PARK HALL
ACADEMY

Park Hall Academy
A-Level Chemistry

Year 11 – Year 12
Transition Booklet

Welcome to A level Chemistry!

Welcome to A-Level Chemistry at Park Hall!

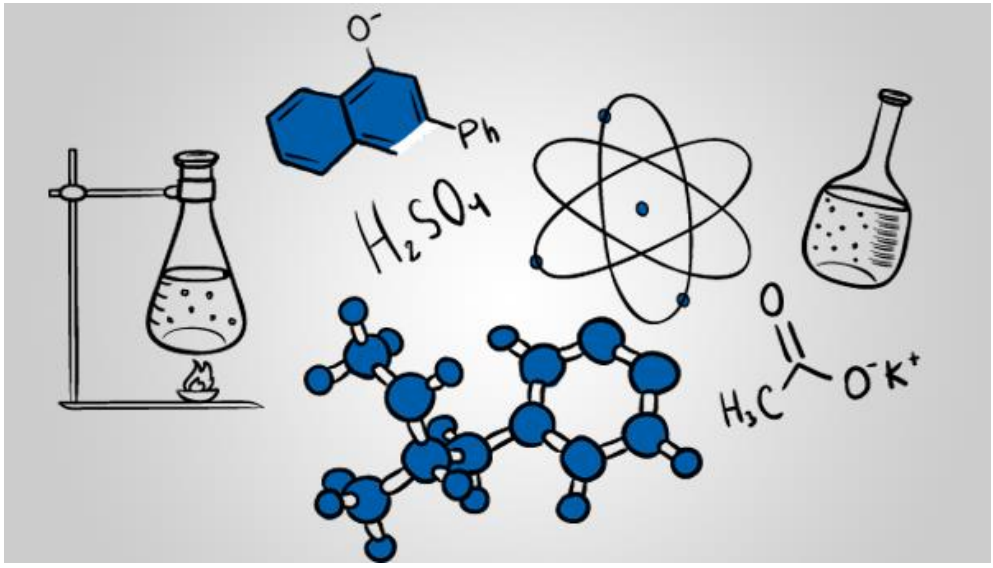
We are really pleased that you have chosen to study Chemistry at A-level and I look forward to meeting you all in September.

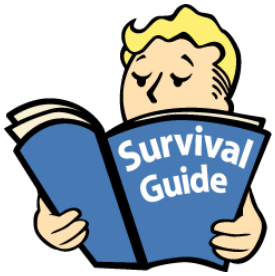
Chemistry is a very challenging subject, but it is also very rewarding as you will develop a wide range of skills and knowledge which will be of great benefit to you whatever you choose to do post-18.

This transition booklet aims to prepare you for the start of your Chemistry course so you can hit the ground running in September.

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.





Your Chemistry Survival Guide

Pre-lesson Checklist:

- ✓ Got your folder (right topic and subject!!)
- ✓ Got textbook
- ✓ Got paper
- ✓ Got pen, pencil, ruler, rubber
- ✓ Got calculator (scientific)
- ✓ Turn up on time

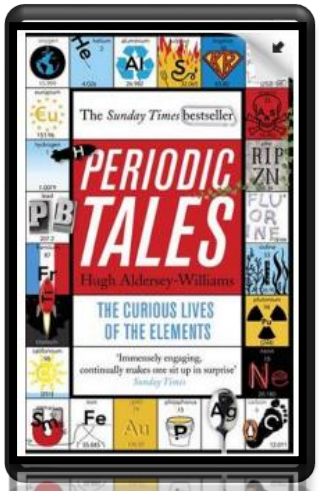
Weekly Checklist:

- ✓ Put all your lessons in separate plastic wallets
- ✓ Make sure that all notes have a date an title
- ✓ New topic? Use a divider to separate them out
- ✓ Read through your notes – do they make sense?
- ✓ Use the internet (Chemguide!) to make sure that you have all the key info
- ✓ Go and find your teacher if there's something you didn't understand (regardless of how small!)
- ✓ Do your homework in advance and ask for help if you get stuck
- ✓ Make revision cards/mind map on what you've covered this week and use them!

A-level Science is challenging (and rewarding) and things can quickly get out of hand if you don't keep them in check! Fail to prepare; prepare to fail.

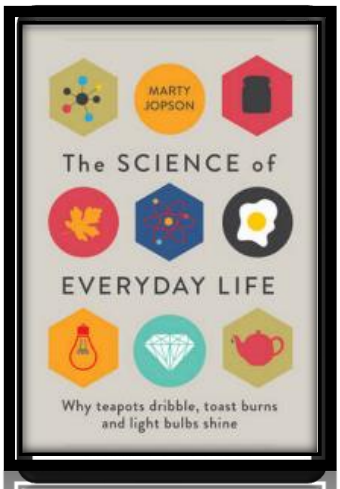
Book Recommendations

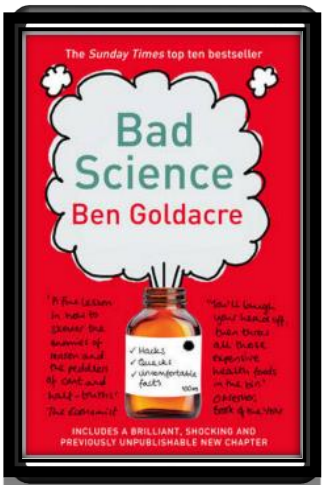
Kick back this summer with a good read. The books below are all popular science books and great for extending your understanding of chemistry



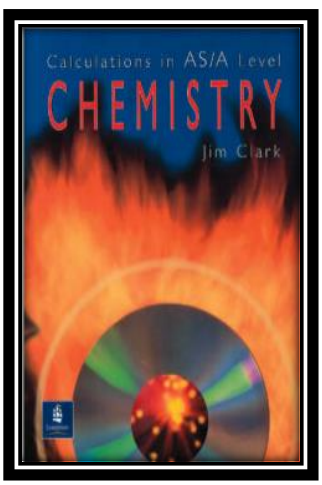
Periodic Tales: The Curious Lives of the Elements
This book covers the chemical elements, where they come from and how they are used. There are loads of fascinating insights into uses for chemicals you would have never even thought about.

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!

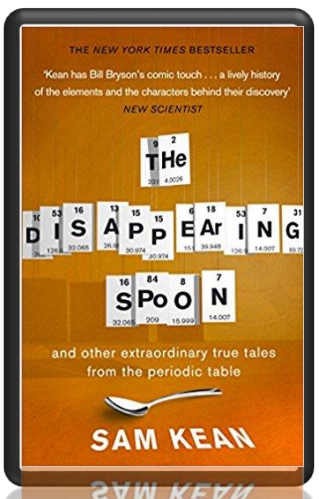




Bad Science
Here Ben Goldacre takes apart anyone who published bad / misleading or dodgy science – this book will make you think about everything the advertising industry tries to sell you by making it sound 'sciencey'.



