A-level Chemistry Transition Guide

You will be following the AQA Course. This resource is to help students make the transition from GCSE to A level Chemistry.

What will you study?

- Atoms, compounds, molecules and equations
- Amount of substance
- Redox and electrode potentials
- Acid–base and redox reactions
- Transition elements
- Electrons, bonding and structure
- Organic chemistry
- Enthalpy, entropy and free energy
- The periodic table and periodicity
- Polymers
- Group 2 and the halogens
- Organic synthesis
- Reaction rates and equilibrium
- Analytical techniques (IR and MS)
- pH and buffers
- Chromatography and spectroscopy

Emphasis throughout the course is on developing knowledge, competence and confidence in practical skills and problem solving. You will learn how society makes decisions about scientific issues and how sciences contribute to the success of the economy and society

How will you be assessed

- Total of 6 hours of examinations (2 x 2 hours 15 minutes and 1 x 1 hour 30 minutes) taken at the end of the course.

- A wide range of question types including multiple choice, short answer and extended response questions.

To achieve a Practical Endorsement you will be expected through a range of experiments to display your competency in:

- Following procedures

- Applying an investigative approach when using instruments and equipment

- Working safely

- Making and recording observations

- Researching, referencing and reporting

What are the benefits of studying A level Chemistry?

- An interesting and challenging experience to link key chemical ideas and understand how they relate to each other.

- The development of transferable skills including investigating, problem solving, research, decision making, mathematical skills and analytical skills.

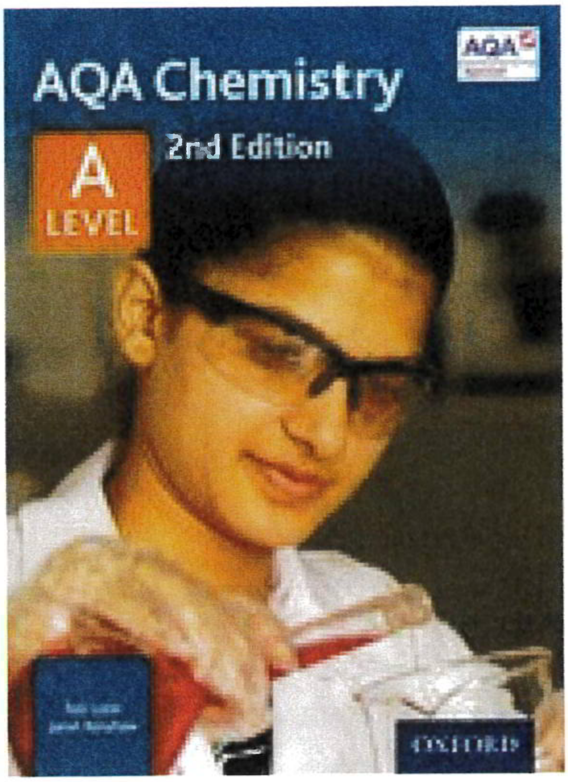
- Opens up a range of possibilities for further study and careers associated with the subject.

Where can A Level Chemistry A take me?

- A Level Chemistry A is an excellent base for a university degree in healthcare such as medicine, pharmacy and dentistry as well as the biological sciences, physics, mathematics, pharmacology and analytical chemistry. Chemistry is also taken by many law applicants as it shows you can cope with difficult concepts. Chemistry can also complement a number of arts subjects.

- A range of career opportunities including chemical, manufacturing and pharmaceutical industries and in areas such as forensics, environmental protection and healthcare. The problem solving skills are useful for many other areas, too, such as law and finance.

What resources will I need for the course?



We will use the A Level Chemistry Student Book. second-hand copy would be suitable.

ISBN: 978-0-19-835182-5
Publication date: 23/07/2015
Paperback: 568 pages

What other resources will be useful?

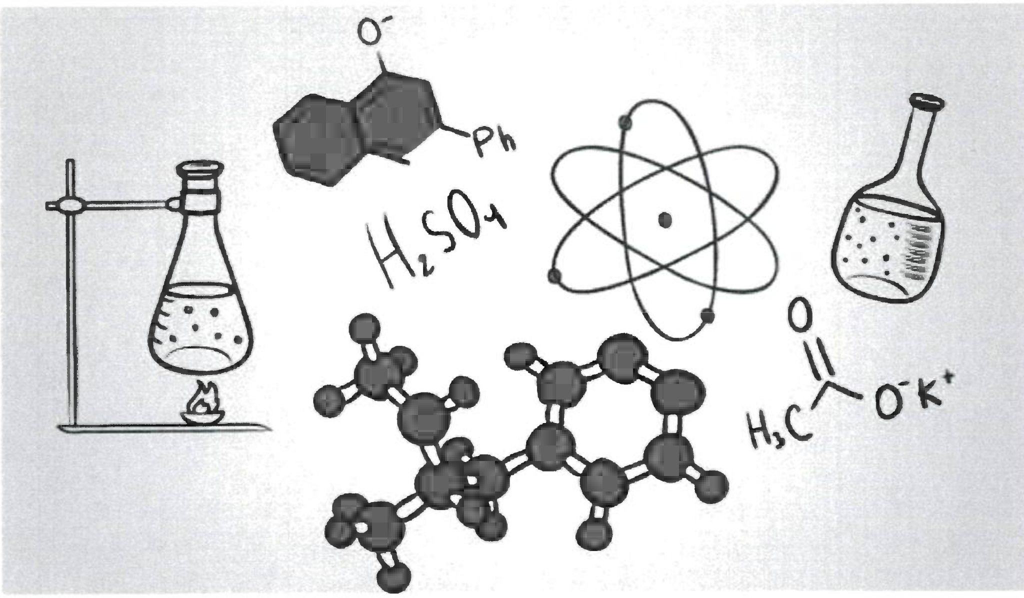
- https://www.chemguide.co.uk/
- https://www.youtube.com/user/MaChemGuy
- https://quizlet.com/en-gb
- https://snaprevise.co.uk/ (some resources are not free)

What do I need to do to prepare for September?

Please complete all of the activities below. You can work on lined paper if you do not wish to print this document.

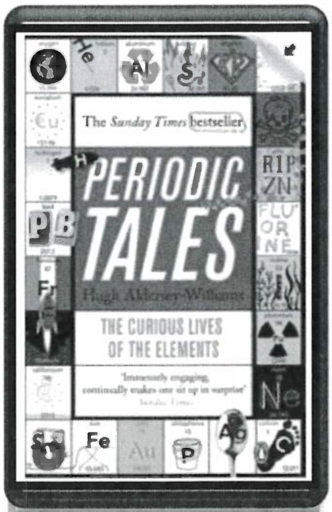
So you are considering A level Chemistry?

This pack contains a programme of activities and resources to prepare you to start A level in Chemistry in September. It is aimed to be used after you complete your GCSE, throughout the remainder of the summer term and over the summer holidays to ensure you are ready to start your course in September.



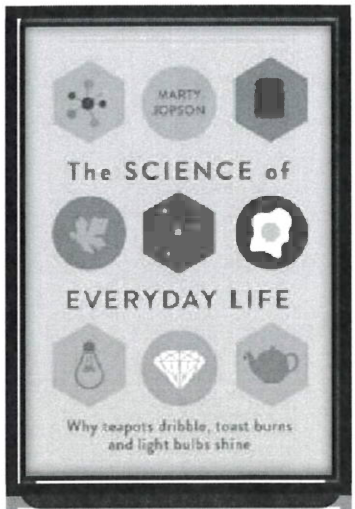
Book Recommendations

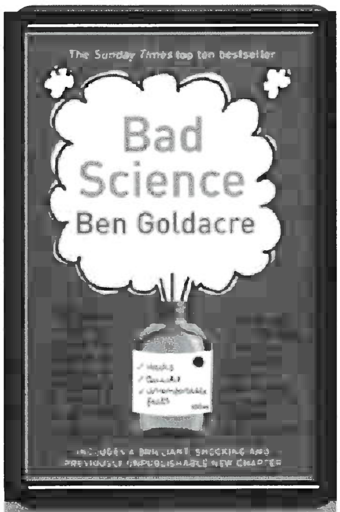
Kick back this summer with a good read. The books below are all popular science books and great for extending your understanding of chemistry



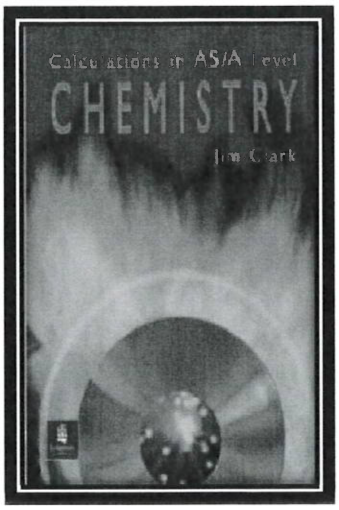
Periodic Tales: The Curious Lives of the Elements
This book covers the chemical elements, where they come from and how they are used. There are loads of fascinating insights into uses for chemicals you would have never even thought about.

The Science of Everyday Life: Why Teapots Dribble, Toast Burns and Light Bulbs Shine
The title says it all really, lots of interesting stuff about the things around your home!

