JWS Bridging Project
A Level Chemistry
L Bardon

A Level Chemistry Bridging Project suggested support book

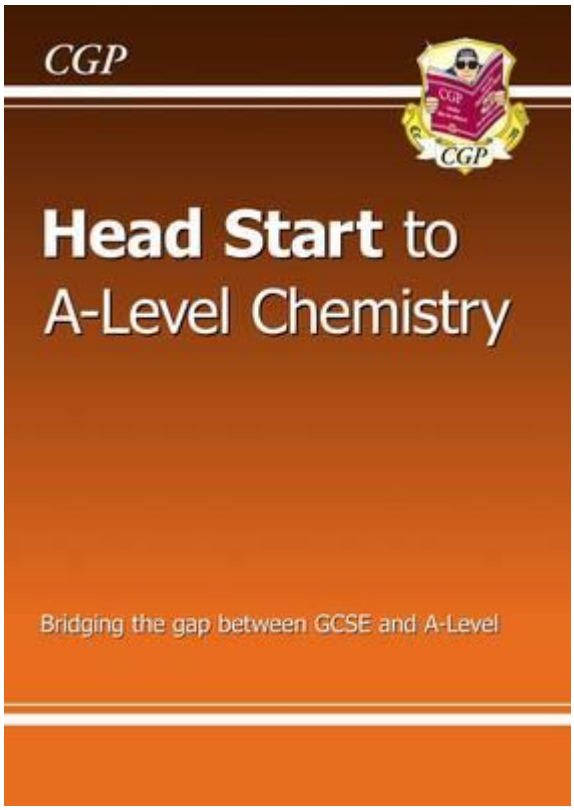
This book is a good introduction

to A level Chemistry and is available

on Amazon or free on the kindle app…

You can work through the different sections and

answer the questions and then review the answers at the back of the book.



How to use this booklet

Within this booklet, you will find access to a lot of resources that might interest you.

Work your way through the resources and tasks.

The tasks that are highlighted in purple should be submitted either by post to school for my attention or alternatively, you could photograph them and send them to my e-mail address at

l.bardon@jws.bham.sch.uk

If you do manage to get hold of the suggested book, this would be a good introduction for you.

Secondly, complete and submit all of the tasks that are highlighted in purple for my attention.

Lastly, when you feel ready, complete and submit the baseline assessment at the end of the booklet.

Deadline for this baseline assessment is 29th June

Bridging Tasks from Mrs Bardon

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:
The tasks that are in purple are required for submission

