Worthing College

Getting Ready For *Chemistry*	
Your Name	

We are delighted you have chosen to study Chemistry at Worthing College.

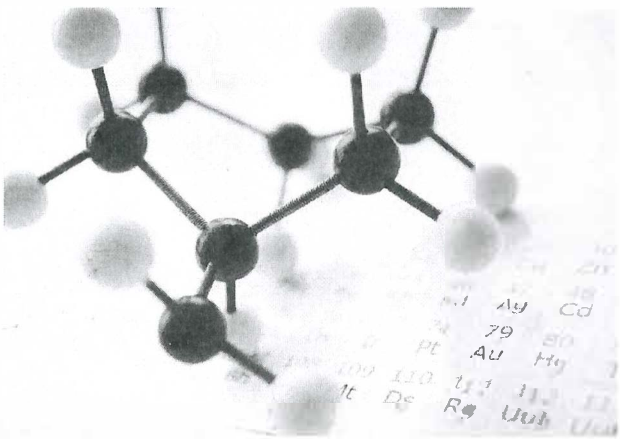
Instructions: This pack will help you make the best possible start to studying this subject.

The tasks in this pack:

- should take you **about 4 hours to complete.**
- should be handed into your teacher when teaching starts
- are also available on the internet – follow the links in the document.

If you need help: The tasks are designed to get a bit more difficult as you work through them as they are preparing you for studying at a higher level and to become an effective independent learner. You should try to get as far as you can working on your own but if you do need help, please email us at gettingreadyfor@worthing.ac.uk, telling us which Getting Ready For pack you are working on and what help you need. Help is available throughout the summer holidays.

Skills Focus for this Getting Ready for Pack
Building on your GCSE knowledge through independent research, mathematical skills, interpreting & handling data



Worthing College

Task	Information
1 Building on GCSE mathematical knowledge	**Practical & Maths Skills** This is another optional task where activities cover some of the key skills from GCSE science that will be relevant at AS and A-level. Try the activities first and see what you remember and then use textbooks or other resources to answer the questions.
2 Research and building on GCSE knowledge	**Pre-Knowledge topics** This is an optional task where you can do some research on some of the topics that we will cover in Year 1. You can complete as many of the tasks as you like and check your understanding against the answers. Keep any notes that you make as they will be useful to revisit throughout the year.
3 Research and building on GCSE knowledge	**Research activities** Choose one of the five topics to research, where you can look at the wider information on some of the topics, we will cover in Year 1. Follow the instructions and write a page of notes, including pictures or diagrams where appropriate. Include a list of any sources used. This will be asked to be handed in your first lesson in September.
4 Building on GCSE knowledge	**Transition baseline assessment** Complete the baseline assessment near the end of the pack and bring your answers to your first lesson. This work will be marked, and feedback given.
5 Fun!	**Science of social media** Have a look through the last section of the pack to see if anything interests you. Enjoy!

Work Experience week

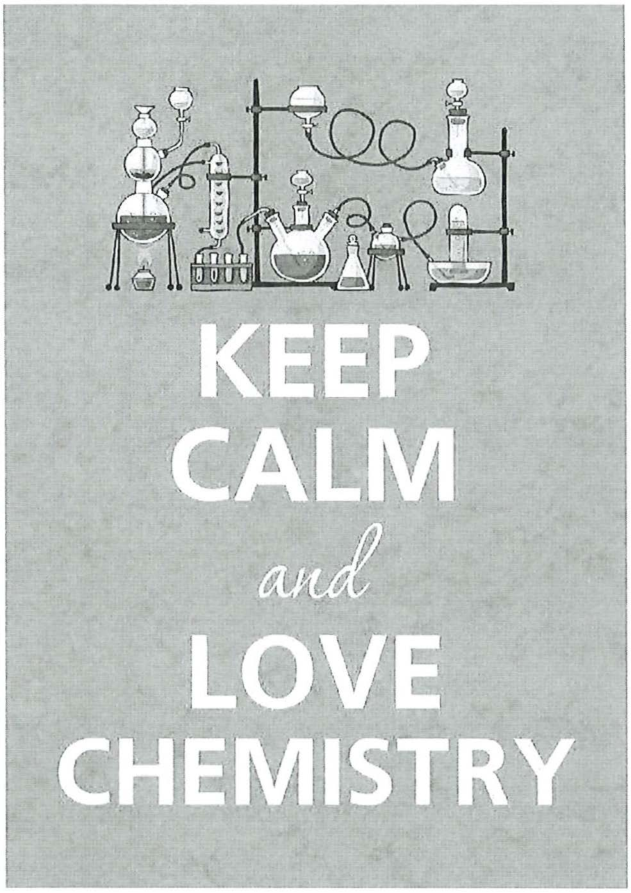
All year 1 students are required to participate in a week-long work placement during their first year of study. You will be expected to locate one week's worth of work placement and submit your work experience form before October half term.