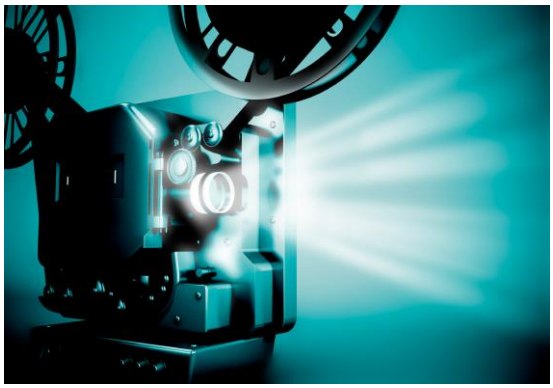
Calculations in AS/A Level Chemistry
If you struggle with the calculations side of chemistry, this is the book for you. Covers all the possible calculations you are ever likely to come across. Brought to you by the same guy who wrote the excellent chemguide.co.uk website.

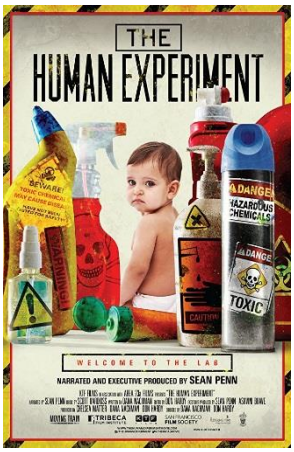


One of our crowning scientific achievements is also a treasure trove of passion, adventure, betrayal and obsession. **The Disappearing Spoon** follows the elements, their parts in human history, finance, mythology, conflict, the arts, medicine and the lives of the (frequently) mad scientists who discovered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

Movie Recommendations

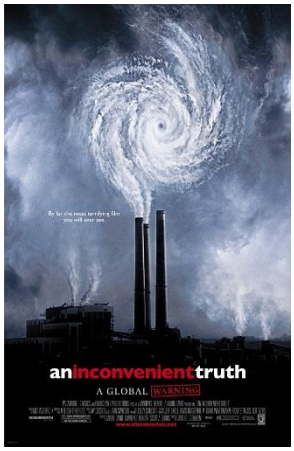
Everyone loves a good story and everyone loves some great science. Here are some of the picks of the best films based on real life scientists and discoveries. You wont find Jurassic Park on this list! We've looked back over the last 50 years to give you our top 5 films you might not have seen before.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



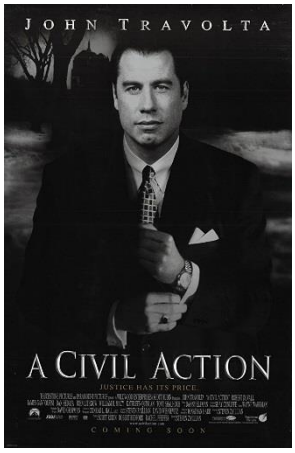


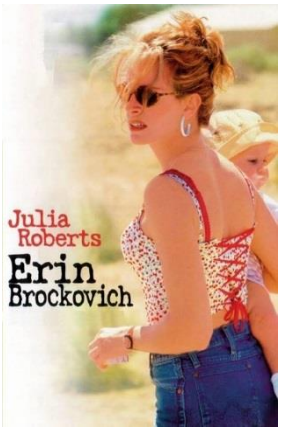
The Human Experiment (2013)
A documentary that explores chemicals found in everyday household products.

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)

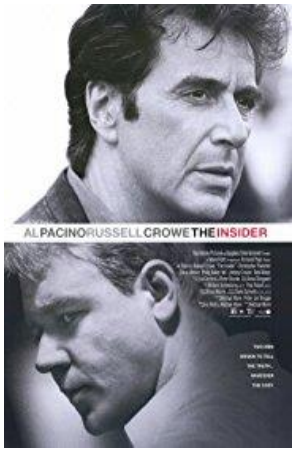


A Civil Action (1998)
A tenacious lawyer takes on a case involving a major company responsible for causing several people to be diagnosed with leukemia due to the town's water supply being contaminated, at the risk of bankrupting his firm and career.





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.

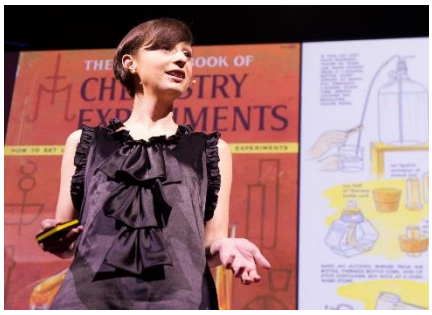


The Insider (1999)
A research chemist comes under personal and professional attack when he decides to appear in a "60 Minutes" expose on Big Tobacco.

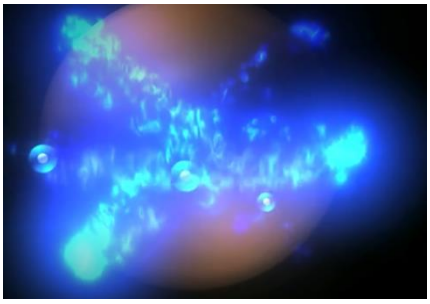
Movie Recommendations

If you have 30 minutes to spare, here are some great presentations (and free!) from world leading scientists and researchers on a variety of topics. They provide some interesting answers and ask some thought-provoking questions. Use the link or scan the QR code to view:

Play with Smart Materials
Available at :
https://www.ted.com/talks/catarina_mota_play_with_smart_materials Ink that conducts electricity; a window that turns from clear to opaque at the flip of a switch; a jelly that makes music. All this stuff exists, it's time to play with it. A tour of surprising and cool new materials.



Just how small is an atom?
Available at :
https://www.ted.com/talks/just_how_small_is_an_atom
Just how small are atoms? Really, really, really small. This fast-paced animation from TED-Ed uses metaphors (imagine a blueberry the size of a football stadium!) to give a visceral sense of just how small atoms are.



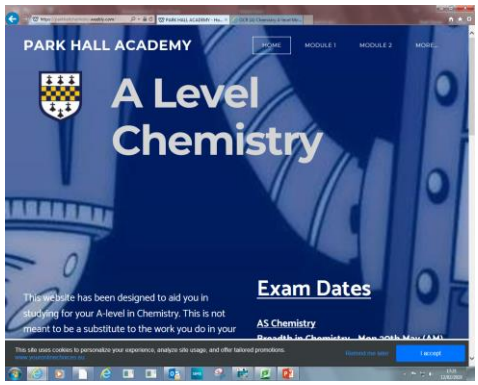
Battling Bad Science
Available at :
https://www.ted.com/talks/ben_goldacre_battling_bad_science#t-44279
Every day there are news reports of new health advice, but how can you know if they're right? Doctor and epidemiologist Ben Goldacre shows us, at high speed, the ways evidence can be distorted, from the blindingly obvious nutrition claims to the very subtle tricks of the pharmaceutical industry.