Atoms

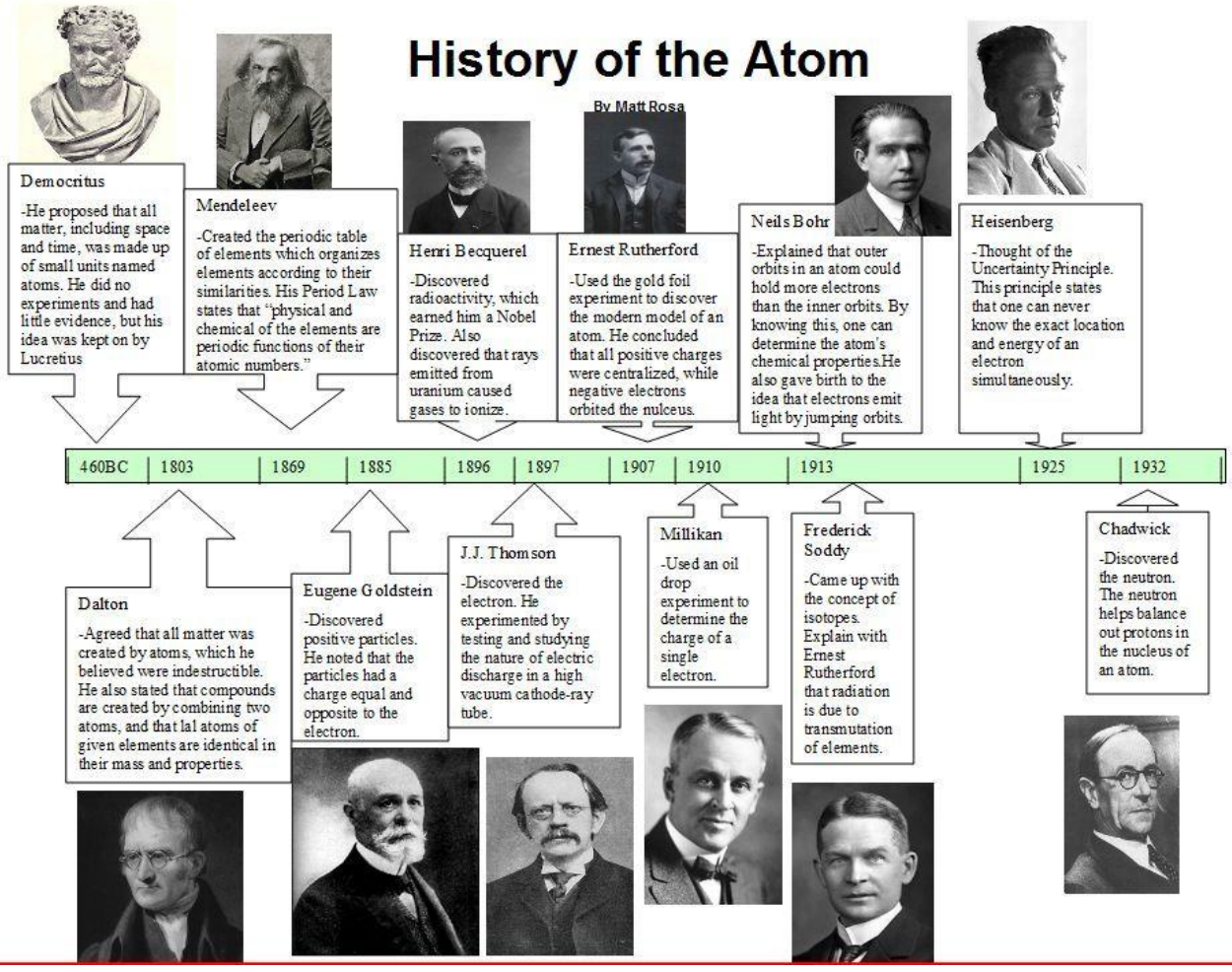
Atomic structure Atoms are made of three sub-atomic particles: protons, neutrons and electrons. Fill in the following table to identify the symbol, mass, charge and location of each.

Task 1

Sub atomic particle	Mass	Charge	Location
Proton			
Neutron			
Electron			

Timeline

It is essential that students studying A-level have a sound appreciation of the key scientists who were responsible for unravelling the structure of an atom. Research the scientists on the internet and summarise your findings in the table below.



Scientist	Date	Outline Discovery

https://www.atomicheritage.org/history/timeline
https://atomictimeline.net/

Writing balanced equations

One of the key skills good A-level students must master is to write balanced equations. Word equations are not allowed at A-level. Follow the general guidance and see if you can write out equations for the following reactions

(a) Identify the reactants and look up the formula on the internet if you are unsure and place on left hand side of the equation.
(b) Identify the products formed, look up the formula and put the formula on the right-hand side of the equation
(c) Many students put an equals symbol (=) in the middle. This is incorrect. You must put an arrow in between reactants and products (→)
(d) You are not allowed to change the formula on either side, but both sides must balance. Place a number in front of the formula to ensure the total number of each element on each side is the same. See if you can balance the following equations.

https://www.khanacademy.org/science/chemistry/chemical-reactions-stoichiome/balancing-chemical-equations/v/balancing-chemical-equations-introduction
https://www.bbc.co.uk/bitesize/guides/zg6bmsg/revision/3

Balance the following equations

$H_2 + Cl_2 \rightarrow HCl$

$Zn + O_2 \rightarrow ZnO$

$Al + Cl_2 \rightarrow AlCl_3$

$Na + O_2 \rightarrow Na_2O$

$Mg + O_2 \rightarrow MgO$

$Mg + HCl \rightarrow MgCl_2 + H_2$

$Fe_2O_3 + Al \rightarrow Fe + Al_2O_3$

$CaCl_2 + KOH \rightarrow Ca(OH)_2 + KCl$

$HCl + Na_2CO_3 \rightarrow NaCl + H_2O + CO_2$

$HNO_3 + NaOH \rightarrow NaNO_3 + H_2O$

$HNO_3 + Ca(OH)_2 \rightarrow Ca(NO_3)_2 + H_2O$

$H_2SO_4 + KOH \rightarrow K_2SO_4 + H_2O$

Common ions

Study the following table which highlights some common ions. It includes both positive ions called cations and negative ions called anions. Prepare some flash cards with the formula of the ion on one side and the name of the ion on the other. Practice using the flash cards to learn all the ions and when ready get someone to test you.