Placement Dates:

L2/L3 students on double /triple qualifications:	1 week course-specific placement, expected placement dates will be confirmed by the course leaders at the beginning of September.
Students with 2 or more single subjects:	1 week placement during the Easter holidays or w/c 23 June 2025

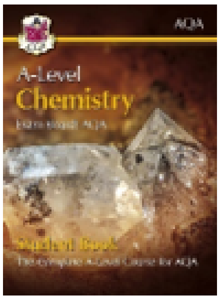
You can find the work experience form HERE
More information and guidance can be found HERE

So you are considering A Level Chemistry?

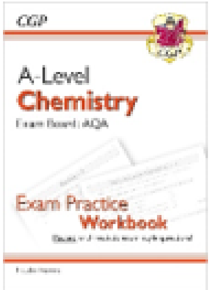


This pack contains a programme of activities and resources to prepare you to start an A level in Chemistry in September. It is aimed to be used after you complete your GCSE, throughout the remainder of the summer term and over the Summer Holidays to ensure you are ready to start your course in September.

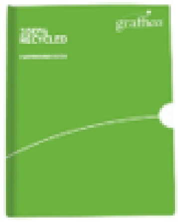
Chemistry A-Level Textbook Bundle



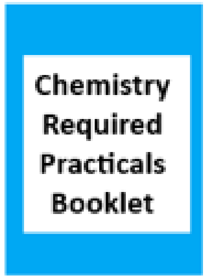
AQA: Year 1 & 2 Chemistry Student Book with Online Edition



AQA Chemistry Year 1 & 2 Exam Practice Workbook - includes Answers



Hardback casebound and 100% recycled A4 Laboratory Notebook



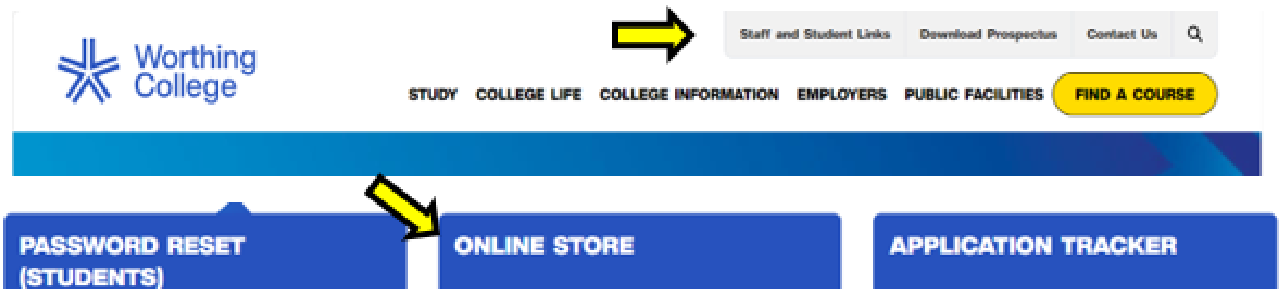
Chemistry required practicals booklet

Bundle cost £35 **Available to buy from 26th August** **RRP £60**

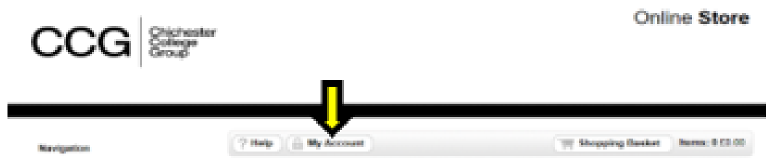
Please note if you choose to purchase this bundle it will be given to you in your lessons at the start of the year.

How to purchase?

- Go to the Worthing College website – click on Staff and Student Links, then scroll down to Online Store and click on Find Out More to access the store.



- If you have not used this service before, go to 'My account' and register an account



- When you fill in your details, please enter your **student number or student name** in the box marked **'student number'** in the **'user details'** section as this will enable us to track your purchase.
- Once registered in the shop navigate to **product catalogue → worthing college →course materials** the book bundle should be visible there. Once purchased you will then receive an email confirming your purchase, please retain your email invoice in case of problems. Your purchases will be given to you in your lesson.
- For those that get help with student funding once you have an account set up you will be able to email your receipt along with your name and student number to **studentfinance@chigroup.ac.uk** and you should be reimbursed.
- For those that get help with student funding once you have an account set up you will be able to email your receipt along with your name and student number to **studentfinance@chigroup.ac.uk** and you should be reimbursed.

Other equipment:

- ✓ Pens, pencils, ruler, highlighter etc…

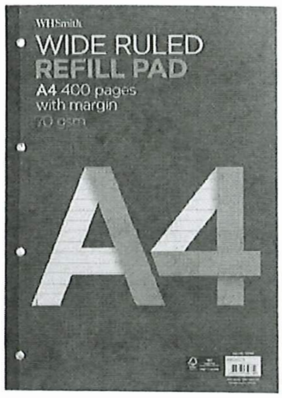
- ✓ Scientific calculator
  The one you used at GCSE is fine for A-Level Chemistry.