How Spectroscopy Could Reveal Alien Life
Available at :
https://www.ted.com/talks/garik_israelian_what_s_inside_a_star
Garik Israelian is a spectroscopist, studying the spectrum emitted by a star to figure out what it's made of and how it might behave. It's a rare and accessible look at this discipline, which may be coming close to finding a planet friendly to life.

Useful websites

Park Hall school website designed for you

https://parkhallchemistry.weebly.com/



Chemguide

Useful website for more detailed explanations. Easy to read and understand

chemguide

Helping you to understand Chemistry

http://www.chemguide.co.uk/

Knockhardy

This website contains a lot of useful information in presentations and one page notes

"... surely sets the standard for UK A and AS resources."

KNOCKHARDY Publishing

www.knockhardy.org.uk/sci.htm

http://www.knockhardy.org.uk/sci.htm

OCR Homepage

For general information about the course

OCR Oxford Cambridge and RSA

AS/A Level GCE

Chemistry A - H032, H432 (from 2015)

http://www.ocr.org.uk/qualifications/as-a-level-gce-chemistry-a-h032-h432-from-2015/

S-cool Chemistry

General revision notes and questions arranged by topic.

S-cool the revision website

http://www.s-cool.co.uk/a-level/chemistry

https://www.physicsandmathstutor.com/chemistry-revision/a-level-ocr-a/module-2/

Useful websites
Scan the QR codes

https://parkhallchemistry.weebly.com/

http://www.chemguide.co.uk/

http://www.ocr.org.uk/qualifications/as-a-level-gce-chemistry-a-h032-h432-from-2015/

http://www.knockhardy.org.uk/sci.htm

http://www.s-cool.co.uk/a-level/chemistry

In order to achieve an A grade you need to be fully prepared

Let's start with the structure of the terminal exams

The papers are broken down into areas from the Chemistry curriculum as follows:

2 The specification overview

2a. Overview of A Level in Chemistry A (H432)

Learners must complete all components (01, 02, 03 and 04).

Content Overview	Assessment Overview	
Content is split into six teaching modules: • Module 1 – Development of practical skills in chemistry • Module 2 – Foundations in chemistry • Module 3 – Periodic table and energy • Module 4 – Core organic chemistry • Module 5 – Physical chemistry and transition elements • Module 6 – Organic chemistry and analysis Component 01 assesses content from modules 1, 2, 3 and 5. Component 02 assesses content from modules 1, 2, 4 and 6. Component 03 assesses content from all modules (1 to 6).	Periodic table, elements and physical chemistry (01) 100 marks 2 hours 15 minutes written paper	**37%** of total A level
	Synthesis and analytical techniques (02) 100 marks 2 hours 15 minutes written paper	**37%** of total A level
	Unified chemistry (03) 70 marks 1 hour 30 minutes written paper	**26%** of total A level
	Practical Endorsement in chemistry (04) (non exam assessment)	Reported separately (see Section 5)

All components include synoptic assessment.

Section A of paper 01/02 are multiple choice

Section B of paper 01/02 contains short answered structured questions/calculations/practical questions and extended response questions

Paper 03 contains short answered structured questions/calculations/practical questions and extended response questions

There are three assessment objectives in A level Chemistry:

	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas, processes, techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas, processes, techniques and procedures: • in a theoretical context • in a practical context • when handling qualitative data • when handling quantitative data.
AO3	Analyse, interpret and evaluate scientific information, ideas and evidence, including in relation to issues, to: • make judgements and reach conclusions • develop and refine practical design and procedures.

- All three assessed units contain some synoptic assessment, extended response questions and stretch and challenge questions.
- Stretch and challenge questions allow the most able learners to show the extent of their knowledge and skills and support the awarding of the A* grade
- Extended response questions ask learners to construct and develop a sustained coherent line of reasoning.
- The quality of the extended response is rewarded and the questions are clearly identified in the papers
- Synoptic assessment tests the learners' understanding of the connections between the different elements of chemistry A level course
- E.g. apply knowledge and understanding of more than one area to a particular situation
- use knowledge and understanding in planning experimental procedures, analysing and evaluating data

Mathematical requirements

20% of the marks in the exam papers

will be Level 2 standard mathematics or higher.

Mathematical skill to be assessed	Example
Arithmetic and numerical computation	Use appropriate units and convert units (e.g. cm3 to dm3)
Recognise and use expressions in decimal and ordinary form	Use appropriate number of decimal places Calculations using numbers in ordinary and standard form (e.g. Avogadro's constant) Significant figures need retaining when making conversions between standard and ordinary form (e.g. 0.0050 is 5.0 x10-3
Use ratios fractions and %	Calculate %yield/atom economy/balance equations
Estimate results	e.g. how the value of Kc would change with temperature
Use a calculator to find and use powers/exponential/ logarithmic functions	Use Avogadro's constant/calculate pH and pKa/make approximations in buffer calculations

Mathematical requirements

20% of the marks in the exam papers will be Level 2 standard mathematics or higher.

Mathematical skill to be assessed	Example
Handling data Use an appropriate number of significant figures	Raw data may be varying in significant figures and calculated results can only be reported to the least accurate measurement
Find arithmetic means	Calculate atomic mass based on isotopic abundances Select appropriate titration data to calculate mean titre
Determine uncertainty in data	Determine uncertainty when two burette readings are used to calculate a titre
Algebra Understand and use algebraic symbols	e.g. $<$ $\geq$ [ ]
Change the subject of an equation	Carry out structured and unstructured mole calculations Calculate rate constant from a rate equation
Substitute numerical values into algebraic equations using appropriate units for physical quantities	Carry out enthalpy change calculations Calculate the value of an equilibrium constant
Use logarithms that range over several orders of magnitude	Carry out pH and pKa calculations

Mathematical requirements

20% of the marks in the exam papers will be Level 2 standard mathematics or higher.

Mathematical skill to be assessed	Example
Graphs Translate data between graphical, numerical and algebraic forms	Interpret and analyse spectra Determine the order of a reaction from and graph and derive the rate expression
Plot two variables from data	Plot graph from data Draw line of best fit Extrapolate and interpolate Construct calibration curves
Determine the slope and intercept of a linear graph	Calculate values of Ea and A from an Arrhenius graph
Calculate rate of change from a linear graph	Calculate rate constant of a first order reaction by determining the gradient of a rate-concentration graph
Draw and use the slope of a tangent to a curve as a measure of rate of change	Calculate rate of reaction from a concentration-time graph for a first or second order reaction

Mathematical requirements

20% of the marks in the exam papers will be Level 2 standard mathematics or higher.

