolved in a solution..
Reactions happen more quickly when concentrated solutions are used because the particles are closer and so are more likely to collide and react.

Pressure

When gases are at high pressure, their particles are closer, and so are more likely to collide and react.

Surface Area

Solids in powder form will react much more quickly than those in lump form. This is because the powder particles have much more surface area exposed to the other reactant. If a lump is used, only the outside of that lump can react.

Summary

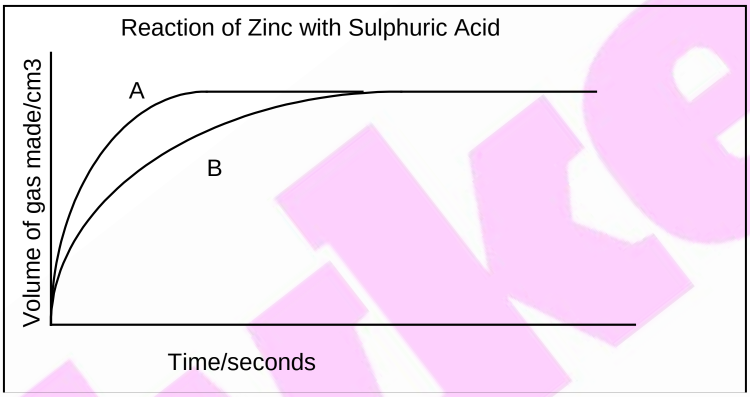
If we take a reaction such as the reaction between zinc an sulphuric acid:

ZINC + SULPHURIC ACID → ZINC SULPHATE + HYDROGEN

The rate of this reaction can be measured by seeing how much hydrogen gas is given off in one minute. This rate can be increased by:

1) Raising the temperature of the reaction.
2) Using more concentrated sulphuric acid.
3) Using powdered zinc rather than lumps.
4) Adding some copper, which acts as a catalyst.

The rate of a reaction can be measured and followed on a graph, e.g.



Curve A represents a reaction between powdered zinc and sulphuric acid, while curve B represents a reaction between lumps of zinc and the same amount of sulphuric acid. You should note:

a) That a steeper curve (A) represents a faster reaction.
b) That the curves start steeply, but then level off. This is because the concentration of the acid is high at the start of the reaction, but gets less as the acid is used up and eventually stops.
c) That the amount of gas made by the end of the reaction is the same as long as the amounts of reactants are the same. The rate of a reaction does not affect the final amount of product made.

Measuring the Rate of a Reaction

The rate of a reaction is defined as:

$$Rate = \frac{Amount\ of\ reactant\ used\ up\ \mathbf{or}\ Amount\ of\ product\ formed}{Time\ taken}$$

A reaction can be followed in various ways, e.g. by seeing how much mass is lost in a certain time, or how much gas is produced in a certain time.

For instance, a number of similar experiments can be done under similar conditions, e.g. when reacting limestone with hydrochloric acid, different concentrations of hydrochloric acid could be used and the time taken to collect a boiling-tube of gas ($50cm^3$) could be compared.

Also, the rate of a reaction changes as it proceeds. When the reaction starts, the reactants are quite concentrated, but as it goes on, the reactants become less concentrated, and the reaction slows down and eventually stops.

The following reaction shows the thermal decomposition of Copper Carbonate:

$$CuCO_3(s) \rightarrow CuO(s) + CO_2(g)$$

1) Give two ways in which the rate of this reaction could be speeded up.

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2) For each way of speeding up the reaction explain why the reactions would speed up.

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3) Describe how you would measure the rate of this reaction.

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Energy changes in reactions

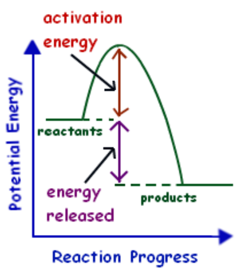
Reactions which give out energy are called **Exothermic**. They cause the temperature to rise. Many reactions are exothermic, including all burning (combustion) reactions

e.g. $2Mg + O_2 \rightarrow 2MgO$

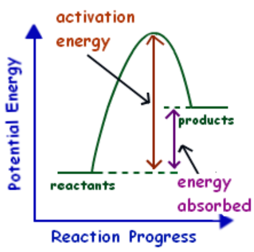
Reactions which take in energy are called **Endothermic**. They may cause the temperature to fall. Thermal decompositions are always endothermic

e.g. $CaCO_3 \rightarrow CaO + CO_2$

Some reactions require an initial input of energy to start the reaction (called the activation energy) but are exothermic. E.g. the match to light the fire.