Charge	Name of cation	Formula		charge	Name of anion	Formula
+1	Sodium ion	Na^+		-1	Fluoride ion	F^-
	Potassium ion	K^+			Chloride ion	Cl^-
	Silver ion	Ag^+			Bromide ion	Br^-
	Hydrogen ion	H^+			Iodide ion	I^-
	Ammonium ion	NH_4^+			Hydroxide ion	OH^-
+2	Magnesium ion	Mg^{2+}			Nitrate ion	NO_3^-
	Calcium ion	Ca^{2+}			Manganate ion	MnO_4^-
	Zinc ion	Zn^{2+}		-2	Oxide ion	O^{2-}
	Barium ion	Ba^{2+}			Sulphate ion	SO_4^{2-}
+3	Aluminium ion	Al^{3+}			Sulphide ion	S^{2-}
Use of Roman numerals	Iron (II) ion	Fe^{2+}			Carbonate ion	CO_3^{2-}
	Iron (III) ion	Fe^{3+}			Chromate ion	CrO_4^{2-}
	Copper (II) ion	Cu^{2+}			Dichromate ion	$Cr_2O_7^{2-}$
	Lead (II) ion	Pb^{2+}				
	Manganese (II) ion	Mn^{2+}				
	Chromium(III) ion	Cr^{3+}				

Balancing Ionic compound formulas

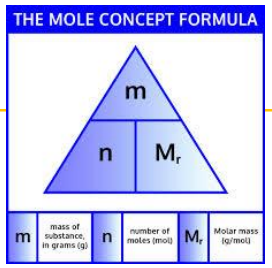
Example: Ammonium sulfate

1. Write the formulas for the cation and anion which make up the substance, including charges. NH_4^+ and SO_4^{2-}
2. Check to see if charges are balanced.
3. Balance charges, if necessary, using brackets and subscripts to ensure the overall charges balance each other out.

$$(NH_4)_2SO_4$$

Have a go at working out the following formulas:

Aluminium Nitrate	Copper (II) sulfate	Silver chloride
Chromium (III) oxide	Sodium nitrate	Barium sulphide
Potassium manganate	Manganese chloride	Iron (II) nitrate
Sodium dichromate	Iron (III) hydroxide	Calcium oxide
Magnesium carbonate	Lead chromate	Ammonium nitrate



Calculations involving moles

The number of moles of a substance can be determined using the expression on the right-hand side. This is an important skill all A-level students need to master. The first thing we need is a question. Underline the key detail in the question needed to solve the problem. Example:

Q: Calculate the number of moles of carbon dioxide in 22 g of CO_2.

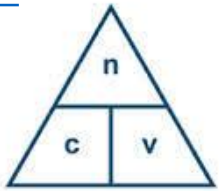
a. Use the formula of the substance to workout the Molar mass. (This is the sum of the atomic masses from a periodic table using the formula) Eg CO2 = 12.0 + 16.0 +16.0 = 44.0 (Ar Carbon = 12.0 and Ar Oxygen = 16.0)

b. Inset figures into the triangle n=mass /molar mass = 22/44 = 0.5 Answer = 0.5 moles

Have a go at the following questions: How many moles?

1. Calculate the number of moles of sulfuric acid in 6.125 g of H_2SO_4
2. Calculate the number of moles of Sodium hydroxide in 2 g of NaOH
3. Calculate the number of moles of sodium hydrogencarbonate in 7 g of $NaHCO_3$
4. Calculate the number of moles of Barium chloride in 20.8 g of $BaCl_2$
5. Calculate the number of moles of magnesium oxide in 2.52 g of MgO
6. Calculate the number of moles of ethanol in 1.15 g of CH_3CH_2OH

https://www.youtube.com/watch?v=-_-fNVmDwJk



n = Number of moles
c = Concentration (in mol l^{-1})
v = Volume (in litres)

Calculations involving solutions

Balanced equations are important in problem solving exercises in practical procedures.
A balanced equation is important to compare the ratio of reacting substances being used.
Follow the instructions:

a. Look at the question and identify the reactants:
Q: 30.0cm^3 of NaOH **sodium hydroxide** of unknown concentration, reacts with 50.0cm^3 HCl **hydrochloric acid** which has a concentration of 0.150 moldm^{-3}.