Mathematical skill to be assessed	Example
Geometry and trigonometry Use angles and shapes in regular 2-D and 3-D structures	Predict /identify shapes and bond angles in molecules with and without lone pairs
Visualise and represent 2-D and 3-D forms including 2-D representations of 3-D objects	Draw different forms of isomers Identify chiral centres from 2-D and 3-D representations
Understand the symmetry of 2-D and 3-D shapes	Describe the types of stereoisomerism shown by molecules/complexes

Practical activities

Make sure you go through the analysis and extension questions of your PAGs

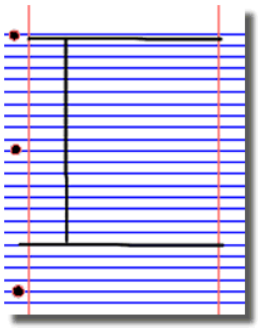
Table 1 Practical activity requirements for the OCR Chemistry Practical Endorsement

Practical activity group (PAG)	Techniques/skills covered (minimum)	Example of a suitable practical activity (a range of examples will be available from the OCR website and centres can devise their own activity)
1 Moles determination	• Measurement of mass • Measurement of volume of gas	Determination of the composition of copper(II) carbonate
2 Acid–base titration	• Measurement of volume of a liquid • Use of volumetric flask, including accurate technique for making up a standard solution • Titration, using burette and pipette • Use of acid–base indicators in titrations of weak/strong acids with weak/strong bases	Titration of sodium hydrogencarbonate against hydrochloric acid
3 Enthalpy determination	• Measurement of temperature	Determination of the enthalpy change of neutralisation
4 Qualitative analysis of ions	• Use of apparatus for qualitative tests for ions • Make and record qualitative observations	Identification of the anions and cations present in a mixture of Group 2 salts
5 Synthesis of an organic liquid	• Heating under reflux[1] • Purification using a separating funnel • Distillation • Risk assessment	Synthesis of a haloalkane
6 Synthesis of an organic solid	• Purification by recrystallisation • Use of melting point apparatus • Use of thin layer or paper chromatography • Filtration • Heating under reflux[1] • Risk assessment	Synthesis of aspirin
7 Qualitative analysis of organic functional groups	• Use of apparatus for qualitative tests for organic functional groups • Heating using water bath or electric heater • Make and record observations	Identifying functional groups in a series of unknown organic compounds
8 Electrochemical cells	• Set up of electrochemical cells and measurement of voltages	The effect of concentration on the cell potential of an electrochemical cell
9 Rates of reaction – continuous monitoring method	• Measurement of rate of reaction by a continuous monitoring method • Measurement of time • Use of appropriate software to process data[2]	Finding the half-life of a reaction
10 Rates of reaction – initial rates method	• Measurement of rate of reaction by an initial rate method • Use of appropriate software to process data[2] • Identify and control variables	Finding the order and rate constant for a reaction
11 pH measurement	• Measurement of pH	Identifying unknown solutions via pH measurements
12 Research skills	• Apply investigative approaches • Use online and offline research skills • Correctly cite sources of information	How long does it take iron tablets to break down in the stomach?

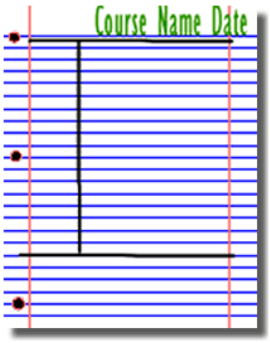
How to take effective notes

Research, reading and note making are essential skills for A level chemistry study. For the following task you are going to produce 'Cornell Notes' to summarise your reading.

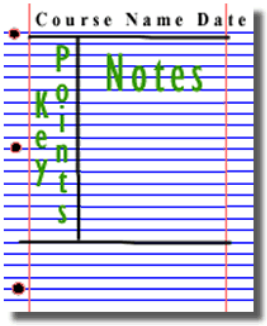
1. Divide your page into three sections like this



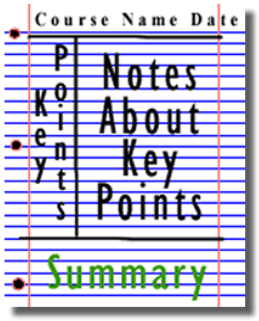
2. Write the name, date and topic at the top of the page



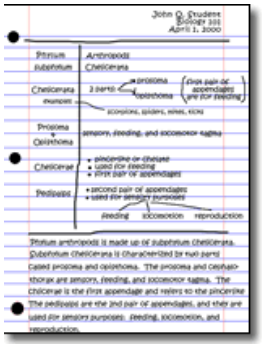
3. Use the large box to make notes. Leave a space between separate idea. Abbreviate where possible.



4. Review and identify the key points in the left hand box



5. Write a summary of the main ideas in the bottom space

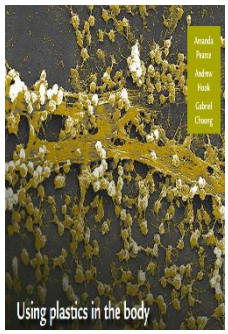


General Interest

Aimed at students aged 14-19, Catalyst magazine is packed with interesting articles on cutting-edge science, interviews and new research written by leading academics. It also includes a booklet of teacher's notes, full of ideas and lesson plans to bring the articles to life in the classroom.
For each of the following topics you are going to use the resources to produce one page of Cornell style notes.
Use the links of scan the QR code to take you to the resources.

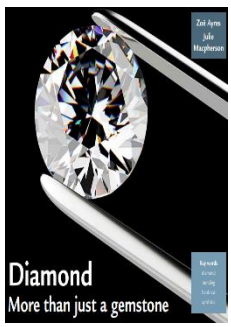
CATALYST

Topic 1: Using Plastics in the Body
Available at:
https://www.stem.org.uk/resources/elibrary/resource/382317/using-plastics-body
This Catalyst article looks at how scientists are learning to use polymers for many medical applications, including implants, bone repairs and reduction in infections.

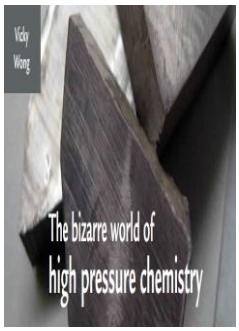


Topic 2: Catching a Cheat
Available at:
https://www.stem.org.uk/system/files/elibrary-resources/2017/03/Catching%20a%20cheat.pdf
This Catalyst article looks at analytical chemists who are involved in many kinds of testing, including drug testing to catch cheats in sport.

Topic 3: Diamond: More than just a gemstone
Available at:
https://www.stem.org.uk/system/files/elibrary-resources/2017/02/Diamond%20more%20than%20just%20a%20gemstone.pdf
This Catalyst article looks at diamond and graphite which are allotropes of carbon. Their properties, which depend on the bonding between the carbon atoms, are also examined.