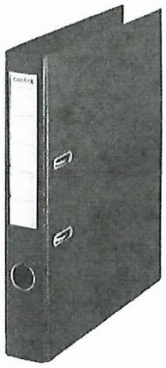
- ✓ A4 folder
  Most students get a smaller one to bring into college every day and a lever arch one to store notes from past topics at home.

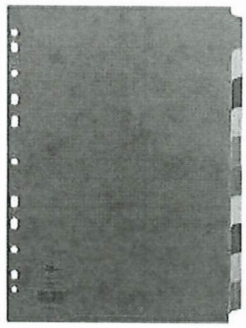
- ✓ A4 paper
  Loose paper is better than a notebook as you will need to file pages in different places and add to your lesson notes during independent study. Bringing a notebook to lesson also means you are unlikely to bring a folder, and you'll need a folder to store handouts, worksheets and topic tests.

- ✓ Dividers
  Useful to separate your notes into topics.

- ✓ Phone / iPad
  We will use online resources in lessons, and you will submit work online so access to the internet in lesson is useful. Please don't worry if you can't, we have laptops that you can use in class if needed.







Practical & Maths Skills

Activity 1 Scientific vocabulary: Designing an investigation

Link each term on the left to the correct definition on the right.

Term	Definition
Hypothesis	The maximum and minimum values of the independent or dependent variable
Dependent variable	A variable that is kept constant during an experiment
Independent variable	The quantity between readings, eg a set of 11 readings equally spaced over a distance of 1 metre would give an interval of 10 centimetres
Control variable	A proposal intended to explain certain facts or observations
Range	A variable that is measured as the outcome of an experiment
Interval	A variable selected by the investigator and whose values are changed during the investigation

Activity 2 Scientific vocabulary: Making measurements

Link each term on the left to the correct definition on the right.

Term	Definition
True value	The range within which you would expect the true value to lie
Accurate	A measurement that is close to the true value
Resolution	Repeated measurements that are very similar to the calculated mean value
Precise	The value that would be obtained in an ideal measurement where there were no errors of any kind
Uncertainty	The smallest change that can be measured using the measuring instrument that gives a readable change in the reading

Activity 3 Scientific vocabulary: Errors

Link each term on the left to the correct definition on the right.

Random error	Causes readings to differ from the true value by a consistent amount each time a measurement is made
Systematic error	When there is an indication that a measuring system gives a false reading when the true value of a measured quantity is zero
Zero error	Causes readings to be spread about the true value, due to results varying in an unpredictable way from one measurement to the next

Understanding and using SI units

Every measurement has a size (eg 2.7) and a unit (eg metres or kilograms). Sometimes, there are different units available for the same type of measurement. For example, milligram, gram, kilogram and tonne are all units used for mass.

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.

There are seven SI base units, which are given in the table.

Physical quantity	Unit	Abbreviation
Mass	kilogram	kg
Length	metre	m
Time	second	s
Electric current	ampere	A
Temperature	kelvin	K
Amount of substance	mole	mol
luminous intensity	candela	cd

All other units can be derived from the SI base units. For example, area is measured in metres square (written as m^2) and speed is measured in metres per second (written as m s^{-1}: not that this is a change from GCSE, where it would be written as m/s).

Using prefixes and powers of ten

Very large and very small numbers can be complicated to work with if written out in full with their SI unit. For example, measuring the width of a hair or the distance from Manchester to London in metres (the SI unit for length) would give numbers with a lot of zeros before or after the decimal point, which would be difficult to work with.

So, we use prefixes that multiply or divide the numbers by different powers of ten to give numbers that are easier to work with. You will be familiar with the prefixes milli (meaning 1/1000), centi (1/100), and kilo (1 × 1000) from millimetres, centimetres and kilometres.

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

The most common prefixes you will encounter are given in the table.

Prefix	Symbol	Power of 10	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 4 SI units and prefixes

1. What would be the most appropriate unit to use for the following measurements?

    a. The mass of water in a test tube.
    b. The volume of water in a burette.
    c. The time taken for a solution to change colour.
    d. The radius of a gold atom.
    e. The number of particles eg atoms in a chemical.
    f. The temperature of a liquid.

2. Re-write the following quantities using the correct SI units.

    a. 0.5 litres
    b. 5 minutes
    c. 20 °C
    d. 70 °F
    e. 10 ml (millilitres)
    f. 5.5 tonnes
    g. 96.4 microlitres (μl)

3. Scientists have been developing the production of a new material through the reaction of two constituents.

    Before going to commercial production, the scientists must give their data in the correct SI units.