Exothermic reaction



Endothermic reaction

Reversible reactions

If a reaction is exothermic in one direction, it will be endothermic in the other direction and the amount of heat given out by the exothermic reaction will be equal to the amount of heat taken in by the endothermic reaction.

e.g. HYDRATED COPPER SULPHATE ↔ ANHYDROUS COPPER SULPHATE + WATER
(Blue) (White)

If the hydrated copper sulphate is heated, it turns white as the water is given off. This requires energy so the forward reaction is endothermic.

When water is added to anhydrous copper sulphate, it turns blue and heat is given out so the reverse reaction is exothermic. This reaction is sometimes used as a test for water.

In any industrial process it is necessary to minimise the amount of energy used. This makes the process cheaper, and does less harm to the environment. In general non-vigorous conditions should be used.

Energy Calculations

The energy produced by a reaction can be used to heat water. The energy gained by the water is the same as the energy given out by the reaction. We can calculate the energy gained by the water using the following equation:

$$Q = mc\Delta T$$

Q = the energy gained by the water
m = the mass of the water
c = the specific heat capacity of the water (usually taken as 4.2 $J\ g^{-1}\ K^{-1}$)
ΔT = the temperature change of the water

e.g. A methanol burner is used to heat 50g of water. The temperature of the water raises by 20^{o}C. The energy gained by the water can be calculated as follows.

$$Q = mc\Delta T \ = 50 \ \times 4.2 \ \times 20 = 4200\,J$$

The energy changes for a reaction are usually given per mole and have the symbol ΔH. We can calculate ΔH using the following equation when n is the number of moles:

$$\Delta H = \frac{-Q}{n}$$

Note the negative sign is used so that if Q is positive (i.e. the water has gained energy) then ΔH would be negative (the reaction is exothermic and has given out energy) and vice versa.

e.g. If in the example above 0.006 moles of methanol was burnt then the energy change per mole could be calculated by:

$$\Delta H = \frac{-Q}{n} = \frac{-4200}{0.006} = -700000\,J\,mol^{-1} = -700\,kJ\,mol^{-1}$$

Exercise 5 - Energy Calculations

1) A propane burner is used to heat 100g of water. The water temperature rises by $50^{o}C$.

a) Calculate the energy gained by the water.

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b) If 0.01 moles of propane have been burnt what is the energy change per mole?

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2) 200g of water are heated by 0.02 mol of ethanol. The temperature of the water rises by $28^{o}C$.

a) Calculate the energy gained by the water.

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b) Calculate the energy change per mole of ethanol.

____

____

____

____

Electrochemistry

Conductors

Metals and graphite are the only solids which conduct electricity, but no chemical change is involved. Liquid (melted) metals also conduct, but again there is no chemical change.

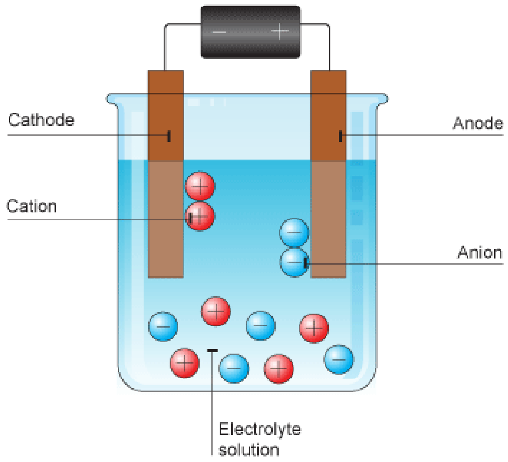
Electrolytes

These are liquids which conduct electricity, and are decomposed by it. They are ionic substances which are dissolved in water or have been melted. This includes all acids and metal compounds.

Examples: Copper sulphate solution, iron chloride solution, molten sodium chloride, dilute sulphuric acid. Non-electrolytes are covalent substances, e.g. pure water, sugar solution, alcohol, petrol.

Electrolysis

This is when an electric current passes through an electrolyte.



Electrons enter the solution through the negative electrode (cathode), cause a chemical change and leave by the positive electrode (anode).