Topic 4: The Bizarre World of High Pressure Chemistry
Available at:
https://www.stem.org.uk/system/files/elibrary-resources/2016/11/Catalyst27_1_the_bizarre_world_of_high_pressure_chemistry.pdf
This Catalyst article investigates high pressure chemistry and discovers that, when put under extreme pressure, the properties of a material may change dramatically.



Topic 5: Microplastics and the Oceans
Available at:
https://www.stem.org.uk/system/files/elibrary-resources/2016/11/Catalyst27_1_microplastics_%20and_the_oceans.pdf
This Catalyst article looks at microplastics. Microplastics are tiny particles of polymer used in many products. They have been found to be an environmental pollutant especially in oceans.

Watch the TEDx TUFT talk **Chemistry is fun. No, seriously! By Jordin Metz.** It is available https://www.youtube.com/watch?v=3LhNRJkh87w or you can search for it. Jordin is American. Can you say why you want to study chemistry

Research Activities

Task 1: Thalidomide:

Aim: To understand why new drugs need to be testing and how the structure of chemical compounds can affect the properties of a compound.

Instructions: Research the use of the drug Thalidomide. Write an article for a Pop Science magazine explaining the issue and history of this drug. Explain what an enantiomer and a racemic mixture is and explain why this led to problems with this drug.

Lesson resources:
https://www.youtube.com/watch?v=mrTHfBCduRA

https://www.youtube.com/watch?v=41n3mDoVbvk

https://www.sciencemuseum.org.uk/objects-and-stories/medicine/thalidomide

Research Activities

Task 2: The Haber Process:

Aim: To be able to explain why it is important to choose a compromise of conditions in Haber Process .

Instructions: Research the Haber Process and complete a quick summary of the process and why it is important.
Explain (using le Chatelier's principle) what the best temperature for the reaction would be and what the best pressure would be.
Explain why a compromise must be made (think both about the effect of temperature on pressure, cost and safety).

Lesson resources:
https://ed.ted.com/lessons/the-chemical-reaction-that-feeds-the-world-daniel-d-dulek

https://www.chemguide.co.uk/physical/equilibria/haber.html

Research Activities

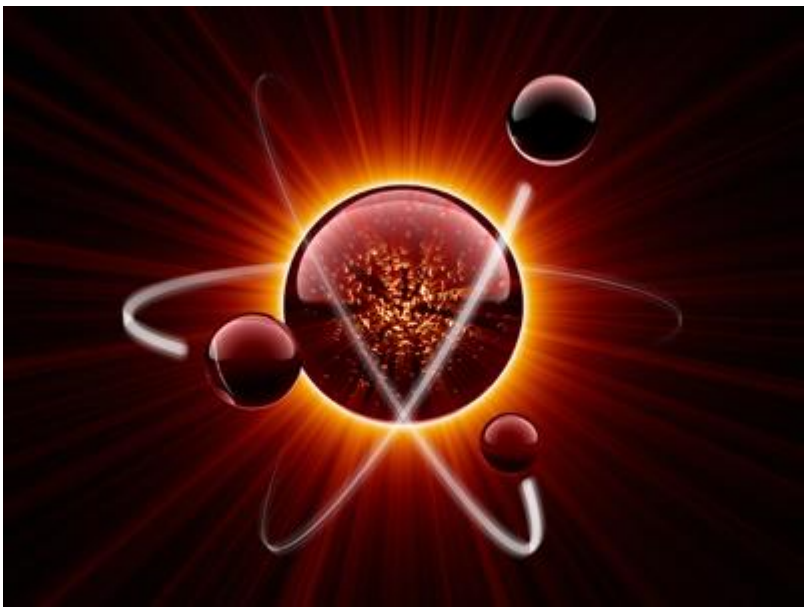
Task 3: Atomic Structure:

Aim: To be able to explain the history of the development of models of the atom.

Instructions: Research the contributions of the following scientists in the development of the model of the atom; Dalton, Thompson, Rutherford (really Geiger and Marsden), Chadwick, Bohr, Schrodinger and Heisenberg (yes that's where Walter White got his pseudonym from in breaking Bad!). Write a short summary of each. How far do you agree with the statement of George Box that "All models are wrong, but some models are useful".

Lesson resources:
https://www.compoundchem.com/2016/10/13/atomicmodels/

https://www.thoughtco.com/history-of-atomic-theory-4129185



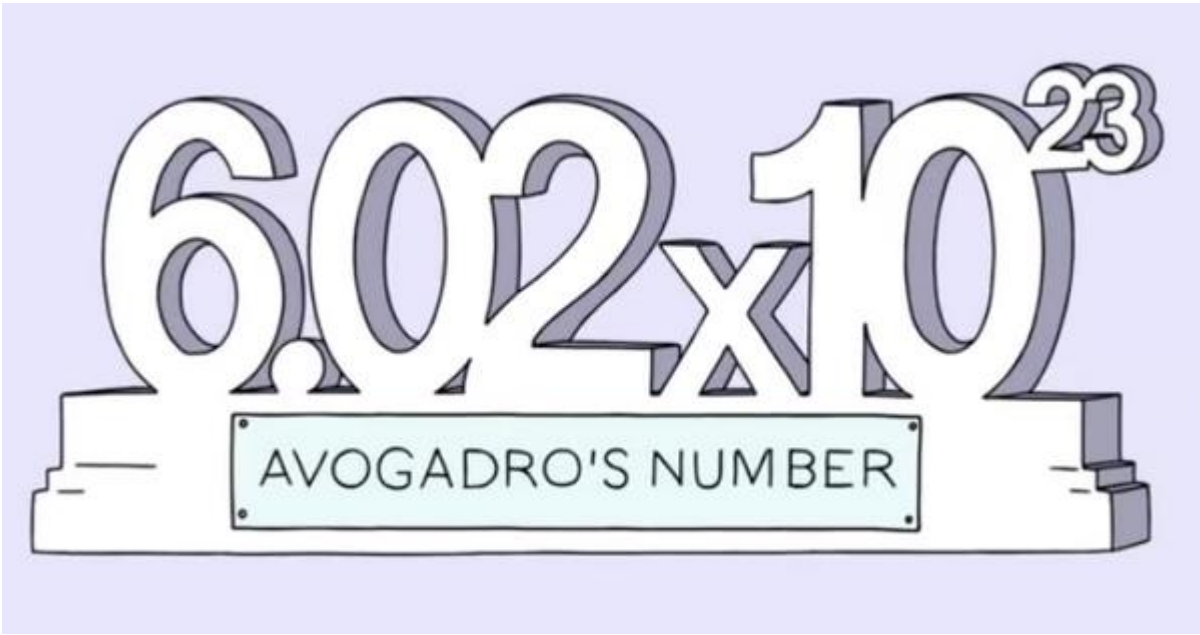
Research Activities

Task 4: Avogadro's Number:

Aim: To understand what Avogadro's number represents and what a mole is.