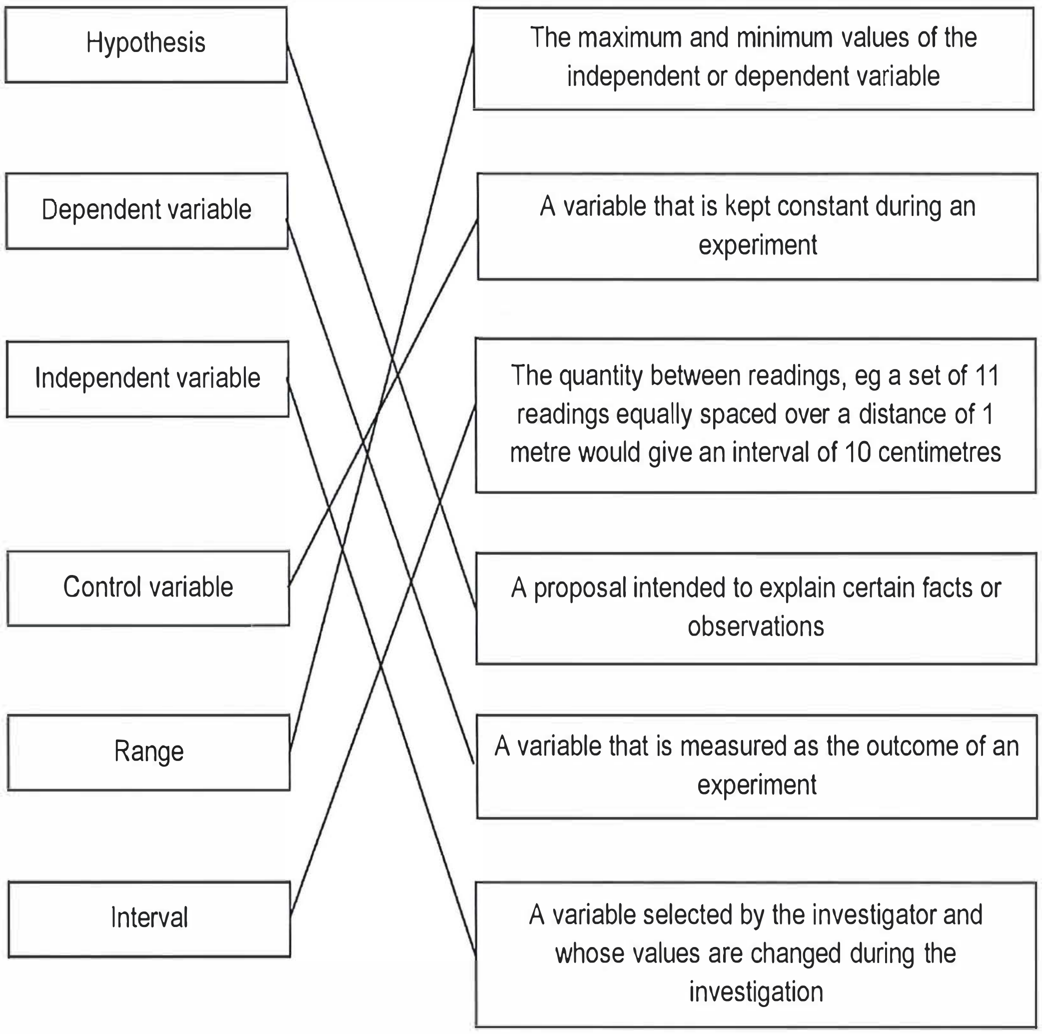
    a. The flow rate of the critical chemical was reported as 240 grams per minute at a temperature of 20 °C.
    Re-write this flow rate using the correct SI units. Show your working.

Activity 5 Converting data

Re-write the following.

1. 0.1 metres in millimetres
2. 1 centimetre in millimetres
3. 104 micrograms in grams
4. 1.1202 kilometres in metres
5. 70 decilitres in millilitres
6. 70 decilitres in litres
7. 10 cm^3 in litres
8. 2140 pascals in kilopascals

Activity 1 Scientific vocabulary: Designing an investigation



Activity 2 Scientific vocabulary: Making measurements

True value	The range within which you would expect the true value to lie
Accurate	A measurement that is close to the true value
Resolution	Repeated measurements that are very similar to the calculated mean value
Precise	The value that would be obtained in an ideal measurement where there were no errors of any kind
Uncertainty	The smallest change that can be measured using the measuring instrument that gives a readable change in the reading

Activity 3 Scientific vocabulary: Errors

Random error	Causes readings to differ from the true value by a consistent amount each time a measurement is made
Systematic error	When there is an indication that a measuring system gives a false reading when the true value of a measured quantity is zero
Zero error	Causes readings to be spread about the true value, due to results varying in an unpredictable way from one measurement to the next

Activity 4 SI units and prefixes

1.
   a. Kg - As the mass of water will be much less than a kilogram it could be expressed using power of ten (eg 1 gram would be written as 1x 10^{-3} kg.
   b. cm^3 - Volume is a derived SI unit, and is measured in cubic meters written as m^3. The volume in a burette is small and so the centi prefix is used to express a volume as centimeters cubed, written as cm^3.
   c. s
   d. picometres – length is measured in metres but as the length is so small the prefix pico is used.
   e. mol
   f. Kelvin

2.
   a. 500 cm^3
   b. 300 s (seconds)
   c. 293.1 K -
   d. 294.261K – To convert Fahrenheit to kelvin $(F - 32) \times 5 \div 9 + 273.15$
   e. 1×10^{-5} m^3
   f. 5 500 kg
   g. 9.64×10^{-8} m^3 - SI units 1 µl = 1 x 10-9 m^3

3. The flow rate of the critical chemical was reported as 0.24 kg per 60 seconds (4×10^{-3} kg per second) at a temperature of 293.1 K.