Molten electrolytes are split into their elements by electrolysis.
The metal is produced at the cathode (-),
while the non-metal is produced at the anode (+)

e.g. Lead Bromide (molten) → Lead (at the cathode) + Bromine (at the anode)
Aluminium Oxide (molten) → Aluminium (cathode) + Oxygen (anode)

With aqueous electrolytes, the electrolyte is also split up, but if the metal is reactive, then hydrogen from the water is produced at the cathode in place of the metal.

e.g. Copper chloride (aq) = Copper (at the cathode) + Chlorine (at the anode)
Sodium chloride (aq) = Hydrogen (at the cathode) + Chlorine (at the anode)

The lower in the reactivity table a metal is (including hydrogen), the more likely it is to be released at the cathode.

Electrolysis of Sodium Chloride Solution

When sodium chloride solution is electrolysed a number of useful products are formed.

1) Hydrogen is given off at the cathode. (cathode is -, hydrogen ions are +)
(**Not** sodium as reactive metals cannot be released when solutions are electrolysed)
2) Chlorine is given off at the anode (anode is + chloride ions are -)
3) Sodium hydroxide is left in solution

Acids and alkalis

Acids

1) They are corrosive.
2) They have a pH of less than 7
3) They react with and neutralise bases.
4) They produce hydrogen (H^+) ions in water.

Examples:

Sulphuric acid	H_2SO_4
Hydrochloric acid	HCl
Nitric acid	HNO_3

Bases

1) Bases react with and neutralise acids.
2) Metal oxides and metal hydroxides are bases
3) ALKALIS are soluble bases
4) Alkalis produce OH^- ions in water.

Examples:

1) These are soluble and are therefore alkalis as well as bases:

Sodium hydroxide	NaOH
Calcium hydroxide	$Ca(OH)_2$
Ammonia	NH_3

2) These bases are insoluble:

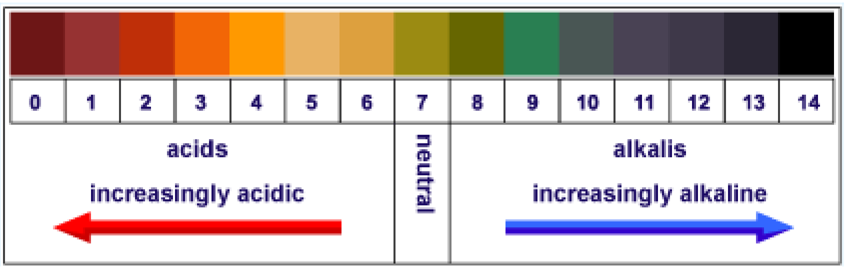
Magnesium oxide	MgO
Copper oxide	CuO

Salts

These are crystalline substances, generally compounds of metals. They are formed when an acid neutralises a base. The salt is formed when hydrogen in an acid is replaced by metal atoms.

Sodium chloride	NaCl (A salt of hydrochloric acid, HCl)
Copper sulphate	$CuSO_4$ (A salt of sulphuric acid H_2SO_4)
Potassium nitrate	KNO_3 (A salt of nitric acid HNO_3)

The pH Scale



Reactions of acids

1) Acids react with and neutralise bases

ACID + BASES → SALT + WATER

The name of the salt comes from the metal in the base and a word derived from the acid

- Sulphuric acid gives sulphates
- Nitric acid gives nitrates
- Hydrochloric acid gives chlorides

e.g. Sodium hydroxide + sulphuric acid → sodium sulphate + water

Ammonia reacts with acids to give ammonium salts such as ammonium nitrate. These are valuable fertilisers

2) Acids react with metals (except for the unreactive metals such as copper, silver and gold)

ACID + METAL → SALT + HYDROGEN
e.g. Zinc + sulphuric acid → zinc sulphate + hydrogen

Neutralisation

To find out the neutralisation point for an acid-alkali reaction, various techniques can be used:

1) When Universal Indicator becomes pale green (pH7)
2) When a pH meter indicates that the pH is 7

Therefore when an acid reacts with an alkali, H+ ions from the acid react with OH- ions from the alkali to make water

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

Exercise 6 - Acids and Bases

1) Would the following be above, below or equal to 7 on the pH scale?

a) H_2SO_4 _________ b) Water _________ c) KOH __________

d) NaO _________ e) NaCl _________

2) Complete the following reactions:

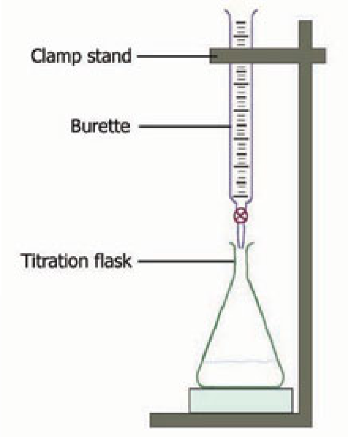
a) HCl + KOH →

b) HNO_3 + NaOH →

c) HCl + $Mg(OH)_2$ →

d) H_2SO_4 + Na →

Concentration, volume and moles are linked by the following equation:



$$n = CV$$

n = number of moles
C = concentration (in mol dm^{-3})
V = volume (dm^3)

Remember that 1 dm^3 = 1000 cm^3

So to work out the number of moles in a 250 cm^3 solution of concentration 0.1 mol dm^{-3}:

$$n = CV = 0.1 \times \frac{250}{1000} = 0.025mol$$

An unknown concentration of an acid or alkali can be determined by titration. An indicator is used to determine at which point neutralisation has been reached. Suitable indicators you may have come across are:

Indicator	**Colour in Acids**	**Colour in Alkalis**
Methyl Orange	*Red*	*Orange*
Phenolphthalein	*Colourless*	*Pink*

Titration Calculations

The unknown concentration is worked out by titrating with a solution of known concentration. The following is an example question and answer.

25 cm^3 of sodium hydroxide solution requires 20 cm^3 of 0.1 mol dm^{-3} hydrochloric acid for neutralisation. What is the concentration of the sodium hydroxide?

Firstly work out the number of moles of acid added (remember volume should be in dm^3):

$$n = CV = 0.1 \times \frac{20}{1000} = 0.0020mol$$

Next look at the balanced chemical equation:

$$HCl + NaOH \rightarrow NaCl + H_2O$$

This tell us that 1 mol of HCl reacts with 1 mol of NaOH, so if 0.0020 mol of HCl was used then there must have been 0.0020 mol of NaOH.

Now the concentration of the sodium hydroxide can be worked out:

$$C = \frac{n}{V} = \frac{0.0020}{25/1000} = 0.08mol$$

Exercise 7 - Titration Calculations

1) How many moles are there in 200 cm^3 of a 0.2 mol dm^{-3} solution.

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2) If a 50 cm^3 solution contains 0.004 moles what is the concentration?

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3) 25 cm^3 of sodium hydroxide solution requires 15 cm^3 of 0.2 mol dm^{-3} hydrochloric acid for neutralisation. What is the concentration of the sodium hydroxide?

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____

____

4) 20 cm^3 of potassium hydroxide solution requires 22.6 cm^3 of 0.1 mol dm^{-3} hydrochloric acid for neutralisation. What is the concentration of the potassium hydroxide?

____

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____

5) 25 cm^3 of sodium hydroxide solution requires 10 cm^3 of 0.1 mol dm^{-3} sulphuric acid for neutralisation. What is the concentration of the sodium hydroxide? (Careful with balancing the equation here)

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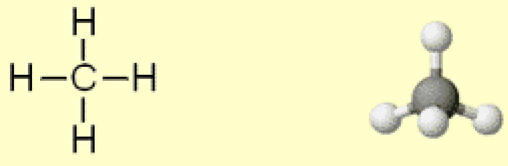
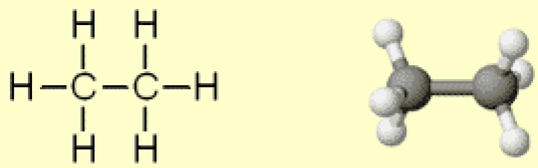
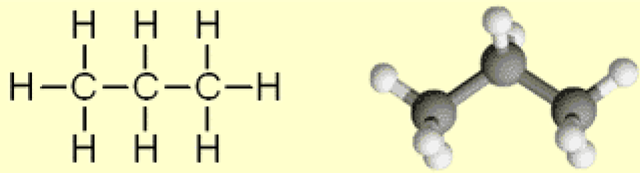
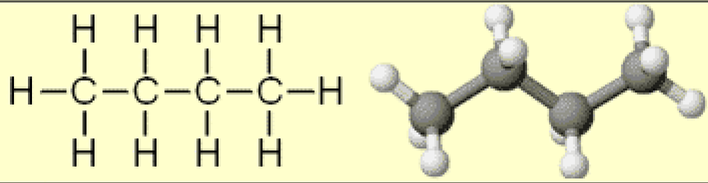
Organic chemistry concerns molecules containing carbon. The carbon atoms are usually joined together in rings or chains and each carbon atom has four bonds.