Instructions: Answer the following question: "How did we calculate the number of molecules in 1 mole of a substance (Avogadro's number)?" HINT Avogadro didn't come up with this, it is named after him, but his law was pivotal to working it out.

Lesson resources:
https://www.scientificamerican.com/article/how-was-avogadros-number/



Research Activities

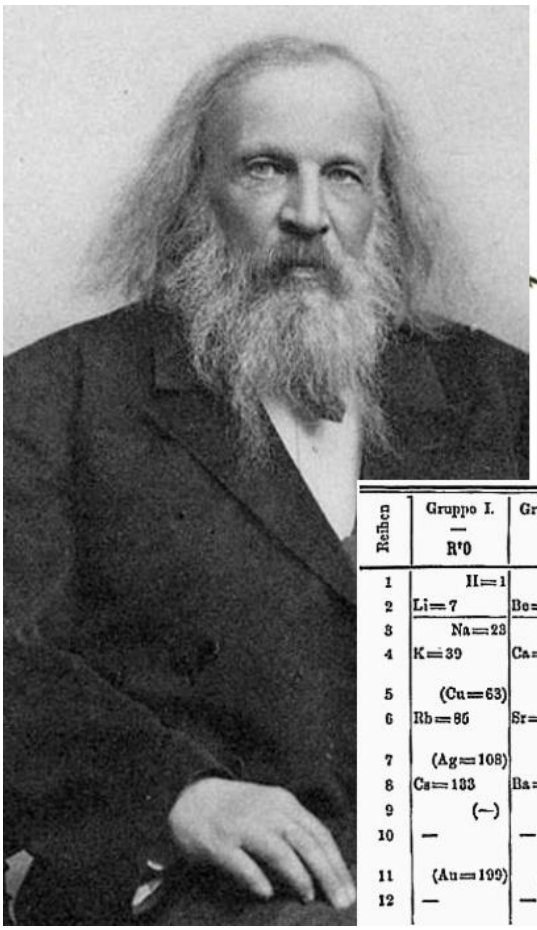
Task 5: Periodic Table:

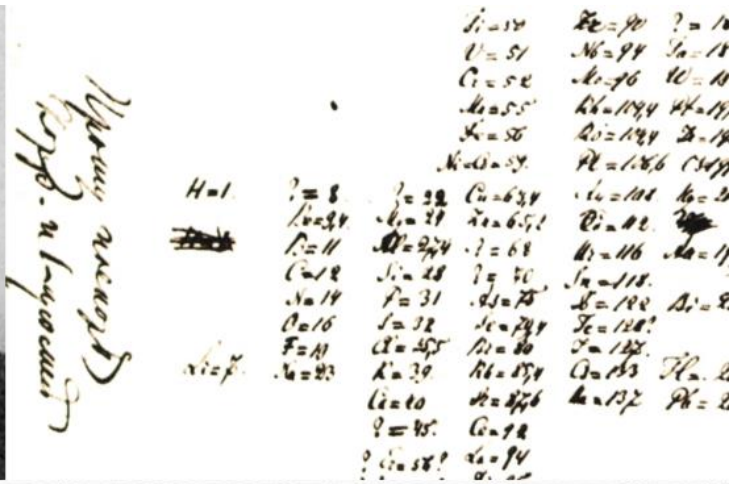
Aim: To understand the development of the periodic table

Instructions: Discuss the following statement: “Mendeleev’s contribution to the development of the periodic table is hugely over-exaggerated”.

Lesson resources:
https://www.rsc.org/periodic-table/history/about

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

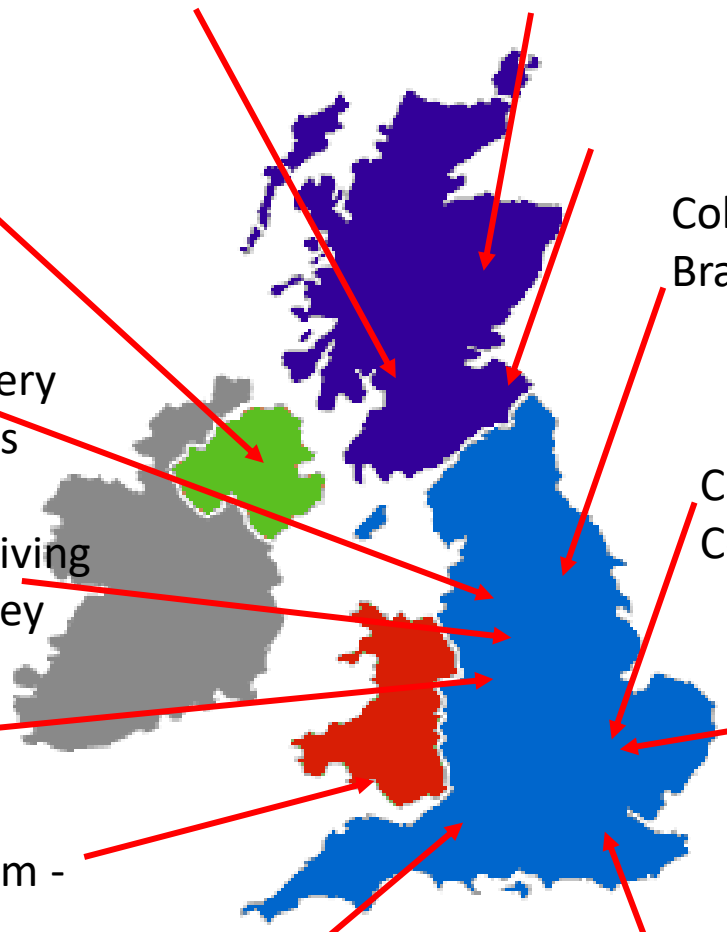




Reihen	Gruppo I. — R^1O	Gruppo II. — RO	Gruppo III. — R^2O^3	Gruppo IV. RH^4 RO^2	Gruppo V. RH^3 R^2O^5	Gruppo VI. RH^2 RO^3	Gruppo VII. RH R^2O^7	Gruppo VIII. — RO^4
1	H=1							
2	Li=7	Be=9,4	B=11	C=12	N=14	O=16	F=19	
3	Na=23	Mg=24	Al=27,3	Si=28	P=31	S=32	Cl=35,5	
4	K=39	Ca=40	—=44	Ti=48	V=51	Cr=52	Mn=55	Fe=56, Co=59, Ni=59, Cu=63.
5	(Cu=63)	Zn=65	—=68	—=72	As=75	Se=78	Br=80	
6	Rb=85	Sr=87	?Yt=88	Zr=90	Nb=94	Mo=96	—=100	Ru=104, Rh=104, Pd=106, Ag=108.
7	(Ag=108)	Cd=112	In=113	Sn=118	Sb=122	Te=125	J=127	
8	Cs=133	Ba=137	?Di=138	?Ce=140	—	—	—	— — — —
9	(—)	—	—	—	—	—	—	
10	—	—	?Er=178	?La=180	Ta=182	W=184	—	Os=195, Ir=197, Pt=198, Au=199.
11	(Au=199)	Hg=200	Tl=204	Pb=207	Bi=208	—	—	
12	—	—	—	Th=231	—	U=240	—	— — — —

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 :



Glasgow Science Centre - Glasgow

Dundee Science Centre - Dundee

W5 - Belfast

Colour Experience - Bradford

Catalyst Discovery Centre - Widnes

Cambridge Science Centre - Cambridge

Black Country Living Museum - Dudley

Think-tank - Birmingham

The Whipple Museum - Cambridge

National Museum - Cardiff

The Faraday Museum - London

Bristol Science Centre - Bristol

Science: Things to do!