Activity 5 Converting data

1. 100mm
2. 10mm
3. 1.04×10^{-5} g
4. 1120.2 m or 1.1202×10^3
5. 7 000 ml or 7.0×10^3 ml
6. 7 liters
7. 0.01 cm^3 or 1×10^{-2}
8. 2.14 kPa

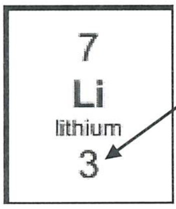
Pre-Knowledge Topics

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:

https://www.chemguide.co.uk/atoms/properties/atomorbs.html

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

$1s^2$, $2s^2$, $2p^6$ etc.

Q1.1 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

Q1.2 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 know 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 learned 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:

https://www.chemguide.co.uk/inorganic/redox/oxidnstates.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	

Q2.1 Work out the oxidation state of the **underlined** atom in the following:

a) Mg<u>C</u>O_3 c) Na<u>Cl</u>O_3 d) <u>Mn</u>O_2 e) <u>Fe</u>$_2O_3$

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

Chemistry topic 3 – Isotopes and mass

You will remember that an isotopes are elements that have differing numbers of neutrons. Hydrogen has 3 isotopes; H_1^1 H_1^2

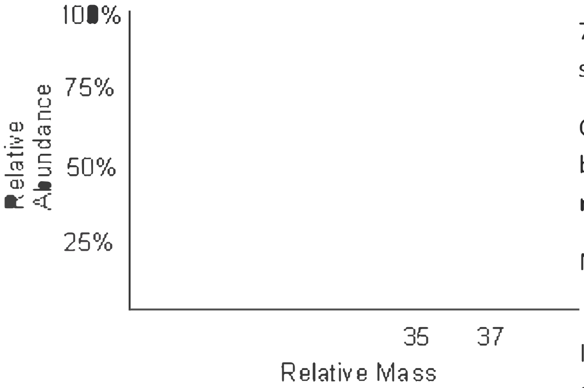
Isotopes occur naturally, so in a sample of an element you will have a mixture of these isotopes. We can accurately measure the amount of an isotope using a **mass spectrometer**. You will need to understand what a mass spectrometer is and how it works at A level. You can read about a mass spectrometer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

https://www.chemguide.co.uk/analysis/masspec/howitworks.html#top

Q3.1 What must happen to the atoms before they are accelerated in the mass spectrometer?

Q3.2 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:

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

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

http://www.avogadro.co.uk/definitions/ar.htm

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

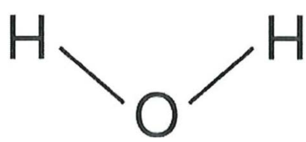
Given the percentage of each isotope you can calculate the mean mass which is the accurate atomic mass for that element.

Q3.3 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%

Chemistry topic 4 – The shapes of molecules and bonding.

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:

https://www.chemguide.co.uk/atoms/bonding/covalent.html

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:

https://www.chemguide.co.uk/atoms/bonding/shapes.html

Q4.1 Draw a dot and cross diagram to show the bonding in a molecule of aluminium chloride ($AlCl_3$)

Q4.2 Draw a dot and cross diagram to show the bonding in a molecule of ammonia (NH_3)

Q4.3 What is the shape and the bond angles in a molecule of methane (CH_4)?

Chemistry topic 5 – Chemical equations

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 chemical, don't worry about that, the key idea is to get balancing right.

https://www.chemguide.co.uk/14to16/equations/equations.html

Q5.1 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. $Fe + O_2 \rightarrow Fe_2O_3$

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

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

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:

https://filestore.aqa.org.uk/sample-papers-and-mark-schemes/2018/june/AQA-74052-INS-JUN18.PDF

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

$$Mg + S \rightarrow MgS$$

We can see that one atom of magnesium will react with one atom of sulfur, 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.

https://www.chemguide.uk/14to16/calculations/moles.html

a) How many moles of phosphorus pentoxide (P_4O_{10}) are in 85.2g?
b) How many moles of potassium in 73.56g of potassium chlorate (V) ($KClO_3$)?
c) 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.

d) What is the mass of 0.125 moles of tin sulfate ($SnSO_4$)?

e) 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.

https://www.chemguide.uk/14to16/calculations/solutions.html

Q7.1

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.

https://www.chemguide.uk/14to16/calculations/
titrations.html

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 → 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.

https://www.chemguide.co.uk/14to16/calculations/titrations.html

Use the steps on the last page to help you

Q8.1 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) → $BaSO_4$(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:

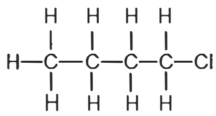
https://www.chemguide.co.uk/14to16/organicmenu.html

And how to name organic compounds here:

https://www.chemguide.co.uk/basicorg/conventions/names.html#:~:text=For%20example%2C%20to%20understand%20the,any%20carbon%2Dcarbon%20double%20bonds.