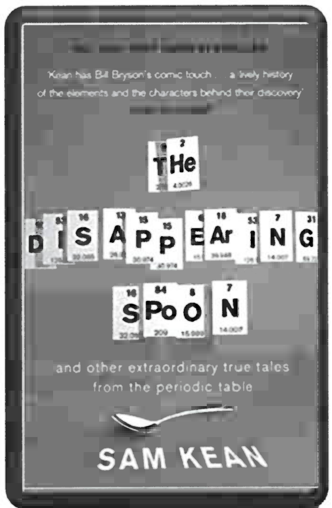




Bad Science
Here Ben Goldacre takes apart anyone who published bad / misleading or dodgy science – this book will make you think about everything the advertising industry tries to sell you by making it sound 'sciencey'.



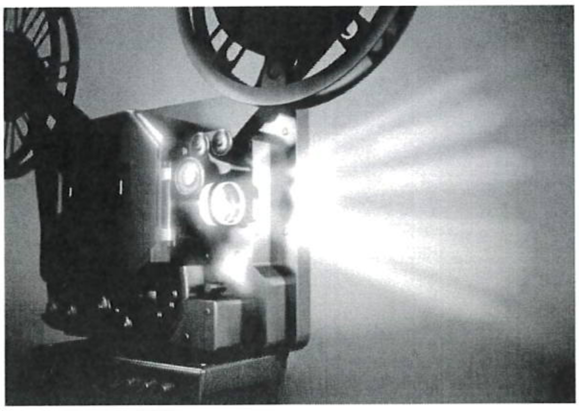
Calculations in AS/A Level Chemistry
If you struggle with the calculations side of chemistry, this is the book for you. Covers all the possible calculations you are ever likely to come across. Brought to you by the same guy who wrote the excellent chemguide.co.uk website.

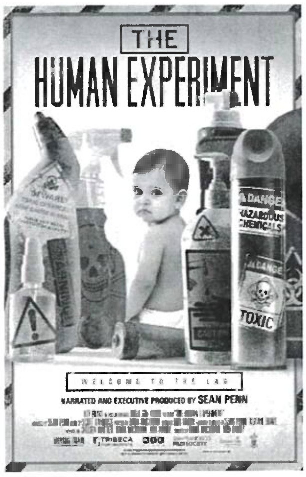


One of our crowning scientific achievements is also a treasure trove of passion, adventure, betrayal and obsession. **The Disappearing Spoon** follows the elements, their parts in human history, finance, mythology, conflict, the arts, medicine and the lives of the (frequently) mad scientists who discovered them.

Movie Recommendations

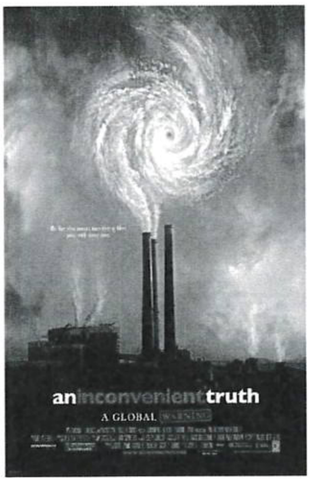
Everyone loves a good story and everyone loves some great science. Here are some of the picks of the best films based on real life scientists and discoveries. You wont find Jurassic Park on this list! We've looked back over the last 50 years to give you our top 5 films you might not have seen before. Great watching for a rainy day.



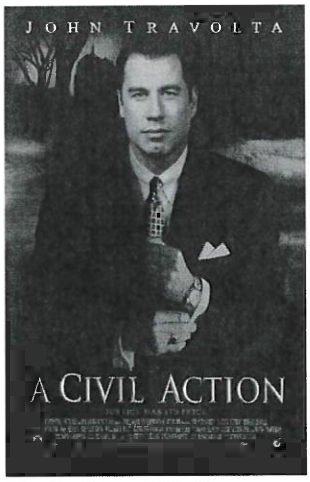


The Human Experiment (2013)
A documentary that explores chemicals found in everyday household products.

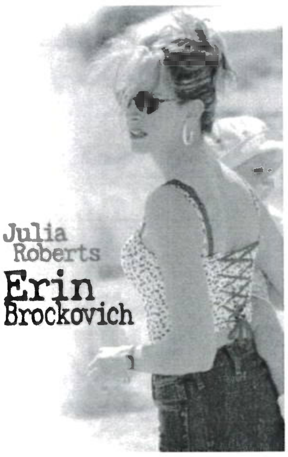
An Inconvenient Truth (2006)
Al Gore, former presidential candidate campaigns to raise public awareness of the dangers of global warming and calls for immediate action to curb its destructive effects on the environment.
(See also: An Inconvenient Sequel, 2017)



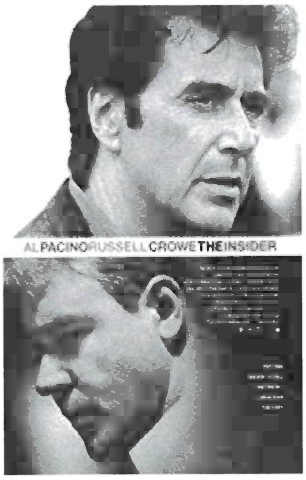
A Civil Action (1998)
A tenacious lawyer takes on a case involving a major company responsible for causing several people to be diagnosed with leukemia due to the town's water supply being contaminated, at the risk of bankrupting his firm and career.



The Insider (1999)
A research chemist comes under personal and professional attack when he decides to appear in a "60 Minutes" expose on Big Tobacco.



Erin Brokovich (2000)
Based on a true story. An unemployed single mother becomes a legal assistant and almost single-handedly brings down a California power company accused of polluting a city's water supply.



Useful information and activities

There are a number of activities throughout this resource. The answers to some of the activities are available on our secure website, e-AQA. Your teacher will be able to provide you with these answers.

Greek letters

Greek letters are used often in science. They can be used as symbols for numbers (such as π = 3.14...), as prefixes for units to make them smaller (eg μm = 0.000 000 001 m) or as symbols for particular quantities (such as λ which is used for wavelength).

The Greek alphabet is shown below.

Α	α	alpha
Β	β	beta
Γ	γ	gamma
Δ	δ	delta
Ε	ε	epsilon
Ζ	ζ	zeta
Η	η	eta
Θ	θ	theta
Ι	ι	iota
Κ	κ	kappa
Λ	λ	lambda
Μ	μ	mu

Ν	ν	nu
Ξ	ξ	ksi
Ο	ο	omicron
Π	π	pi
Ρ	ρ	rho
Σ	ς or σ	sigma
Τ	τ	tau
Υ	υ	upsilon
Φ	φ	phi
Χ	χ	chi
Ψ	ψ	psi
Ω	ω	omega

Activity 1

A lot of English words are derived from Greek ones, but it's difficult to see as the alphabet is so different.

Many of the Greek letters are pronounced like the start of their name. For example, omega is pronounced "o", sigma is pronounced "s" and lambda is pronounced "l".

See if you can work out what the following Greek words mean by comparing the phonetic spelling with similar English words.

Πυθαγόρας	Name of a mathematician
Ωκεανος	Atlantic, Pacific or Arctic...
μόνος	Single
Τηλε	Far or distant
Τρωγλοδύτης	Cave dweller

SI units

Every measurement must have a size (eg 2.7) and a unit (eg metres or °C). Sometimes there are different units available for the same type of measurement, for example ounces, pounds, kilograms and tonnes are all used as units for mass.

To reduce confusion and to help with conversion between different units, there is a standard system of units called the SI units which are used for most scientific purposes.

These units have all been defined by experiment so that the size of, say, a metre in the UK is the same as a metre in China.

The seven SI base units are:

Physical quantity	Usual quantity symbol	Unit	Abbreviation
mass	m	kilogram	kg
length	l or x	metre	m
time	t	second	s
electric current	I	ampere	A
temperature	T	kelvin	K
amount of substance	N	mole	mol
luminous intensity	(not used at A-level)	candela	cd

All other units can be derived from the SI base units.

For example, area is measured in square metres (written as m^2) and speed is measured in metres per second (written as ms^{-1}).

It is not always appropriate to use a full unit. For example, measuring the width of a hair or the distance from Manchester to London in metres would cause the numbers to be difficult to work with.

Prefixes are used to multiply each of the units. You will be familiar with centi (meaning 1/100), kilo (1000) and milli (1/1000) from centimetres, kilometres and millimetres.

There is a wide range of prefixes. The majority of quantities in scientific contexts will be quoted using the prefixes that are multiples of 1000. For example, a distance of 33 000 m would be quoted as 33 km.

The most common prefixes you will encounter are:

Prefix	Symbol	Multiplication factor		
Tera	T	10^{12}	1 000 000 000 000	
Giga	G	10^{9}	1 000 000 000	
Mega	M	10^{6}	1 000 000	
kilo	k	10^{3}	1000	
deci	d	10^{-1}	0.1	1/10
centi	c	10^{-2}	0.01	1/100
milli	m	10^{-3}	0.001	1/1000
micro	μ	10^{-6}	0.000 001	1/1 000 000
nano	n	10^{-9}	0.000 000 001	1/1 000 000 000
pico	p	10^{-12}	0.000 000 000 001	1/1 000 000 000 000
femto	f	10^{-15}	0.000 000 000 000 001	1/1 000 000 000 000 000

Activity 2

Which SI unit and prefix would you use for the following quantities?

1. The mass of water in a test tube.
2. The time taken for a solution to change colour.
3. The radius of a gold atom.
4. The volume of water in a burette.
5. The amount of substance in a beaker of sugar.
6. The temperature of the blue flame from a Bunsen burner.