b. Write a balanced equation for the reaction using the reactants identified:
Remember: acid + base → salt + water HCl + NaOH → NaCl + H_2O

c. Use the triangle:

$$\text{number of moles (n)} = \frac{\text{volume (cm}^3\text{) x concentration (moldm}^{-3}\text{)}}{1000}$$

$n = \frac{v \times C}{1000}$ we are given the volume of HCl and concentration so start with the HCl

$n = \frac{50 \times 0.150}{1000} = 7.5 \times 10^{-3}$ moles....this is the amount of moles of HCl used

d. Use the mole ratio in the equation to determine number of moles of sodium hydroxide in the 30.0cm^3. Ratio is 1: 1 so they will be the same number of moles of NaOH
7.5×10^{-3} moles in 30.0cm^3

e. Determine concentration using a rearranged equation: $c = \frac{n \times 1000}{V} = \frac{7.5 \times 10^{-3} \times 1000}{30.0} =$

Answer: 0.25moldm^{-3}

Bonding

There are three key types of bonding that A-level students need to recognise, define and draw diagrams of them. These include: A: Covalent bonding B: Metallic bonding C: Ionic bonding

A: Covalent bonding:

i. Define covalent bonding and explain how it is formed

ii. Which elements found in the periodic table combine to form covalent bonds? Give 4 examples in your answer.

iii. Draw a dot and cross to represent methane CH_4, Water H_2O, ammonia NH_3, hydrogen chloride HCl and carbon dioxide CO_2

B: Metallic bonding:

i. Define Metallic bonding and explain how it is formed

ii. What elements found in the periodic table have metallic bonding? Give 4 examples in your answer.

iii. Draw a well labelled diagram to illustrate metallic bonding

C: Ionic bonding:

i. Define Ionic bonding and explain how it is formed

ii. Which elements found in the periodic table combine to form Ionic bonds? Give examples in your answer.

iii. Draw a dot and cross to represent sodium chloride NaCl, sodium oxide Na_2O, and magnesium chloride $MgCl_2$.

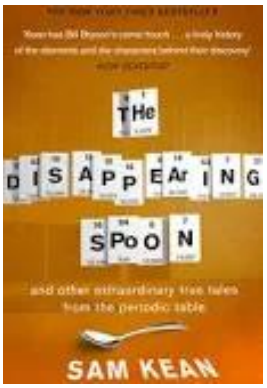
https://www.chemguide.co.uk/atoms/bonding/ionic.html
https://www.chemguide.co.uk/atoms/bonding/covalent.html
https://www.chemguide.co.uk/atoms/bonding/metallic.html

Complete the table for the different substances

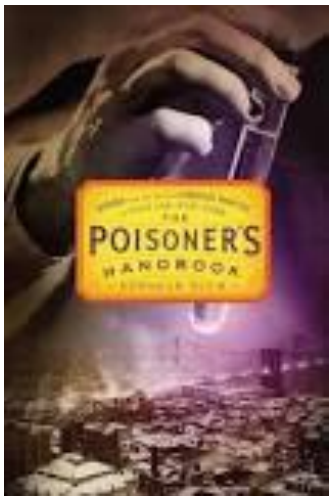
Examples and properties	formulas	Covalent bonding	Metallic bonding	Ionic bonding
Tin				
Calcium chloride				
Oxygen				
Sulfuric acid				
Platinum				
Lithium bromide				
Under the correct column highlight three typical physical properties of each				

Book Recommendations

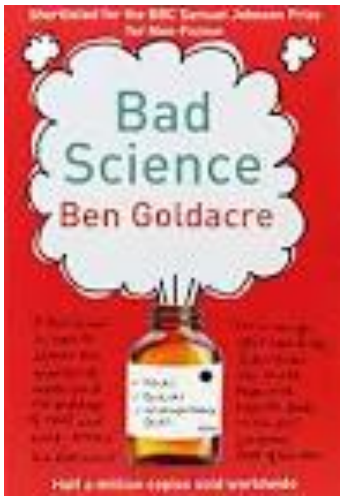
Kick back this summer with a good read. The books below are all popular science books and great for extending your understanding of Chemistry