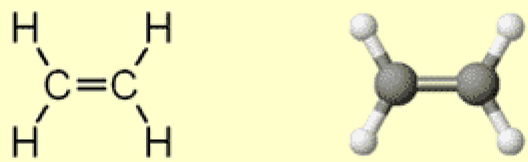
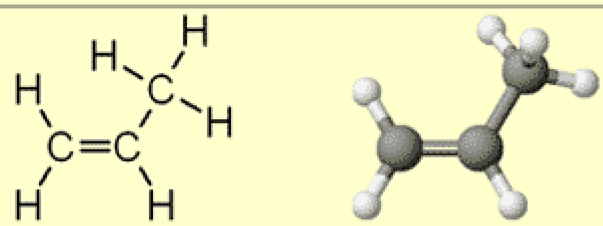
Alkanes

Alkanes just contain chains of carbon with the remaining bonds being to hydrogen atoms. Their names end with the letters -ane. The first part of the name depends on how many carbons are in the chain.

methane CH_4	
ethane C_2H_6	
propane C_3H_8	
butane C_4H_{10}	

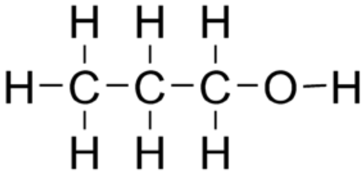
Alkenes

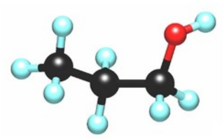
Alkenes are like alkanes but they contain a double bond so they are known as unsaturated hydrocarbons. Their names end with the letters -ene. Again, the first part of the name depends on how many carbons are in the chain.

ethene C_2H_4	
propene C_3H_6	

Alcohols

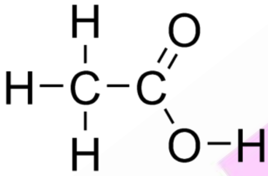
Alcohols are organic molecules which contain an -OH group attached to the chain. Their names end with the letters -ol. The molecule shown below is propanol.

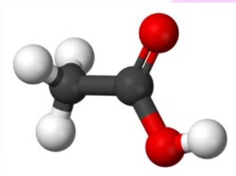




Carboxylic Acids

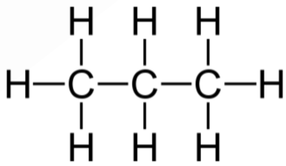
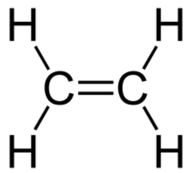
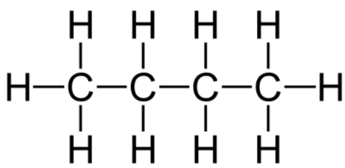
Carboxylic acids contain the functional group -COOH. Their names end with the letters -oic acid. The molecule shown below is ethanoic acid which is found in vinegar.





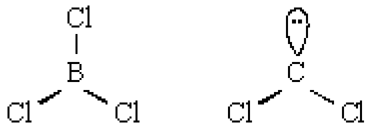
Exercise 8 - Organic molecules

Complete the following table (an example is given):

Name	'Family'	Displayed formula
Propane	Alkane	
Ethanol		
		
		
Propanoic acid		

The following questions build on the work you did at Wyke Start. Use what you have learnt and the internet to help you answer these questions. Note there are no answers to these questions in this booklet.

1) (a) The shape of the molecule BCl_3 and that of the unstable molecule CCl_2 are shown below.



(i) Why is each bond angle exactly 120° in BCl_3?

....

....

(ii) Predict the bond angle in CCl_2 and explain why this angle is different from that in BCl_3

Predicted bond angle ....

Explanation ....

....

(5)

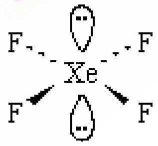
(b) Give the name which describes the shape of molecules having bond angles of 109.5°. Give an example of one such molecule.

Name of shape ....

Example ....

(2)

(c) The shape of the XeF_4 molecule is shown below.



(i) State the bond angle in XeF_4

....

(ii) Suggest why the lone pairs of electrons are opposite each other in this molecule.

....

....

(iii) Name the shape of this molecule, given that the shape describes the positions of the Xe and F atoms only.