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

Q9.1 Halogenoalkanes



What is the name of this halogenoalkane?

How could you make it from butan-1-ol?

Q9.2 Alcohols

How could you make ethanol from ethene?

How does ethanol react with sodium, in what ways is this a) similar to the reaction with water, b) different to the reaction with water?

Q9.3 Aldehydes and ketones

Draw the structures of a) propanal b) propanone

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.

https://www.chemguide.co.uk/physical/acideqiamenu.html

Q10.1 What is your new definition of what an acid is?

Q10.2 How does ammonia (NH_3) act as a base?

Q10.3 Ethanoic acid (vinegar) is a weak acid, what does this mean?

Q10.4 What is the pH of a solution of 0.01 $moldm^{-3}$ of the strong acid, hydrochloric acid?

Pre-Knowledge Topics Answers to problems

Q1.1a) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ 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) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 4s^2\ 3d^{10}\ 4p^3$

Q1.2a) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6$ 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) $1s^2\ 2s^2\ 2p^6 3s^2 3p^6\ 3d^7$

==

Q2.1 a) +4 b) +6 c) +5 d) +4 e) +3 f) +5 g) +7 h) +6 i) +4

==

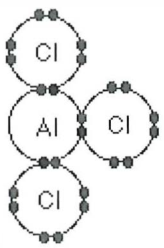
Q3.1 They must be ionised / turned into ions

Q3.2 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.

Q3.3 a) 121.855 b) 67.796 c) 107.973 d) 204.41 e) 87.710 / 87.7102

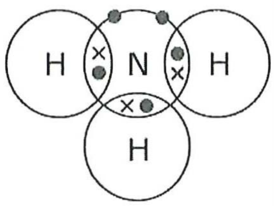
==

Q4.1



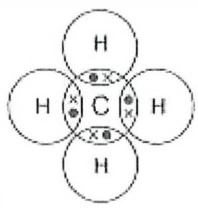
a) 120°

b)



107°

c)



109.5°

==

Q5a. $2H_2 + 0_2 \rightarrow 2\ H_20$

b. $S_8 +\ 1202 \rightarrow\ 8S0_3$

c. $2HgO \rightarrow\ 2Hg +\ 0_2$

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

e. $2Na +\ 2H_20 \rightarrow\ 2NaOH +\ H_2$

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

g. $2Fe +\ 30_2 \rightarrow\ 2Fe_20_3$

h. $C_6H_{12}0_6 +\ 60_2 \rightarrow\ 6\ C0_2 +\ 6\ H_20$

i. $Fe_20_3 +\ 3H_2 \rightarrow\ 2Fe +\ 3H_20$

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

Q6.1 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

7.1 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

==

8.1

$Ba(NO_3)_2 : Na_2SO_4$

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

==

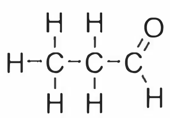
9.1 1-chlorobutane

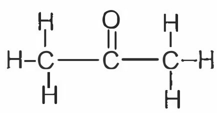
Add butan-1-ol to concentrated HCl and shake

9.2 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

9.3 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

Research activities

Use your online searching abilities to see if you can find out as much about the topic as you can. Remember it you are a prospective A level chemist, you should aim to push **your** knowledge.

You can make a 1-page summary for each one you research using Cornell notes:

https://docs.google.com/document/d/1X5vuSm8piiUwnsoYlyTt28inijWNTBvj7-jGWTUSmSQ/edit

Task 1: The chemistry of fireworks

What are the component parts of fireworks? What chemical compounds cause fireworks to explode? What chemical compounds are responsible for the colour of fireworks?

Task 2: Why is copper sulfate blue?

Copper compounds like many of the transition metal compounds have got vivid and distinctive colours – but why?

Task 3: Aspirin

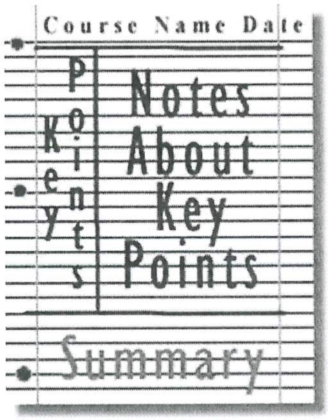
What was the history of the discovery of aspirin, how do we manufacture aspirin in a modern chemical process?

Task 4: The hole in the ozone layer

Why did we get a hole in the ozone layer? What chemicals were responsible for it? Why were we producing so many of these chemicals? What is the chemistry behind the ozone destruction?