Sometimes, there are units that are used that are not combinations of SI units and prefixes.

These are often multiples of units that are helpful to use. For example, one litre is 0.001 m^3.

Activity 3

Rewrite the following in SI units.

1. 5 minutes

2. 2 days

3. 5.5 tonnes

Activity 4

Rewrite the following quantities.

1. 0.00122 metres in millimetres

2. 104 micrograms in grams

3. 1.1202 kilometres in metres

4. 70 decilitres in millilitres

5. 70 decilitres in litres

6. 10 cm^3 in litres

Important vocabulary for practical work

There are many words used in practical work. You will have come across most of these words in your GCSE studies. It is important you are using the right definition for each word.

Activity 5

Join the boxes to link the word to its definition.

Accurate	A statement suggesting what may happen in the future.
Data	An experiment that gives the same results when a different person carries it out, or a different technique or set of equipment is used.
Precise	A measurement that is close to the true value.
Prediction	An experiment that gives the same results when the same experimenter uses the same method and equipment.
Range	Physical, chemical or biological quantities or characteristics.
Repeatable	A variable that is kept constant during an experiment.
Reproducible	A variable that is measured as the outcome of an experiment.
Resolution	This is the smallest change in the quantity being measured (input) of a measuring instrument that gives a perceptible change in the reading.
Uncertainty	The interval within the true value can be expected to lie.
Variable	The spread of data, showing the maximum and minimum values of the data.
Control variable	Measurements where repeated measurements show very little spread.
Dependent variable	Information, in any form, that has been collected.

Precise language

It is essential at AS and A-level to use precise language when you write reports and when you answer examination questions. You must always demonstrate that you understand a topic by using the correct and appropriate terms.

For example, you should take care when discussing bonding to refer to the correct particles and interactions between them.

Also, when discussing the interaction between particles in an ionic solid, you would demonstrate a lack of understanding if you referred to the particles as atoms or molecules instead of ions or the interaction between these ions as intermolecular forces rather than electrostatic forces. In this case, use of the incorrect terms would result in the loss of all the marks available for that part of a question.

Take care also to use the word 'chloride' and not 'chlorine' when referring to the ions in a compound such as sodium chloride. The word 'chlorine' should only be used for atoms or molecules of the element.

The periodic table

The periodic table of elements is shown on the back page of this booklet. The A-level course will build on what you've learned in your GCSE studies.

Activity 6

On the periodic table on the following page:

- Draw a line showing the metals and non-metals.
- Colour the transition metals blue.
- Colour the halogens yellow.
- Colour the alkali metals red.
- Colour the noble gases green.
- Draw a blue arrow showing the direction of periods.
- Draw a red arrow showing the direction of groups.
- Draw a blue ring around the symbols for all gases.
- Draw a red ring around the symbols for all liquids.

Key

relative atomic mass
symbol
name
atomic (proton) number

1	2											3	4	5	6	7	0
(1)	*(2)*	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	*(13)*	*(14)*	*(15)*	*(16)*	*(17)*	*(18)*
							1.0 **H** hydrogen 1										4.0 **He** helium 2
6.9 **Li** lithium 3	9.0 **Be** beryllium 4											10.8 **B** boron 5	12.0 **C** carbon 6	14.0 **N** nitrogen 7	16.0 **O** oxygen 8	19.0 **F** fluorine 9	20.2 **Ne** neon 10
23.0 **Na** sodium 11	24.3 **Mg** magnesium 12											27.0 **Al** aluminium 13	28.1 **Si** silicon 14	31.0 **P** phosphorus 15	32.1 **S** sulfur 16	35.5 **Cl** chlorine 17	39.9 **Ar** argon 18
39.1 **K** potassium 19	40.1 **Ca** calcium 20	45.0 **Sc** scandium 21	47.9 **Ti** titanium 22	50.9 **V** vanadium 23	52.0 **Cr** chromium 24	54.9 **Mn** manganese 25	55.8 **Fe** iron 26	58.9 **Co** cobalt 27	58.7 **Ni** nickel 28	63.5 **Cu** copper 29	65.4 **Zn** zinc 30	69.7 **Ga** gallium 31	72.6 **Ge** germanium 32	74.9 **As** arsenic 33	79.0 **Se** selenium 34	79.9 **Br** bromine 35	83.8 **Kr** krypton 36
85.5 **Rb** rubidium 37	87.6 **Sr** strontium 38	88.9 **Y** yttrium 39	91.2 **Zr** zirconium 40	92.9 **Nb** niobium 41	96.0 **Mo** molybdenum 42	[98] **Tc** technetium 43	101.1 **Ru** ruthenium 44	102.9 **Rh** rhodium 45	106.4 **Pd** palladium 46	107.9 **Ag** silver 47	112.4 **Cd** cadmium 48	114.8 **In** indium 49	118.7 **Sn** tin 50	121.8 **Sb** antimony 51	127.6 **Te** tellurium 52	126.9 **I** iodine 53	131.3 **Xe** xenon 54
132.9 **Cs** caesium 55	137.3 **Ba** barium 56	138.9 **La *** lanthanum 57	178.5 **Hf** hafnium 72	180.9 **Ta** tantalum 73	183.8 **W** tungsten 74	186.2 **Re** rhenium 75	190.2 **Os** osmium 76	192.2 **Ir** iridium 77	195.1 **Pt** platinum 78	197.0 **Au** gold 79	200.6 **Hg** mercury 80	204.4 **Tl** thallium 81	207.2 **Pb** lead 82	209.0 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac †** actinium 89	[267] **Rf** rutherfordium 104	[268] **Db** dubnium 105	[271] **Sg** seaborgium 106	[272] **Bh** bohrium 107	[270] **Hs** hassium 108	[276] **Mt** meitnerium 109	[281] **Ds** darmstadtium 110	[280] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

* **58 – 71** Lanthanides	140.1 **Ce** cerium 58	140.9 **Pr** praseodymium 59	144.2 **Nd** neodymium 60	[145] **Pm** promethium 61	150.4 **Sm** samarium 62	152.0 **Eu** europium 63	157.3 **Gd** gadolinium 64	158.9 **Tb** terbium 65	162.5 **Dy** dysprosium 66	164.9 **Ho** holmium 67	167.3 **Er** erbium 68	168.9 **Tm** thulium 69	173.1 **Yb** ytterbium 70	175.0 **Lu** lutetium 71
† **90 – 103** Actinides	232.0 **Th** thorium 90	231.0 **Pa** protactinium 91	238.0 **U** uranium 92	[237] **Np** neptunium 93	[244] **Pu** plutonium 94	[243] **Am** americium 95	[247] **Cm** curium 96	[247] **Bk** berkelium 97	[251] **Cf** californium 98	[252] **Es** einsteinium 99	[257] **Fm** fermium 100	[258] **Md** mendelevium 101	[259] **No** nobelium 102	[262] **Lr** lawrencium 103

Activity 7

Use the periodic table to find the following:

1. The atomic number of: osmium, sodium, lead, chlorine.

2. The relative atomic mass of: helium, barium, europium, oxygen.

3. The number of protons in: mercury, iodine, calcium.

4. The symbol for: gold, lead, copper, iron.

5. The name of: Sr, Na, Ag, Hg.

6. THInK can be written using a combination of the symbols for Thorium, Indium and Potassium (ThInK). Which combinations of element symbols could be used to make the following words?

   AMERICA, FUN, PIRATE, LIFESPAN, FRACTION, EROSION, DYNAMO

Activity 8: research activity

Research either:

The history of the periodic table

OR

The history of models of atomic structure.

Present your findings as a timeline. You should include the work of at least four people. For each, explain what evidence or experiments they used and how this changed the understanding of chemistry.

Relative atomic mass (A_r)

If there are several isotopes of an element, the relative atomic mass will take into account the proportion of atoms in a sample of each isotope.

For example, chlorine gas is made up of 75% of chlorine-35 $^{35}_{17}Cl$ and 25% of chlorine-37 $^{37}_{17}Cl$.

The relative atomic mass of chlorine is therefore the mean atomic mass of the atoms in a sample, and is calculated by:

$$A_r = \left(\frac{75.0}{100} \times 35\right) + \left(\frac{25.0}{100} \times 37\right) = 26.25 + 9.25 = 35.5$$

Activity 9

1. What is the relative atomic mass of Bromine, if the two isotopes, ^{79}Br and ^{81}Br, exist in equal amounts?

2. Neon has three isotopes. ^{20}Ne accounts for 90.9%, ^{21}Ne accounts for 0.3% and the last 8.8% of a sample is ^{22}Ne. What is the relative atomic mass of neon?

3. Magnesium has the following isotope abundances: ^{24}Mg: 79.0%; ^{25}Mg: 10.0% and ^{26}Mg: 11.0%. What is the relative atomic mass of magnesium?

Harder:

4. Boron has two isotopes, ^{10}B and ^{11}B. The relative atomic mass of boron is 10.8. What are the percentage abundances of the two isotopes?

5. Copper's isotopes are ^{63}Cu and ^{65}Cu. If the relative atomic mass of copper is 63.5, what are the relative abundances of these isotopes?