....

(4)
(Total 11 marks)

What else can I do now that would help prepare me for A Level Chemistry

Chemistry is an academically challenging course and most students do find the start of their A level study demanding. The key to success is, as ever, good preparation. How can you prepare? You need to be comfortable with the basic Chemistry from your GCSE course, most importantly: 'Bonding and Structure', 'Periodicity', 'Chemical Formulae', 'Moles and Chemistry Calculations' and 'Balancing Equations'. Now that you have attended our WykeStart sessions over the summer you need to complete the induction materials to help prepare you but you should also take time to a look at these websites (particularly Chemguide)

http://www.gcsechemistry.co.uk		Some good free resources here
http://www.bbc.co.uk/schools/gcsebitesize/chemistry		Good basic material see GCSE AQA core and additional.
http://www.docbrown.info/page19/AQAchemistryAS.htm		Excellent revision material for all levels 'Dr Brown's site' (but you have to rummage a bit)
http://www.webelements.com http://www.chemsoc.org/viselements/ http://www.theodoregray.com		Useful sources of information on each of the elements. Nice videos of explosions etc.
http://www.s-cool.co.uk		Excellent revision source for both GCSE and ALevel.
http://www.chemguide.co.uk		The best A-Level site very thorough and quite easy to navigate
http://www.mp-docker.demon.co.uk		Includes revision quizzes specific to A-Level

There are also many revision guides on the market. They all offer similar help, their efficacy is probably determined by what works for you.

Your first few weeks of the course are very important and we will carefully monitor your progress and offer support and advice where necessary. Above all, you must be honest with yourself and undertake additional work/come to support sessions as appropriate.

Most important of all: enjoy your study of chemistry!

Answers to Exercises

Exercise 1

1.

Particle	Mass	Charge
PROTON	1	+1
NEUTRON	1	0
ELECTRON	Very Small	-1

2. a) 27.0 b) 13 c) 14 d) 2.8.3

Exercise 2

a) Ionic b) Simple molecular c) Metallic d) Giant Covalent

Exercise 3

1. a) 18 b) 63 c) 58.3 d) 132.1
2. a) 87.4% b) 40% c) 18.7% d) 27.9%
3. 76.5% 4. 89.9% 5. 39.5%

Exercise 4

1. Any two of: Use powdered $CuCO_3$
   Increase the temperature
   Use a catalyst

2. Use powdered $CuCO_3$ - Increases surface area for reaction
   Increase temperature - particles have more energy
   Use a catalyst - Lowers activation energy

3. Either: Measure the amount of CO_2 produced in a set time
   Or: Measure the change in mass of the $CuCO_3$

Exercise 5

1. a) 21 000 J b) 2 100 kJ mol^{-1} c) 23 570 J d) 1 176 kJ mol^{-1}

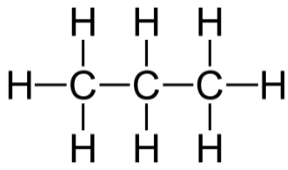
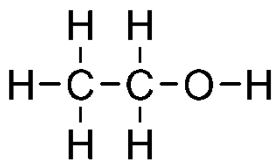
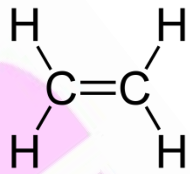
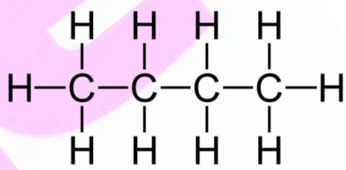
Exercise 6

1. a) Below b) Equal c) Above d) Above e) Above
2. a) $HCl + KOH \rightarrow KCl + H_2O$
   b) $HNO_3 + NaOH \rightarrow NaNO_3 + H_2O$
   c) $2HCl + Mg(OH)_2 \rightarrow MgCl_2 + 2H_2O$
   d) $H_2SO_4 + 2Na \rightarrow Na_2SO_4 + H_2$

Exercise 7

1) 0.04 mol 2) 0.08 mol dm^{-3} 3) 0.12 mol dm^{-3} 4) 0.113 mol dm^{-3} 5) 0.08 mol dm^{-3}

Exercise 8

Name	'Family'	Displayed formula
Propane	Alkane	
Ethanol	Alcohol	
Ethene	Alkene	
Butane	Alkane	
Propanoic acid	Carboxylic Acid