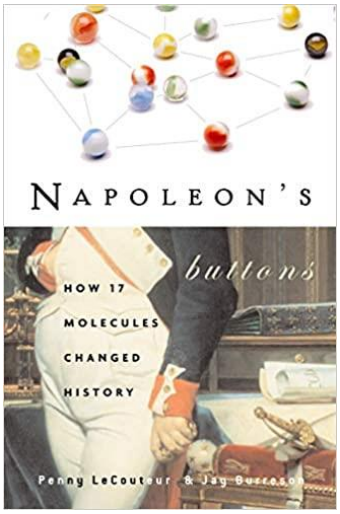
The periodic table is one of our crowning scientific achievements, but it's also a treasure trove of passion, adventure, betrayal and obsession. The fascinating tales in The Disappearing Spoon follow carbon, neon, silicon, gold and every single element on the table as they play out their parts in human history, finance, mythology, conflict, the arts, medicine and the lives of the (frequently) mad scientists who discovered them
By Sam Kean



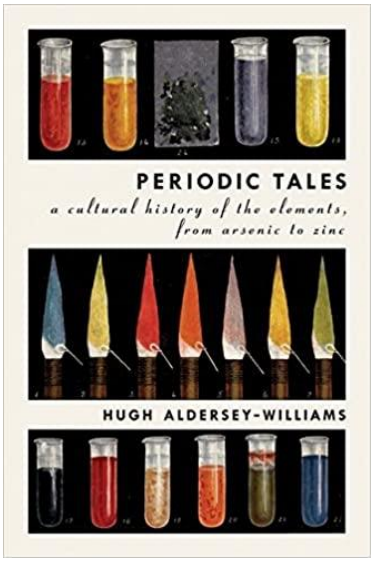
The Poisoner's Handbook: Murder and the Birth of Forensic Medicine in Jazz Age New York
By Deborah Blum



Bad Science is a book by Ben Goldacre, criticising mainstream media reporting on health and science issues.



How 17 Molecules Changed History
By Penny Le Couteur



Wonderful tales about the chemical elements humanity discover and bring in its history.
BY Hugh Aldersey-Williams

Movie Recommendations

If you have time to spare, here are some great clips and videos (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 to view:

The magic of chemistry with Andrew Szydlo
https://www.youtube.com/watch?v=0g8lANs6zpQ

Chemistry: A volatile history with Jim Al-Khalili
https://www.bbc.co.uk/programmes/b00qbq7f

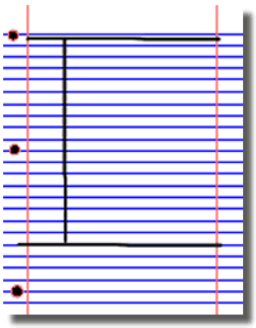
A crash course in organic chemistry
Jakob Magolan is here to change your perception of organic chemistry. In an accessible talk packed with striking graphics, he teaches us the basics while breaking the stereotype that organic chemistry is something to be afraid of.
https://www.ted.com/talks/jakob_magolan_a_crash_course_in_organic_chemistry/transcript

The incredible chemistry powering your smartphones
Take a journey down to the atomic level with scientist Cathy Mulzer, who reveals how almost every component of our high-powered devices exists thanks to chemists -
https://uk.video.search.yahoo.com/search/video?fr=mcafee&p=the+incredible+chemistry+powering+your+smartphones#id=1&vid=bfa02d1dbb149b3419025f92963f7fc0&action=click

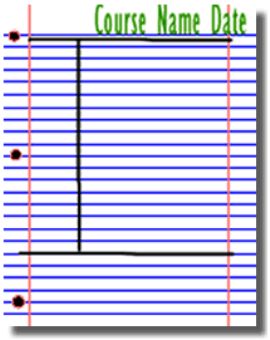
Research activities

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.

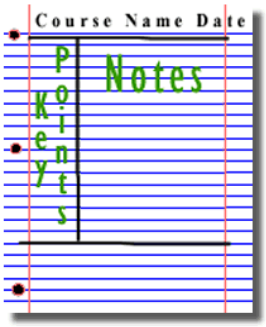
1. Divide your page into three sections like this



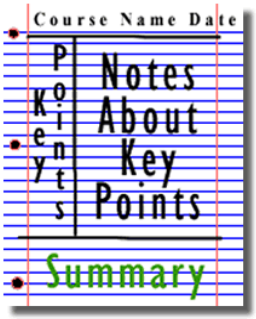
2. Write the name, date and topic at the top of the page



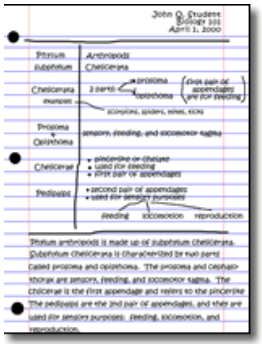
3. Use the large box to make notes. Leave a space between separate idea. Abbreviate where possible.