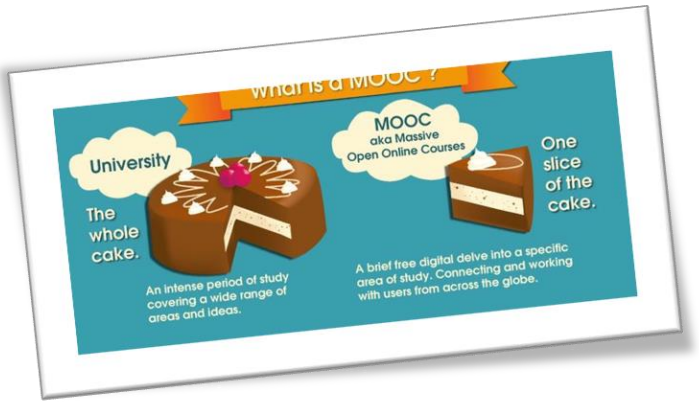
Day 4 of the holidays and boredom has set in?
There are loads of citizen science projects you can take part in either from the comfort of your bedroom, out and about, or when on holiday. Wikipedia does a comprehensive list of all the current projects taking place. Google 'citizen science project'

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.

canvas NETWORK
edX
coursera
OPEN 2 STUDY
open2study.com
UDACITY
udacity.com
FUTURELEARN
KHAN ACADEMY
ed2go

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



Science: Things to do!

Online MOOC course:

https://www.futurelearn.com/courses/good-brain-bad-brain-drugs

Other useful links to prep you for starting Chemistry:

CGP Headstart to A Level (free as a kindle book)
https://www.amazon.co.uk/Head-Start-level-Chemistry-Level-ebook/dp/B00VE2NIGG/ref=msx_wsirn_v1_1/259-0922743-4799544?_encoding=UTF8&pd_rd_i=B00VE2NIGG&pd_rd_r=0b9dbecd-8c91-43ed-8cb7-95c3137282ef&pd_rd_w=XxLER&pd_rd_wg=adPAb&pf_rd_p=2c73497e-0658-4f6d-8f3c-06c50c0881ec&pf_rd_r=XM9XCBYH1TH593V5E0S9&psc=1&refRID=XM9XCBYH1TH593V5E0S9

PIXL A Level Chemistry Baseline Test
https://drive.google.com/open?id=1f2ib7Z2zU2MlzlGvxoFLmLOXkCisw2eB
Transition to A Level Transition book (@GriffithsEllis)
https://drive.google.com/open?id=1554zkBwxMsMZaOnR3R600UaqrnuQ9dq5
Summer Start to A Level Chemistry (Primrose Kitten)
https://drive.google.com/open?id=1DC8PVlhJ5jbuN2_coGM-iDqfk7-ALSXh
AQA Chemistry Transition Guide
https://drive.google.com/open?id=1pIyWnFm-MnDx4Wv0MPFPlpWb980wD6V9
Oxford University Press transition pack:
http://fdslive.oup.com/www.oup.com/oxed/secondary/science/Science_A_Level_Transition_Pack_Chemistry.pdf

Pre-Knowledge Topics

Student's Checklist to be A level Chemistry Ready

Electron configuration for the first 20 elements e.g. Mg 2,8,2
Naming compounds from formulae and vice versa
Bonding
Three main types – formation and properties
ionic
covalent
and metallic
Dot and cross diagrams for covalent molecules and ionic compounds to include:
IONIC sodium chloride, calcium oxide, calcium fluoride, aluminium oxide
COVALENT chlorine, oxygen, nitrogen, ammonia, carbon dioxide, methane, ethane, ethanol, sulfur dioxide, water
Writing formulae for all of the above plus compounds with:
Carbonate e.g. magnesium carbonate
Nitrate e.g. copper nitrate
hydroxide
hydrogen carbonate
sulfate.
Balancing equations for
neutralisation – acid with alkali
metals with acids
metal carbonates with acid
alkali metals with water
redox (displacement of halogens and metals), thermal decomposition
Calculations
relative atomic mass, relative formula mass and empirical formulae
Percentage yield and atom economy
Reacting masses and limiting reagent
Energetics
difference between exothermic and endothermic
graphs associated with these
energies in bond making and bond breaking
Equilibria
recall that chemical reactions are reversible
the direction of some reversible reactions can be altered by changing the reaction conditions
Organic Chemistry
differences between alkanes and alkenes
naming and reactions of alkanes and alkenes e.g. methane to decane and ethane to decene
fractional distillation including the products and their uses
cracking including how to test for a double bond
characteristics of good fuels
balancing combustion equations

Pre-Knowledge Topics

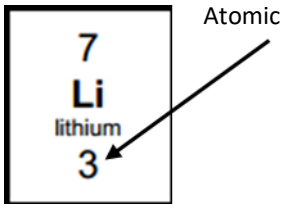
A level chemistry will use your knowledge from GCSE and build on this to help you understand new and more demanding ideas. Complete the following tasks to make sure your knowledge is up to date and you are ready to start studying:

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) O2- c) Zn2+ d) V5+ e) Co2+

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!

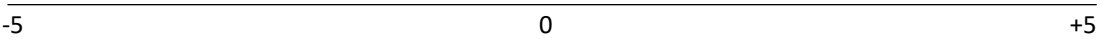
You know that the metals in group 1 react to form ions that are +1, i.e. Na+ and that group 7, the halogens, form -1 ions, i.e. Br -.

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 O2, 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.



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) $MgCO_3$ b) SO_3 c) $NaClO_3$ d) MnO_2 e) Fe_2O_3 f) V_2O_5

g) $KMnO_4$ h) $Cr_2O_7^{2-}$ i) Cl_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_1^2 H_1^3

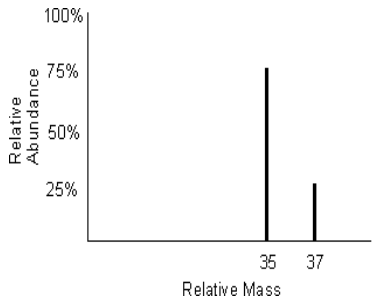
Isotopes occur naturally, so in a sample of an element you will have a mixture of these isotopes. We can accurately measure the amount of an isotope using a **mass spectrometer**. You will need to understand what a mass spectrometer is and how it works at A level. You can read about a mass spectrometer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

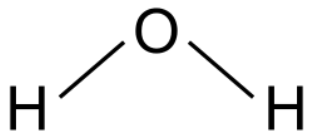
Given the percentage of each isotope you can calculate the mean mass which is the accurate atomic mass for that element.