Relative formula mass (M_r)

Carbon dioxide, CO_2 has 1 carbon atom (A_r = 12.0) and two oxygen atoms (A_r = 16.0). The relative formula mass is therefore

$M_r = (12.0 \times 1) + (16.0 \times 2) = 44.0$

Magnesium hydroxide $Mg(OH)_2$ has one magnesium ion (A_r = 24.3) and two hydroxide ions, each with one oxygen (A_r = 16.0) and one hydrogen (A_r = 1.0).

The relative formula mass is therefore:

$(24.3 \times 1) + (2 \times (16.0 + 1.0)) = 58.3$

Activity 10

Calculate the relative formula mass of the following compounds:

1. Magnesium oxide MgO

2. Sodium hydroxide $NaOH$

3. Copper sulfate $CuSO_4$

4. Ammonium chloride NH_4Cl

5. Ammonium sulfate $(NH_4)_2SO_4$

Common ions

Positive ions (cations)		Negative ions (anions)	
Name	Symbol	Name	Symbol
Hydrogen	H^+	Hydroxide	OH^-
Sodium	Na^+	Chloride	Cl^-
Lithium	Li^+	Bromide	Br^-
Silver	Ag^+	Oxide	O^{2-}
Magnesium	Mg^{2+}	Hydrogencarbonate	HCO_3^-
Calcium	Ca^{2+}	Nitrate	NO_3^-
Zinc	Zn^{2+}	Sulfate	SO_4^{2-}
Aluminium	Al^{3+}	Carbonate	CO_3^{2-}
Ammonium	NH_4^+	Phosphate	PO_4^{3-}

Some elements have more than one charge. For example, iron can form ions with a charge of +2 or +3. Compounds containing these are named Iron(II) and Iron(III) respectively.

Other common elements with more than one charge include:

Chromium(II) and chromium(III)

Copper(I) and copper(II)

Lead(II) and lead(IV)

Activity 11

On the periodic table on the following page, colour elements that form one atom ions (eg Na^+ or O^{2-}) according to the following key:

Charge	Colour
+1	red
+2	yellow
+3	green
-1	blue
-2	brown

Key

relative atomic mass
symbol
name
atomic (proton) number

1	2											3	4	5	6	7	0
							1.0 **H** hydrogen 1										*(18)*
(1)	*(2)*											*(13)*	*(14)*	*(15)*	*(16)*	*(17)*	4.0 **He** helium 2
6.9 **Li** lithium 3	9.0 **Be** beryllium 4											10.8 **B** boron 5	12.0 **C** carbon 6	14.0 **N** nitrogen 7	16.0 **O** oxygen 8	19.0 **F** fluorine 9	20.2 **Ne** neon 10
23.0 **Na** sodium 11	24.3 **Mg** magnesium 12	*(3)*	*(4)*	*(5)*	*(6)*	*(7)*	*(8)*	*(9)*	*(10)*	*(11)*	*(12)*	27.0 **Al** aluminium 13	28.1 **Si** silicon 14	31.0 **P** phosphorus 15	32.1 **S** sulfur 16	35.5 **Cl** chlorine 17	39.9 **Ar** argon 18
39.1 **K** potassium 19	40.1 **Ca** calcium 20	45.0 **Sc** scandium 21	47.9 **Ti** titanium 22	50.9 **V** vanadium 23	52.0 **Cr** chromium 24	54.9 **Mn** manganese 25	55.8 **Fe** iron 26	58.9 **Co** cobalt 27	58.7 **Ni** nickel 28	63.5 **Cu** copper 29	65.4 **Zn** zinc 30	69.7 **Ga** gallium 31	72.6 **Ge** germanium 32	74.9 **As** arsenic 33	79.0 **Se** selenium 34	79.9 **Br** bromine 35	83.8 **Kr** krypton 36
85.5 **Rb** rubidium 37	87.6 **Sr** strontium 38	88.9 **Y** yttrium 39	91.2 **Zr** zirconium 40	92.9 **Nb** niobium 41	96.0 **Mo** molybdenum 42	[98] **Tc** technetium 43	101.1 **Ru** ruthenium 44	102.9 **Rh** rhodium 45	106.4 **Pd** palladium 46	107.9 **Ag** silver 47	112.4 **Cd** cadmium 48	114.8 **In** indium 49	118.7 **Sn** tin 50	121.8 **Sb** antimony 51	127.6 **Te** tellurium 52	126.9 **I** iodine 53	131.3 **Xe** xenon 54
132.9 **Cs** caesium 55	137.3 **Ba** barium 56	138.9 **La** * lanthanum 57	178.5 **Hf** hafnium 72	180.9 **Ta** tantalum 73	183.8 **W** tungsten 74	186.2 **Re** rhenium 75	190.2 **Os** osmium 76	192.2 **Ir** iridium 77	195.1 **Pt** platinum 78	197.0 **Au** gold 79	200.6 **Hg** mercury 80	204.4 **Tl** thallium 81	207.2 **Pb** lead 82	209.0 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac** † actinium 89	[267] **Rf** rutherfordium 104	[268] **Db** dubnium 105	[271] **Sg** seaborgium 106	[272] **Bh** bohrium 107	[270] **Hs** hassium 108	[276] **Mt** meitnerium 109	[281] **Ds** darmstadtium 110	[280] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

* 58 – 71 Lanthanides	140.1 **Ce** cerium 58	140.9 **Pr** praseodymium 59	144.2 **Nd** neodymium 60	[145] **Pm** promethium 61	150.4 **Sm** samarium 62	152.0 **Eu** europium 63	157.3 **Gd** gadolinium 64	158.9 **Tb** terbium 65	162.5 **Dy** dysprosium 66	164.9 **Ho** holmium 67	167.3 **Er** erbium 68	168.9 **Tm** thulium 69	173.1 **Yb** ytterbium 70	175.0 **Lu** lutetium 71
† 90 – 103 Actinides	232.0 **Th** thorium 90	231.0 **Pa** protactinium 91	238.0 **U** uranium 92	[237] **Np** neptunium 93	[244] **Pu** plutonium 94	[243] **Am** americium 95	[247] **Cm** curium 96	[247] **Bk** berkelium 97	[251] **Cf** californium 98	[252] **Es** einsteinium 99	[257] **Fm** fermium 100	[258] **Md** mendelevium 101	[259] **No** nobelium 102	[262] **Lr** lawrencium 103

Ionic compounds must have an overall neutral charge. The ratio of cations to anions must mean that there is as many positives as negatives.

For example:

NaCl	
Na^+	Cl^-
+1	-1

MgO	
Mg^{2+}	O^{2-}
+2	−2

$MgCl_2$	
Mg^{2+}	Cl^- Cl^-
+2	−2

Activity 12

Work out what the formulas for the following ionic compounds should be:

1. Magnesium bromide
2. Barium oxide
3. Zinc chloride
4. Ammonium chloride
5. Ammonium carbonate
6. Aluminium bromide
7. Iron(II) sulfate
8. Iron(III) sulfate

Diatomic molecules

A number of atoms exist in pairs as diatomic (two atom) molecules.

The common ones that you should remember are:

Hydrogen H_2, Oxygen O_2, Fluorine F_2, Chlorine Cl_2, Bromine Br_2, Nitrogen N_2 and Iodine I_2

Common compounds

There are several common compounds from your GCSE studies that have names that do not help to work out their formulas. For example, water is H_2O.

Activity 13: Research activity

What are the formulas of the following compounds?

1. Methane
2. Ammonia
3. Hydrochloric acid
4. Sulfuric acid
5. Sodium hydroxide
6. Potassium manganate(VII)
7. Hydrogen peroxide

Balancing equations

Chemical reactions never create or destroy atoms. They are only rearranged or joined in different ways.

When hydrogen and oxygen react to make water:

hydrogen + oxygen → water

$H_2 + O_2 \rightarrow H_2O$

There are two hydrogen atoms on both sides of this equation, but two oxygen atoms on the left and only one on the right. This is not balanced.

This can be balanced by writing:

$2H_2 + O_2 \rightarrow 2H_2O$

The reactants and products in this reaction are known and you can't change them. The compounds can't be changed and neither can the subscripts because that would change the compounds. So, to balance the equation, a number must be added in front of the compound or element in the equation. This is a coefficient. Coefficients show how many atoms or molecules there are.

Activity 14

Write balanced symbol equations for the following reactions. You'll need to use the information on the previous pages to work out the formulas of the compounds. Remember some of the elements may be diatomic molecules.

1. Aluminium + oxygen → aluminium oxide

2. Methane + oxygen → carbon dioxide + water

3. Aluminium + bromine → aluminium bromide

4. Calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide

5. Aluminium sulfate + calcium hydroxide → aluminium hydroxide + calcium sulfate

Harder:

6. Silver nitrate + potassium phosphate → silver phosphate + potassium nitrate

More challenging:

7. Potassium manganate(VII) + hydrochloric acid →

   potassium chloride + manganese(II) chloride + water + chlorine

Moles

A mole is the amount of a substance that contains 6.02×10^{23} particles.

The mass of 1 mole of any substance is the relative formula mass (M_r) in grams.

Examples:
One mole of carbon contains 6.02×10^{23} particles and has a mass of 12.0 g
Two moles of copper contains 12.04×10^{23} particles, and has a mass of 127 g
1 mole of water contains 6.02×10^{23} particles and has a mass of 18 g

The amount in moles of a substance can be found by using the formula:

$$\text{Amount in moles of a substance} = \frac{\text{mass of substance}}{\text{relative formula mass}}$$

Activity 15

Fill in the table.