Task 5: ITO and the future of touch screen devices

ITO – indium tin oxide is the main component of touch screen in phones and tablets. The element indium is a rare element and we are rapidly running out of it. Chemists are desperately trying to find a more readily available replacement for it. What advances have chemists made in finding a replacement for it?



Chemistry A level transition - baseline assessment. 40 marks

All data is given on this paper, you will not need a periodic table

Answer all questions.

1. Here is part of a periodic table, use it to answer the following questions

10.8 B 5 boron	12.0 C 6 carbon	14.0 N 7 nitrogen	16.0 O 8 oxygen	19.0 F 9 fluorine	20.2 Ne 10 neon
27.0 Al 13 aluminium	28.1 Si 14 silicon	31.0 P 15 phosphorus	32.1 S 16 sulphur	35.5 Cl 17 chlorine	39.9 Ar 18 argon

a. Which is the correct electron configuration for a nitrogen atom, circle the correct answer [1]

$1s^2 2p^5$ $1s^1 2p^6$ $1s^2 2s^2 2p^3$ $1s^2 2s^5$ $1s^2 2s^2 2p^6 3s^2 3p^2$

b. Which is the correct electron configuration for a chlorine atom, circle the correct answer [1]

$1s^2 2s^8 2p^7$ $1s^2 2s^2 2p^8 2d^5$ $1s^2 2s^2 2p^6 3d^7$ $1s^2 2s^2 2p^6 3p^7$ $1s^2 2s^2 2p^6 3s^2 3p^5$

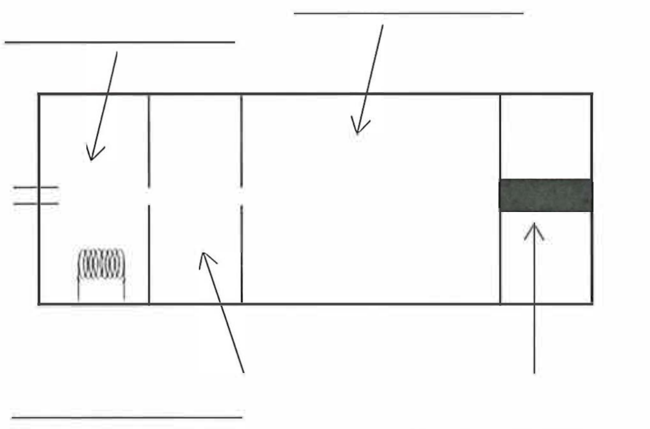
c. Which is the correct electron configuration for an aluminium **ion**, Al^{3+}? Circle the correct answer [1]

$1s^2 2s^2 2p^6$ $1s^2 2s^2 2p^6 3s^2 3p^3$ $1s^2 2s^2 2p^6 3s^2$ $1s^2 2s^2 2p^6 2d^1$

2. Draw a dot and cross diagram to show the bonding in a molecule of water, H_2O. [2]
Atomic numbers: H =1, O =8

3. A time of flight mass spectrometer has 4 main stages. put the correct stage in the diagram below:

Drift region **Ionisation** **Detector** **Acceleration**



[4]

4. A mass spectrometer was used to analyse a sample of chlorine; the results of the analysis are as follows:

isotope mass	% of sample
Cl-35	75.53
Cl-37	24.47

Calculate the accurate atomic mass of chlorine. Give your answer to **3 decimal places**. [3]

mass: ______________________

5. Give the oxidation state of the underlined atom in the following chemicals.
Useful information: H = +1, K = +1, Na = +1, Mg = +2, O = -2, Cl = -1 [7]

c) $H_2\underline{S}O_4$

e) $\underline{Cr}_2O_3$ f) $Na\underline{N}O_3$

6. Balance the following chemical equations:

a) C_3H_8 + ___ O_2 → ___ CO_2 + ___ H_2O [3]

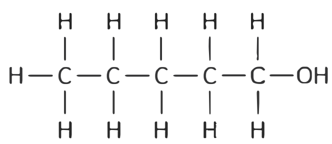
b) ___ HCl + $Mg(OH)_2$ → $MgCl_2$ + ___ H_2O [2]

c) Na_2CO_3 + ___ HCl → ___ NaCl + ___ H_2O + CO_2 [3]

7. Calculate the relative formula masses of the following:
Atomic masses: H = 1, O = 16, S = 32.1, C = 12, Ca = 40.1, Na = 23, Cl = 35.5, Zn = 65.4

a) $CaCl_2$ b) H_2CO_3 c) Na_2SO_4 d) C_3H_7OH e) $Zn(NO_3)_2$ [5]

8. A student carried out a reaction with this molecule:



a. What is the name of this molecule? _____ _________ [2]

9. Vinegar is a solution of ethanoic acid (CH_3COOH) in water. A student carried out a titration of a sample of vinegar.
He used a pipette to measure exactly 25.0cm^3 of vinegar into a flask, added an indicator and titrated it with a 1.00 mol dm^{-3} solution of sodium hydroxide (NaOH).
The reaction is:

$$CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O$$

The student found that his average titration was 27.50cm^3

c = n/v c = concentration (mol dm^{-3}), n = number of moles, v = volume (dm^3)

n = m/Rfm n = number of moles, m = mass in grams, Rfm = formula mass

1dm^3 = 1000 cm^3

a. Using the chemical equation, how many moles of sodium hydroxide will react with 1 mole of ethanoic acid?