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%

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:



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)?

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 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 on moles.
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 0.100$moldm^{-3}$ 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 0.25$moldm^{-3}$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.

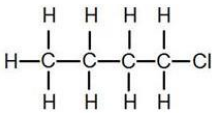
You will find a menu for organic compounds here:

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?

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

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 j) +4

==========

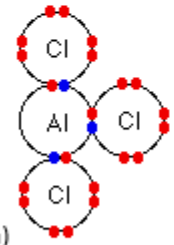
Q1 They must be ionised / turned into ions

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.

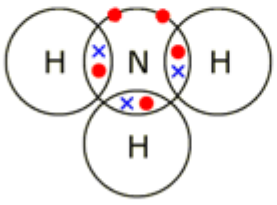
Q3 a) 121.855 b) 67.796 c) 107.973 d) 204.41 e) 87.710 / 87.7102

==========

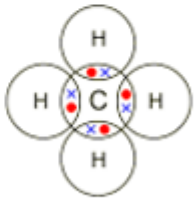
Q1



a) 120° b)



107° c)



109.5°

==========

Q1

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

b. $S_8 + 1202 \rightarrow 8SO_3$

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. $2Fe + 30_2 \rightarrow 2Fe_2O_3$

h. $C_6H_{12}O_6 + 60_2 \rightarrow 6\ CO_2 + 6\ H_20$

i. $Fe_2O_3 + 3H_2 \rightarrow 2Fe + 3H_20$

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

==========

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 $7.5cm^3$

==========

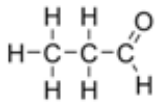
Q1 1-chlorobutane

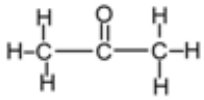
Add butan-1-ol to concentrated HCl and shake

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

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:

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@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
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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.

A Level chemistry Transition Baseline Assessment

The following 40 minute test is designed to test your recall, analysis and evaluative skills and knowledge.
Remember to use your exam technique: look at the command words and the number of marks each question is worth.
A suggested mark scheme is provided for you to check your answers.

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]

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

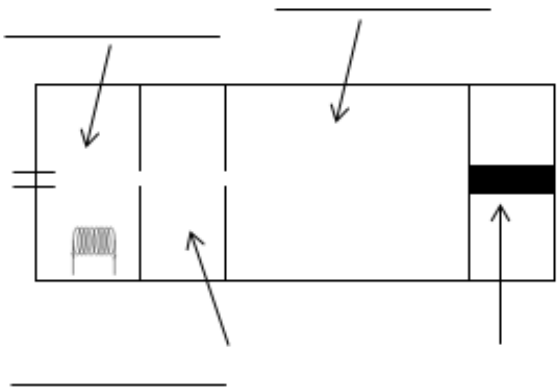
   c. Which is the correct electron configuration for an aluminium **ion**, Al^{3+}? Circle the correct answer [1]

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

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]

a) $\underline{C}O_2$ b) $\underline{S}O_3$ c) $H_2\underline{S}O_4$ d) $\underline{Al}Cl_3$

e) $\underline{Cr}_2O_3$ f) $Na\underline{N}O_3$ g) $\underline{V}Cl_4$

6. Balance the following chemical equations:

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

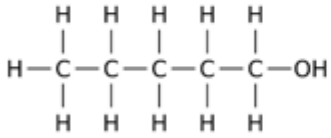
b) ___ HCl + $Mg(OH)_2$ → $MgCl_2$ + ___ H_2O [2]

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]

Suggested Mark Scheme:

Chemistry A level transition - baseline assessment. - Answers

1. .

   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]

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

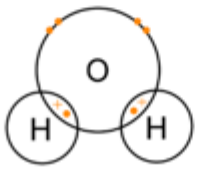
   c. Which is the correct electron configuration for an aluminium **ion**, Al^{3+}? Circle the correct answer [1]

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

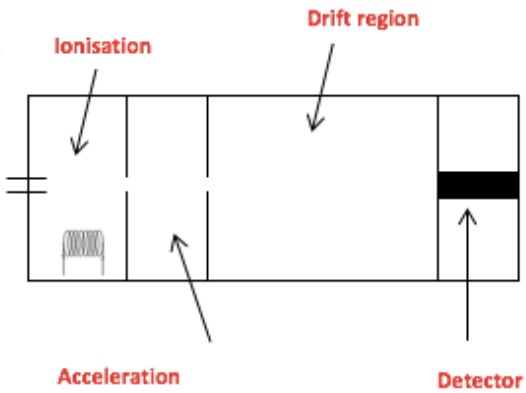
2. Draw a dot and cross diagram to show the bonding in a molecule of water, H_2O. [2]
   Atomic numbers: H =1, O =8

1 mark for 2 x shared electrons

1 mark for lone pairs



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



[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

(35x75.53) + (37x24.47)/100 [1]

= 35.4894 [1]

To 3dp = 35.489 [1] [2 marks if above line is missing]

[3]

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]

a) $\underline{C}O_2$ +4 b) $\underline{S}O_3$ +6 c) $H_2\underline{S}O_4$ +6 d) $\underline{Al}Cl_3$ +3

e) $\underline{Cr}_2O_3$ +3 f) $NaNO_3$ +5 g) $\underline{V}Cl_4$ +4

6. Balance the following chemical equations:

a) C_3H_8 + _5_ O_2 → _3_ CO_2 + _4_ H_2O [3]

b) _2_ HCl + $Mg(OH)_2$ → $MgCl_2$ + _2_ H_2O [2]

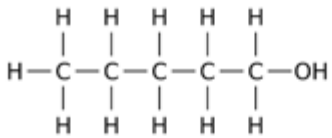
c) Na_2CO_3 + _2_ HCl → _2_ NaCl + _1_ H_2O + CO_2 [3]

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

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

111.1 62 142.3 60 189.4

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



a. What is the name of this molecule? pentan-1-ol [2]

Pentanol = 1 mark pentan-1-ol = 2 marks

9.

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

_____1_____moles [1]

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

27.5/1000 [1] x 1.00 = 0.0275 [1]

0.0275 [2] moles [2]

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

___0.0275 __moles [1]

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

0.0275 x 1000/25 = 1.10

___1.10____moles [1]

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

1.1 x 48 = 52.8g

___52.8g ___g [1]