Substance	Mass of substance	Amount/moles	Number of particles
Helium			18.12×10^{23}
Chlorine	14.2		
Methane		4	
Sulfuric acid	4.905		

Empirical formula

If you measure the mass of each reactant used in a reaction, you can work out the ratio of atoms of each reactant in the product. This is known as the empirical formula. This may give you the actual chemical formula, as the actual formula may be a multiple of this. For example, hydrogen peroxide is H_2O_2 but would have the empirical formula HO.

Use the following to find an empirical formula:

1. Write down reacting masses
2. Find the amount in moles of each element
3. Find the ratio of moles of each element

Example:

A compound contains 2.232 g of ion, 1.284 g of sulfur and 1.920 g of oxygen. What is the empirical formula?

Element	Iron	Sulfur	Oxygen
mass/relative atomic mass	2.232/55.8	1.284/32.1	1.920/16.0
Amount in moles	0.040	0.040	0.120
Divide by smallest value	0.040/0.040	0.040/0.040	0.120/0.040
Ratio	1	1	3

So the empirical formula is $FeSO_3$.

If the question gives the percentage of each element instead of the mass, replace mass with the percentage of an element present and follow the same process.

Activity 16

Work out the following empirical formulas:

1. The smell of a pineapple is caused by ethyl butanoate. A sample is known to contain only 0.180 g of carbon, 0.030 g of hydrogen and 0.080 g of oxygen. What is the empirical formula of ethyl butanoate?

2. Find the empirical formula of a compound containing 0.0578 g of titanium, 0.288 g of carbon, 0.012 g of hydrogen and 0.384 g of oxygen.

3. 300 g of a substance are analysed and found to contain only carbon, hydrogen and oxygen. The sample contains 145.9 g of carbon and 24.32 g of hydrogen. What is the empirical formula of the compound?

4. Another 300 g sample is known to contain only carbon, hydrogen and oxygen. The percentage of carbon is found to be exactly the same as the percentage of oxygen. The percentage of hydrogen is known to be 5.99%. What is the empirical formula of the compound?

The Periodic Table of the Elements

Key

relative atomic mass
symbol
name
atomic (proton) number

1	2											3	4	5	6	7	0
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
							1.0 **H** hydrogen 1										4.0 **He** helium 2
6.9 **Li** lithium 3	9.0 **Be** beryllium 4											10.8 **B** boron 5	12.0 **C** carbon 6	14.0 **N** nitrogen 7	16.0 **O** oxygen 8	19.0 **F** fluorine 9	20.2 **Ne** neon 10
23.0 **Na** sodium 11	24.3 **Mg** magnesium 12											27.0 **Al** aluminium 13	28.1 **Si** silicon 14	31.0 **P** phosphorus 15	32.1 **S** sulfur 16	35.5 **Cl** chlorine 17	39.9 **Ar** argon 18
39.1 **K** potassium 19	40.1 **Ca** calcium 20	45.0 **Sc** scandium 21	47.9 **Ti** titanium 22	50.9 **V** vanadium 23	52.0 **Cr** chromium 24	54.9 **Mn** manganese 25	55.8 **Fe** iron 26	58.9 **Co** cobalt 27	58.7 **Ni** nickel 28	63.5 **Cu** copper 29	65.4 **Zn** zinc 30	69.7 **Ga** gallium 31	72.6 **Ge** germanium 32	74.9 **As** arsenic 33	79.0 **Se** selenium 34	79.9 **Br** bromine 35	83.8 **Kr** krypton 36
85.5 **Rb** rubidium 37	87.6 **Sr** strontium 38	88.9 **Y** yttrium 39	91.2 **Zr** zirconium 40	92.9 **Nb** niobium 41	96.0 **Mo** molybdenum 42	[98] **Tc** technetium 43	101.1 **Ru** ruthenium 44	102.9 **Rh** rhodium 45	106.4 **Pd** palladium 46	107.9 **Ag** silver 47	112.4 **Cd** cadmium 48	114.8 **In** indium 49	118.7 **Sn** tin 50	121.8 **Sb** antimony 51	127.6 **Te** tellurium 52	126.9 **I** iodine 53	131.3 **Xe** xenon 54
132.9 **Cs** caesium 55	137.3 **Ba** barium 56	138.9 **La** * lanthanum 57	178.5 **Hf** hafnium 72	180.9 **Ta** tantalum 73	183.8 **W** tungsten 74	186.2 **Re** rhenium 75	190.2 **Os** osmium 76	192.2 **Ir** iridium 77	195.1 **Pt** platinum 78	197.0 **Au** gold 79	200.6 **Hg** mercury 80	204.4 **Tl** thallium 81	207.2 **Pb** lead 82	209.0 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac** † actinium 89	[267] **Rf** rutherfordium 104	[268] **Db** dubnium 105	[271] **Sg** seaborgium 106	[272] **Bh** bohrium 107	[270] **Hs** hassium 108	[276] **Mt** meitnerium 109	[281] **Ds** darmstadtium 110	[280] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

* 58 – 71 Lanthanides	140.1 **Ce** cerium 58	140.9 **Pr** praseodymium 59	144.2 **Nd** neodymium 60	[145] **Pm** promethium 61	150.4 **Sm** samarium 62	152.0 **Eu** europium 63	157.3 **Gd** gadolinium 64	158.9 **Tb** terbium 65	162.5 **Dy** dysprosium 66	164.9 **Ho** holmium 67	167.3 **Er** erbium 68	168.9 **Tm** thulium 69	173.1 **Yb** ytterbium 70	175.0 **Lu** lutetium 71
† 90 – 103 Actinides	232.0 **Th** thorium 90	231.0 **Pa** protactinium 91	238.0 **U** uranium 92	[237] **Np** neptunium 93	[244] **Pu** plutonium 94	[243] **Am** americium 95	[247] **Cm** curium 96	[247] **Bk** berkelium 97	[251] **Cf** californium 98	[252] **Es** einsteinium 99	[257] **Fm** fermium 100	[258] **Md** mendelevium 101	[259] **No** nobelium 102	[262] **Lr** lawrencium 103

Pre-Knowledge Topics

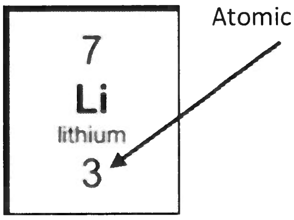
A level chemistry will use your knowledge from GCSE and build on this to help you understand new and more demanding ideas. Complete the following tasks to make sure your knowledge is up to date and you are ready to start studying:

Chemistry Topic 1 – Electronic structure, how electrons are arranged around the nucleus

A periodic table can give you the proton / atomic number of an element, this also tells you how many electrons are in the atom.

You will have used the rule of electrons shell filling, where:

The first shell holds up to 2 electrons, the second up to 8, the third up to 8 and the fourth up to 18 (or you may have been told 8).



Atomic number =3, electrons = 3, arrangement 2 in the first shell and 1 in the second or

Li = 2,1

At A level you will learn that the electron structure is more complex than this and can be used to explain a lot of the chemical properties of elements.

The 'shells' can be broken down into 'orbitals', which are given letters: 's' orbitals, 'p' orbitals and 'd' orbitals.

You can read about orbitals here:

http://bit.ly/pixlchem1

http://www.chemguide.co.uk/atoms/properties/atomorbs.html#top

Now that you are familiar with s, p and d orbitals try these problems. Write your answer in the format:

1s2, 2s2, 2p6 etc.

Q1. Write out the electron configuration of:

a) Ca b) Al c) S d) Cl e) Ar f) Fe g) V h) Ni i) Cu j) Zn k) As

Q2. Extension question, can you write out the electron arrangement of the following ions:

a) K^+ b) O^{2-} c) Zn^{2+} d) V^{5+} e) Co^{2+}

Chemistry Topic 2 – Oxidation and reduction

At GCSE you learnt that oxidation is adding oxygen to an atom or molecule and that reduction is removing oxygen, or that oxidation is removing hydrogen and reduction is adding hydrogen. You may have also learnt that oxidation is removing electrons and reduction is adding electrons.

At A level we use the idea of oxidation number a lot!

You know that the metals in group 1 react to form ions that are +1, i.e. Na^+ and that group 7, the halogens, form -1 ions, i.e. Br^-.

We say that sodium, when it has reacted, has an oxidation number of +1 and that bromide has an oxidation number of -1.

All atoms that are involved in a reaction can be given an oxidation number.

An element, Na or O_2, is always given an oxidation state of zero (0). Any element that has reacted has an oxidation state of + or -.

As removing electrons is reduction, if, in a reaction the element becomes more negative it has been reduced, if it becomes more positive it has been oxidised.

-5 0 +5

You can read about the rules for assigning oxidation numbers here:

http://www.dummies.com/how-to/content/rules-for-assigning-oxidation-numbers-to-elements.html

Elements that you expect to have a specific oxidation state actually have different states, so for example you would expect chlorine to be -1. It can have many oxidation states: NaClO, in this compound it has an oxidation state of +1

There are a few simple rules to remember:

Metals have a + oxidation state when they react.

Oxygen is 'king', it always has an oxidation state of -2.

Hydrogen has an oxidation state of +1 (except metal hydrides).

The charges in a molecule must cancel.