____________moles [1]

b. How many moles of sodium hydroxide are in 27.50cm^3 of 1.00 moldm^{-3} sodium hydroxide?

____________moles [2]

c. How many moles of ethanoic acid are in 25.0cm^3 of the vinegar sample?

____________moles [1]

d. How many moles of ethanoic acid are in 1dm^3 of vinegar?

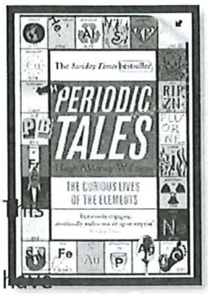
_____ moles [1]

e. Ethanoic acid has a formula mass of 48. What mass of ethanoic acid is present in 1dm^3 of vinegar?

____________g [2]

Book Recommendations

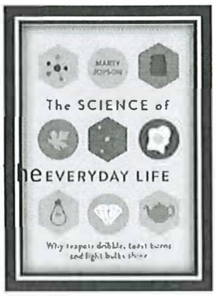
Periodic Tales: The Curious Lives of the Elements (Paperback) Hugh Aldersey-Williams



ISBN-10: 0141041455

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 never even thought about.

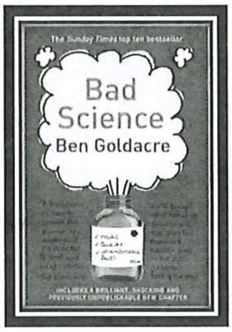
The Science of Everyday Life: Why Teapots Dribble, Toast Burns and Light Bulbs Shine (Hardback) Marty Jopson



ISBN-10: 1782434186

title says it all really, lots of interesting stuff about the things around you home!

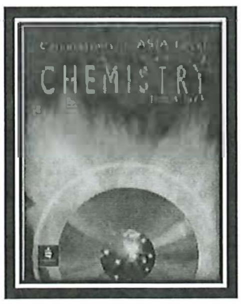
Bad Science (Paperback) Ben Goldacre



ISBN-10: 000728487X

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 'sciency'.

Calculations in AS/A Level Chemistry (Paperback) Jim Clark



ISBN-10: 0582411270

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.

Salters' Advanced Chemistry: Chemical Storylines

Do not feel you need to buy the latest edition (unless you are doing Salters chemistry!) You can pick up an old edition for a few pounds on ebay, gives you a real insight into how chemistry is used to solve everyday problems from global pollution through feeding to world to making new medicines to treat disease.

Videos to watch online

Rough science – the Open University – 34 episodes available

Real scientists are 'stranded' on an island and are given scientific problems to solve using only what they can find on the island.

Great fun if you like to see how science is used in solving problems.

There are six series in total

https://www.youtube.com/playlist?list=PLMC_-FtZbKXJRIWszjknt63nR9ETWS8rY

A thread of quicksilver – The Open University

A brilliant history of the most mysterious of elements – mercury. This program shows you how a single substance led to empires and war, as well as showing you come of the cooler properties of mercury.

http://bit.ly/pixlchemvid2

https://www.youtube.com/watch?v=t46lvTxHHTA

10 weird and wonderful chemical reactions

10 good demonstration reactions, can you work out the chemistry of …. any… of them?

https://www.youtube.com/watch?v=CEhMqR2ZkCM

Chemistry in the Movies

Dantes Peak 1997: Volcano disaster movie.

Use the link to look at the Science of acids and how this links to the movie.

https://www.youtube.com/watch?v=asAd-E5_HPo

Fantastic 4 2005 &2015: Superhero movie

Michio Kaku explains the "real" science behind fantastic four

https://www.youtube.com/watch?v=ppKz2oQ1w5s&list=PLdUsl9J23v-HwR2nl3iOcCVrtzjvRxWKe

Places to visit

1. Go outdoors!
   Have you actually spent any time observing the geology of the area you live in? What rocks or minerals are found in your area? Does your area have a history of extracting minerals? If so what were they, what were they used for, how did they obtain them? Are there any working or remains of mineral extraction industries?

2. Are there any chemical or chemistry based businesses in your area? A big ask, but one that could be really beneficial to you, write them a letter explaining that you are taking A level chemistry and you want to see how chemistry is used in industry and you would like to visit / have some work experience. You never know this could lead to great things!!!!

3. You could also try writing to / searching for your nearest university to see if they are running any summer schools for chemistry – they are usually free and give you the opportunity to experience the laboratories in a university.

4. Science museums.
   You could visit your nearest science museum. They often have special exhibitions that may be of interest to you.