Examples:	Sodium nitrate, $NaNO_3$		sulfate ion, SO_4^{2-}
	Na +1	3x O^{2-}	4xO^{2-} and 2- charges 'showing'
	+1	-6	-8 -2
To cancel:	N = +5		S = +6

Q2. Work out the oxidation state of the **underlined** atom in the following:

a) Mg<u>C</u>O_3 b) <u>S</u>O_3 c) Na<u>Cl</u>O_3 d) <u>Mn</u>O_2 e) <u>Fe</u>$_2O_3$ f) <u>V</u>$_2O_5$

g) K<u>Mn</u>O_4 h) <u>Cr</u>$_2O_7^{2-}$ i) <u>Cl</u>$_2O_4$

Chemistry Topic 3 – Isotopes and mass

You will remember that isotopes are elements that have differing numbers of neutrons. Hydrogen has 3 isotopes; H^1_1 H^2_1 H^3_1

Isotopes occur naturally, so in a sample of an element you will have a mixture of these isotopes. We can accurately measure the amount of an isotope using a **mass spectrometer**. You will need to understand what a mass spectrometer is and how it works at A level. You can read about a mass spectrometer here:

http://bit.ly/pixlchem3
http://www.kore.co.uk/tutorial.htm
http://bit.ly/pixlchem4
http://filestore.aqa.org.uk/resources/chemistry/AQA-7404-7405-TN-MASS-SPECTROMETRY.PDF

Q1. What must happen to the atoms before they are accelerated in the mass spectrometer?

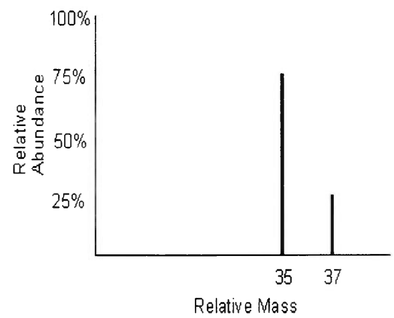
Q2. Explain why the different isotopes travel at different speeds in a mass spectrometer.

A mass spectrum for the element chlorine will give a spectrum like this:

75% of the sample consist of chlorine-35, and 25% of the sample is chlorine-37.

Given a sample of naturally occurring chlorine, ¾ of it will be Cl-35 and ¼ of it is Cl-37. We can calculate what the **mean** mass of the sample will be:

Mean mass = $\frac{75}{100} \times 35 + \frac{25}{100} \times 37 = 35.5$



If you look at a periodic table, this is why chlorine has an atomic mass of 35.5.

An A level periodic table has the masses of elements recorded much more accurately than at GCSE. Most elements have isotopes and these have been recorded using mass spectrometers.

GCSE

11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9
27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17

A Level

10.8 5 **B** boron	12.0 6 **C** carbon	14.0 7 **N** nitrogen	16.0 8 **O** oxygen	19.0 9 **F** fluorine
27.0 13 **Al** aluminium	28.1 14 **Si** silicon	31.0 15 **P** phosphorus	32.1 16 **S** sulphur	35.5 17 **Cl** chlorine

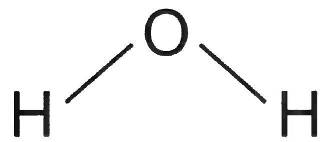
Given the percentage of each isotope you can calculate the mean mass which is the accurate atomic mass for that element.

Q3. Use the percentages of each isotope to calculate the accurate atomic mass of the following elements.

a. Antimony has 2 isotopes: Sb-121 57.25% and Sb-123 42.75%
b. Gallium has 2 isotopes: Ga-69 60.2% and Ga-71 39.8%
c. Silver has 2 isotopes: Ag-107 51.35% and Ag-109 48.65%
d. Thallium has 2 isotopes: Tl-203 29.5% and Tl-205 70.5%
e. Strontium has **4** isotopes: Sr-84 0.56%, Sr-86 9.86%, Sr-87 7.02% and Sr-88 82.56%

<u>Chemistry Topic 4 – The shapes of molecules and bonding</u>

Have you ever wondered why your teacher drew a water molecule like this?
The lines represent a covalent bond, but why draw them at an unusual angle?
If you are unsure about covalent bonding, read about it here:



http://bit.ly/pixlchem5
http://www.chemguide.co.uk/atoms/bonding/covalent.html#top

At A level you are also expected to know how molecules have certain shapes and why they are the shape they are.
You can read about shapes of molecules here:

http://bit.ly/pixlchem6
http://www.chemguide.co.uk/atoms/bonding/shapes.html#top

Q1. Draw a dot and cross diagram to show the bonding in a molecule of aluminium chloride ($AlCl_3$)
Q2. Draw a dot and cross diagram to show the bonding in a molecule of ammonia (NH_3)
Q3. What is the shape and the bond angles in a molecule of methane (CH_4)?

<u>Chemistry Topic 5 – Chemical equations</u>

Balancing chemical equations is the stepping stone to using equations to calculate masses in chemistry.
There are loads of websites that give ways of balancing equations and lots of exercises in balancing.
Some of the equations to balance may involve strange chemicals- don't worry about that, the key idea is to get balancing right.

http://bit.ly/pixlchem7
http://www.chemteam.info/Equations/Balance-Equation.html

This website has a download; it is safe to do so:

http://bit.ly/pixlchem8
https://phet.colorado.edu/en/simulation/balancing-chemical-equations

Q5. Balance the following equations

a. $H_2 + 0_2 \rightarrow H_20$
b. $S_8 + 02 \rightarrow S0_3$
c. $HgO \rightarrow Hg + 0_2$
d. $Zn + HCl \rightarrow ZnCl_2 + H_2$
e. $Na + H_20 \rightarrow NaOH + H_2$
f. $C_{10}H_{16} + Cl_2 \rightarrow C + HCl$
g. $Fe + 0_2 \rightarrow Fe_20_3$
h. $C_6H_{12}0_6 + 0_2 \rightarrow C0_2 + H_20$
i. $Fe_20_3 + H_2 \rightarrow Fe + H_20$
j. $Al + FeO \rightarrow Al_2O_3 + Fe$

Chemistry Topic 6 – Measuring chemicals – the mole

From this point on you need to be using an A level periodic table, not a GCSE one. You can view one here:

http://bit.ly/pixlpertab
https://secondaryscience4all.files.wordpress.com/2014/08/filestore_aqa_org_uk_subjects_aqa-2420-w-trb-ptds_pdf.png

Now that we have our chemical equations balanced, we need to be able to use them in order to work out masses of chemicals we need or we can produce.
The ***mole*** is the chemists equivalent of a dozen. Atoms are so small that we cannot count them out individually, we weigh out chemicals.
For example: magnesium + sulfur → magnesium sulfide
Mg + S → MgS
We can see that one atom of magnesium will react with one atom of sulfu. If we had to weigh out the atoms we need to know how heavy each atom is.
From the periodic table: Mg = 24.3 and S = 32.1
If I weigh out exactly 24.3g of magnesium this will be 1 mole of magnesium. If we counted how many atoms were present in this mass it would be a huge number (6.02×10^{23}!!!!). If I weigh out 32.1g of sulfur then I would have 1 mole of sulfur atoms.
So 24.3g of Mg will react precisely with 32.1g of sulfur, and will make 56.4g of magnesium sulfide.
Here is a comprehensive page on measuring moles, there are a number of descriptions, videos and practice problems. You will find the first 6 tutorials of most use here, and problem sets 1 to 3.

http://bit.ly/pixlchem9
http://www.chemteam.info/Mole/Mole.html

Q1. Answer the following questions onmoles.
How many moles of phosphorus pentoxide (P_4O_{10}) are in 85.2g?
How many moles of potassium are in 73.56g of potassium chlorate (V) ($KClO_3$)?
How many moles of water are in 249.6g of hydrated copper sulfate(VI) ($CuSO_4.5H_2O$)? For this one, you need to be aware the dot followed by $5H_2O$ means that the molecule comes with 5 water molecules so these have to be counted in as part of the molecules mass.
What is the mass of 0.125 moles of tin sulfate ($SnSO_4$)?
If I have 2.4g of magnesium, how many g of oxygen(O_2) will I need to react completely with the magnesium? $2Mg + O_2 \rightarrow MgO$

Chemistry Topic 7 – Solutions and concentrations

In chemistry a lot of the reactions we carry out involve mixing solutions rather than solids, gases or liquids.
You will have used bottles of acids in science that have labels saying 'Hydrochloric acid 1M', this is a solution of hydrochloric acid where 1 mole of HCl, hydrogen chloride (a gas) has been dissolved in $1dm^3$ of water.
The dm^3 is a cubic decimetre, it is actually 1 litre but from this point on as an A level chemist you will use the dm^3 as your volume measurement.

http://bit.ly/pixlchem10
http://www.docbrown.info/page04/4_73calcs11msc.htm

Q1.

a. What is the concentration (in mol dm^{-3}) of 9.53g of magnesium chloride ($MgCl_2$) dissolved in $100cm^3$ of water?
b. What is the concentration (in mol dm^{-3}) of 13.248g of lead nitrate ($Pb(NO_3)_2$) dissolved in $2dm^3$ of water?
c. If I add $100cm^3$ of 1.00 mol dm^3 HCl to $1.9dm^3$ of water, what is the molarity of the new solution?
d. What mass of silver is present in $100cm^3$ of $1moldm^{-3}$ silver nitrate ($AgNO_3$)?
e. The Dead Sea, between Jordan and Israel, contains 0.0526 $moldm^{-3}$ of Bromide ions (Br^-). What mass of bromine is in $1dm^3$ of Dead Sea water?

Chemistry topic 8 – Titrations

One key skill in A level chemistry is the ability to carry out accurate titrations. You may well have carried out a titration at GCSE, at A level you will have to carry them out very precisely **and** be able to describe in detail how to carry out a titration - there will be questions on the exam paper about how to carry out practical procedures.

You can read about how to carry out a titration here, the next page in the series (page 5) describes how to work out the concentration of the unknown.

http://bit.ly/pixlchem11
http://www.bbc.co.uk/schools/gcsebitesize/science/triple_aqa/further_analysis/analysing_substances/revision/4/

Remember for any titration calculation you need to have a balanced symbol equation; this will tell you the ratio in which the chemicals react.

E.g. a titration of an unknown sample of sulfuric acid with sodium hydroxide.

A 25.00cm^3 sample of the unknown sulfuric acid was titrated with 0.100moldm^{-3} sodium hydroxide and required exactly 27.40cm^3 for neutralisation. What is the concentration of the sulfuric acid?

Step 1: the equation $2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$
Step 2: the ratios 2 : 1
Step 3: how many moles of sodium hydroxide 27.40cm^3 = 0.0274dm^3
number of moles = c x v = 0.100 x 0.0274 = 0.00274 moles
step 4: using the ratio, how many moles of sulfuric acid
for every 2 NaOH there are 1 H_2SO_4 so, we must have 0.00274/2 =0.00137 moles of H_2SO_4
Step 5: calculate concentration. concentration = moles/volume ←in dm^3 = 0.00137/0.025 = ***0.0548 moldm^{-3}***

Here are some additional problems which are harder, ignore the questions about colour changes of indicators.

http://bit.ly/pixlchem12
http://www.docbrown.info/page06/Mtestsnotes/ExtraVolCalcs1.htm

Use the steps on the last page to help you.

Q1. A solution of barium nitrate will react with a solution of sodium sulfate to produce a precipitate of barium sulfate.
$Ba(NO_3)_2(aq) + Na_2SO_4(aq) \rightarrow BaSO_4(s) + 2NaNO_3(aq)$
What volume of 0.25moldm^{-3}sodium sulfate solution would be needed to precipitate all of the barium from 12.5cm^3 of 0.15 moldm^{-3} barium nitrate?

Chemistry Topic 9 – Organic chemistry – functional groups

At GCSE you would have come across **hydrocarbons** such as alkanes (ethane etc) and alkenes (ethene etc). You may have come across molecules such as alcohols and carboxylic acids. At A level you will learn about a wide range of molecules that have had atoms added to the carbon chain. These are called functional groups, they give the molecule certain physical and chemical properties that can make them incredibly useful to us.

Here you are going to meet a selection of the functional groups, learn a little about their properties and how we give them logical names.

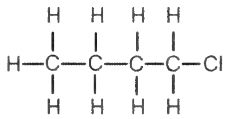
You will find a menu for organic compounds here:

http://bit.ly/pixlchem13
http://www.chemguide.co.uk/orgpropsmenu.html#top

And how to name organic compounds here:
http://bit.ly/pixlchem14
http://www.chemguide.co.uk/basicorg/conventions/names.html#top

Using the two links see if you can answer the following questions:

Q1. Halogenoalkanes



a. What is the name of this halogenoalkane?
b. How could you make it from butan-1-ol?

Q2. Alcohols

a. How could you make ethanol from ethene?
b. How does ethanol react with sodium and in what ways is this a) similar to the reaction with water, b) different to the reaction with water?

Q3. Aldehydes and ketones

a. Draw the structures of a) propanal, b) propanone
b. How are these two functional groups different?

Chemistry Topic 10 – Acids, bases, pH

At GCSE you will know that an acid can dissolve in water to produce H^+ ions, at A level you will need a greater understanding of what an acid or a base is.

Read the following page and answer the questions

http://bit.ly/pixlchem15
http://www.chemguide.co.uk/physical/acidbaseeqia/theories.html#top

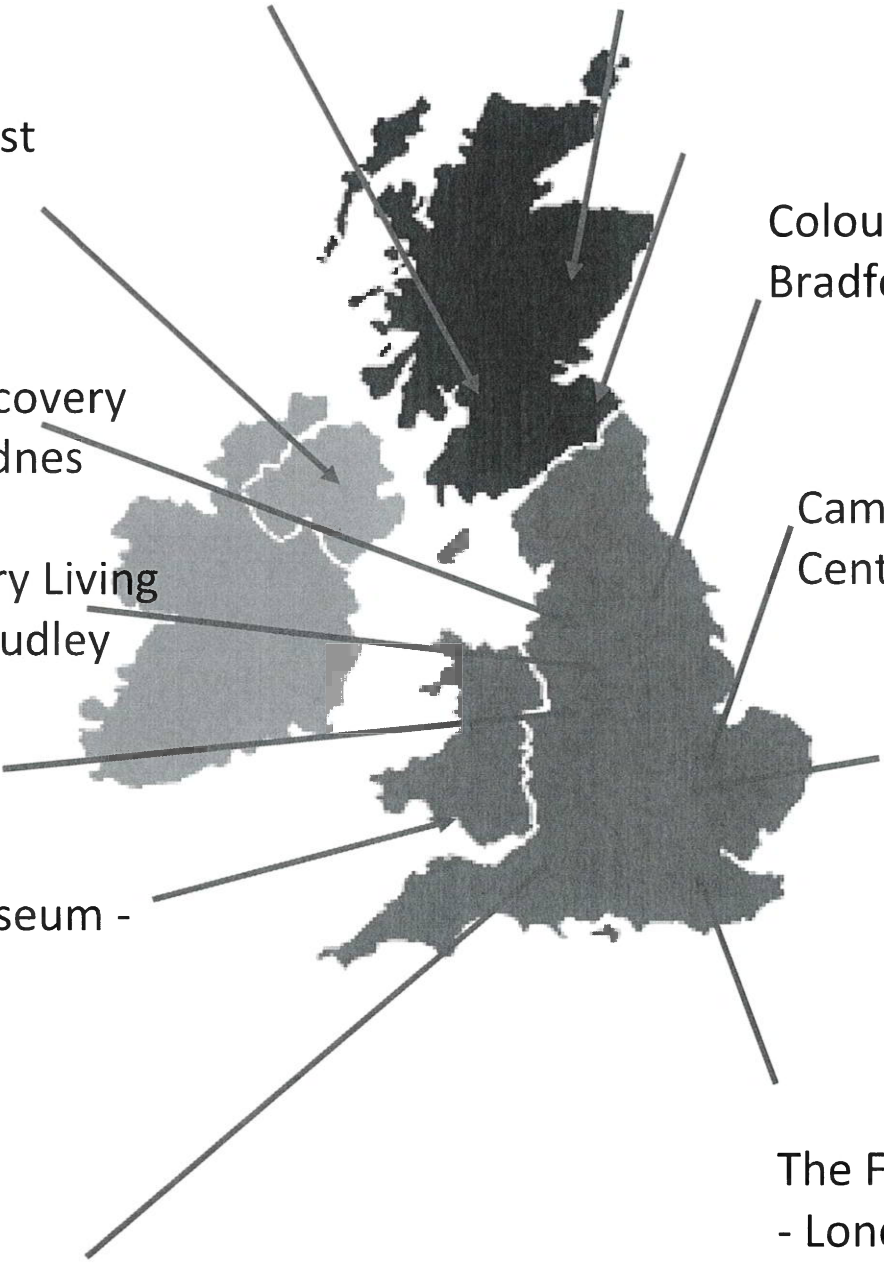
Q1. What is your new definition of what an acid is?
Q2. How does ammonia (NH_3) act as a base?

http://bit.ly/pixlchem16
http://www.chemguide.co.uk/physical/acidbaseeqia/acids.html#top

Q3 Ethanoic acid (vinegar) is a weak acid, what does this mean?
Q4 What is the pH of a solution of 0.01 $moldm^{-3}$ of the strong acid, hydrochloric acid?

Ideas for Day Trips

If you are on holiday in the UK, or on a staycation at home, why not plan a day trip to one of these :



Science on Social Media

Science communication is essential in the modern world and all the big scientific companies, researchers and institutions have their own social media accounts. Here are some of our top tips to keep up to date with developing news or interesting stories:

Follow on Twitter:
Satlers' Institute - Our activities include Festivals of Chemistry; Chemistry Camps; Curricula; Awards for Technicians, Graduates, A Level Students; and Seminars
@salters_inst

Daily A Level Chemistry Facts – Daily Chemistry Facts (Based on the A-Level AQA spec but most facts work with all)
@chemAlevels

Chemistry News –The latest chemistry news from only the best sources
@chemistrynews

Compound Interest– Graphics exploring everyday #chemistry. Winner of @absw 2018 science blog award
@compoundchem

Chemistry World – Chemistry magazine bringing you the latest chemistry news and research every day. Published by the Royal Society of Chemistry.
@ChemistryWorld

Royal Society of Chemistry - Promote, support and celebrate chemistry. Follow for updates on latest activities
@RoySocChem

Periodic Videos– Chemistry video series by @BradyHaran & profs at the Uni of Nottingham - also see @sixtysymbols & @numberphile
@periodicvideos

Find on Facebook:
Science Now - Science Now is a dedicated community that helps spread science news in all fields, from physics to biology, medicine to nanotechnology, space and beyond!

National Science Foundation – As an independent federal agency, NSF fund a significant proportion of basic research. For official source information about NSF, visit www.nsf.gov

Science News Magazine - Science covers important and emerging research in all fields of science

BBC Science News - The latest BBC Science and Environment News: breaking news, analysis and debate on science and nature around the world

Scientific American - Scientific American is the authority on science and technology for a general audience, with coverage that explains how research changes our understanding of the world and shapes our lives.

Science Websites

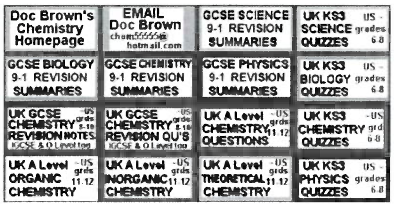
These websites all offer an amazing collection of resources that you should use again and again through out your course.

chemguide

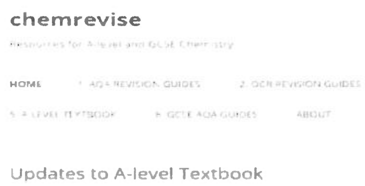
Helping you to understand Chemistry

MAIN MENU

This website is very detailed and identifies other resources which are sharing incorrect or outdated information and suggests the correct materials to use. The site also contains links to the syllabuses of many exam boards which means it is accessible and useful to all students.
https://www.chemguide.co.uk/



Doc Brown is a website dedicated to all three science subjects; physics, chemistry and biology. It provides the user with summarised notes (useful for making flash cards) and practice questions to further their knowledge and understanding.
The site provides resources from a wide range of exam boards including AQA, Edexcel, Chemistry, CCEA, OCR, WJEC, CIE and Salters from GCSE level to A2.
http://www.docbrown.info/



The site was first made to host revision guides that are written for AQA A-level Chemistry. These revision guides have already been circulating on the internet for a couple of years on places like student room. This will be the place for the most up to date versions of them. The site has now extended to cover other exam boards. (OCR and Edexcel)
https://chemrevise.org/

S-cool the revision website

The free revision website for students studying GCSE and A-levels. S-cool provides revision guides, question banks, revision timetable and more
https://www.s-cool.co.uk/a-level/chemistry

CRASH COURSE

Tons of awesome courses in one awesome channel! Check out the playlists for past courses in physics, philosophy, games, economics, U.S. government and politics, astronomy, anatomy & physiology, world history, biology, literature, ecology, chemistry, psychology, and of course, chemistry!
https://www.youtube.com/user/crashcourse/featured

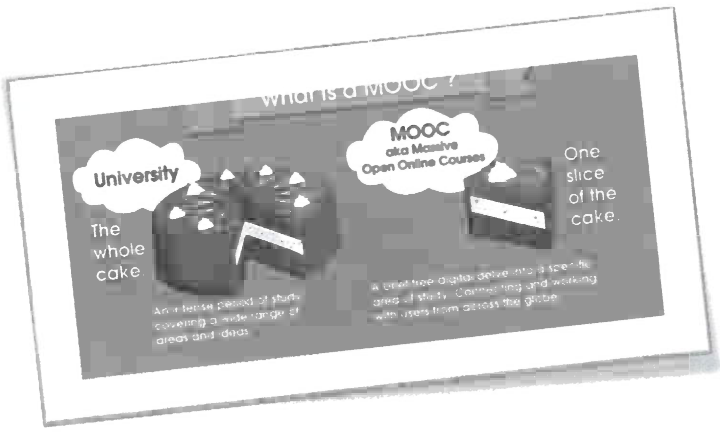
Science: Things to do!

Day 4 of the holidays and boredom has set in?
There are loads of citizen science projects you can take part in either from the comfort of your bedroom, out and about, or when on holiday. Wikipedia does a comprehensive list of all the current projects taking place. Google 'citizen science project'

MOOC

Want to stand above the rest when it comes to UCAS? Now is the time to act.
MOOCs are online courses run by nearly all universities. They are short FREE courses that you take part in. They are usually quite specialist, but aimed at the public, not the genius!
There are lots of websites that help you find a course, such as edX and Future learn.
You can take part in any course, but there are usually start and finish dates.
They mostly involve taking part in web chats, watching videos and interactives.

Completing a MOOC will look great on your Personal statement and they are dead easy to take part in!



Pre-Knowledge Topics Answers to problems

Q1.

a) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6 4s^2$ b) $1s^2\ 2s^2\ 2p^6 3s^2 3p^1$ c) $1s^2\ 2s^2\ 2p^6 3s^2 3p^4$

d) $1s^2\ 2s^2\ 2p^6 3s^2 3p^5$ e) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6$ f) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^6 4s^2$

g) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^3 4s^2$ h) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^8 4s^2$ i) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^{10}\ 4s^1$

j) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^{10}\ 4s^2$ k) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^3$

Q2

a) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6$ b) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6$ c) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^{10}$

d) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6$ e) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^7$

==

Q1

a) +4 b) +6 c) +5 d) +4 e) +3 f) +5 g) +7 h) +6 i) +4

==

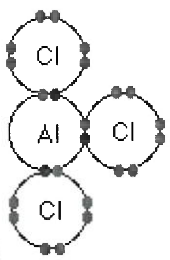
Q1 They must be ionised / turned into ions

Q2 The ions are all given the same amount of kinetic energy, as KE = ½ mv^2 the lighter ions will have greater speed / heavier ions will have less speed.

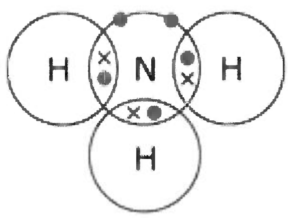
Q3 a) 121.855 b) 67.796 c) 107.973 d) 204.41 e) 87.710 / 87.7102

==

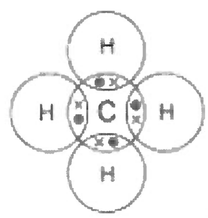
Q1



a) 120°



b) 107°



c) 109.5°

==

the PiXL club partners in excellence

Q1

a. $2H_2 + O_2 \rightarrow 2H_2O$

b. $S_8 + 12O_2 \rightarrow 8SO_3$

c. $2HgO \rightarrow 2Hg + O_2$

d. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$

e. $2Na + 2H_2O \rightarrow 2NaOH + H_2$

f. $C_{10}H_{16} + 8Cl_2 \rightarrow 10C + 16HCl$

g. $2Fe + 3O_2 \rightarrow 2Fe_2O_3$

h. $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

i. $Fe_2O_3 + 3H_2 \rightarrow 2Fe + 3H_2O$

j. $2Al + 3FeO \rightarrow Al_2O_3 + 3Fe$

==

Q1

a) 85.2/284 = 0.3 moles

b) 73.56/122.6 = 0.6 moles

c) 249.5/249.5 = 1.0 moles

d) 0.125 x 212.8 = 26.6g

e) 2Mg : 2O or 1:1 ratio 2.4g of Mg = 0.1moles so we need 0.1 moles of oxygen (O_2): 0.1 x 32 = 3.2g

==

Q1

a) 9.53g/95.3 = 0.1 moles, in 100cm^3 or 0.1dm^3 in 1dm^3 0.1moles/0.1dm^3 = 1.0 mol dm^{-3}

b) 13.284g/331.2 = 0.04 moles, in 2dm^3 in 1dm^3 0.04moles /2dm^3 = 0.02 mol dm^{-3}

c) 100cm^3 of 0.1 mol dm^{-3} = 0.01 moles added to a total volume of 2 dm^3 = 0.01moles/2dm^3 = 0.005 mol dm^{-3}

d) in 1dm^3 of 1 mol dm^{-3} silver nitrate, 1 mole of Ag = 107.9g in 0.1dm^3 = 107.9 x 0.1 = 10.79g

e) 0.0526 x 79.7 = 42.0274g

==

Q1

$Ba(NO_3)_2$: Na_2SO_4

1 : 1 ratio

12.5cm^3 of $Ba(NO_3)_2$ = 0.0125dm^3

0.15 moldm^{-3} x 0.0125dm^3 = 0.001875 moles

same number of moles of sodium sulfate needed, which has a concentration of 0.25 mol dm^{-3}

0.001875 moles / 0.25 mol dm^{-3} = 0.0075 dm^3 or 7.5cm^3

==

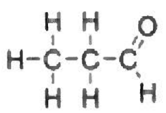
Q1 1-chlorobutane

Add butan-1-ol to concentrated HCl and shake

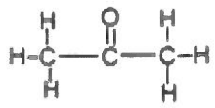
Q2 React ethene with hydrogen gas at high temperature and pressure with a nickel catalyst

The reaction is similar in that it releases hydrogen but different as it proceeds much slower than in water

Q3 propanal



propanone



The carbon atom joined to oxygen in propanal has a hydrogen attached to it, it does not in propanone.

==

10.1 An acid is a proton donor

10.2 Ammonia can accept a proton, to become NH_4^+

10.3 ethanoic acid has not fully dissociated, it has not released all of its hydrogen ions into the solution.

$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$
Mostly this Very few of these

10.4 pH = -log [0.01] = 2 The pH = 2