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



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



Images taken from http://coe.jmu.edu/learningtoolbox/cornellnotes.html

Research activities

The following websites are good for researching any chemistry topics

https://www.youtube.com/user/MaChemGuy
https://www.chemguide.co.uk
http://www.knockhardy.org.uk/sci.htm
http://www.periodicvideos.com
https://edu.rsc.org
http://www.a-levelchemistry.co.uk
https://www.senecalearning.com/blog/a-level-chemistry-revision/
https://studywise.co.uk/a-level-revision/chemistry/
https://chemrevise.org
https://www.rsc.org/periodic-table/
https://www.innovativeeducation.org
https://snaprevise.co.uk

Research activities

Listen at

https://www.bbc.co.uk/programmes/b0

https://www.chemistryw

https://www.theguardian.com/sc

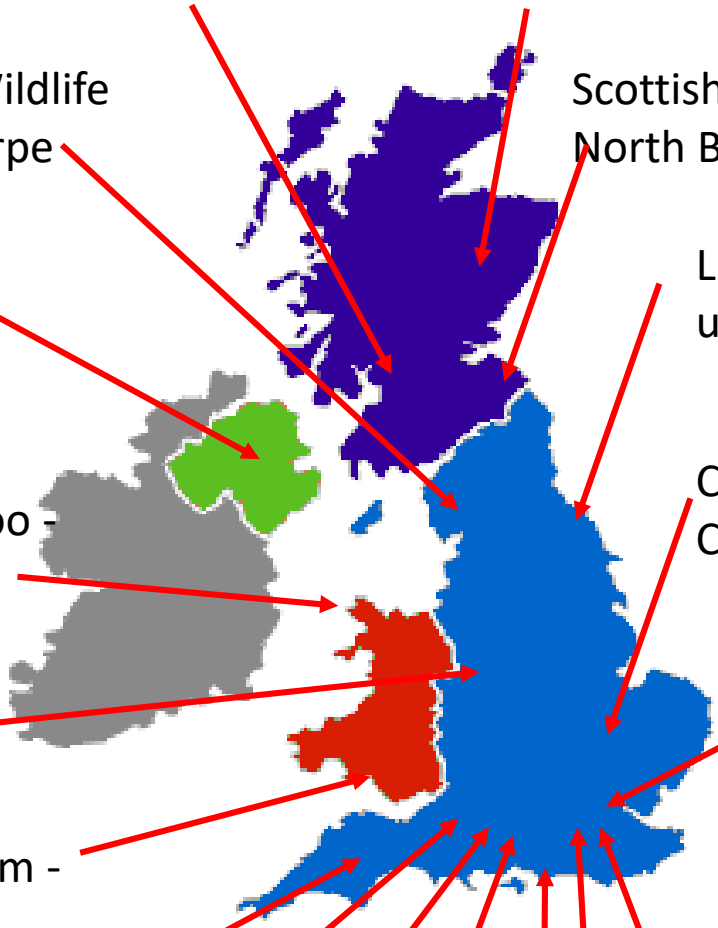
https://www.bbc.co.uk/podcasts/categor

https://player.fm/series/ch

https://audioboom.com/channel/n

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

The Lakeland Wildlife Oasis - Milnthorpe

Scottish Seabird centre – North Berwick

W5 - Belfast

Life – Newcastle-upon-Tyne

Cambridge Science Centre - Cambridge

Anglesey Sea Zoo - Anglesey

Think-tank - Birmingham

Herriman Museum and Gardens - London

National Museum - Cardiff

The Eden Project - Cornwall

Centre of the Cell - London

Bristol Science Centre - Bristol

Royal Botanic Gardens – Kew - Edinburgh

The Living Rainforest - Newbury

Oxford University Museum of Natural History - Oxford

National Marine Aquarium - Plymouth

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 :

Remember there are also lots of zoos, wildlife and safari parks across the country, here are some you may not have heard of or considered:
Colchester Zoo, Cotswold Wildlife Park, Banham Zoo (Norfolk), Tropical Birdland (Leicestershire), Yorkshire Wildlife Park, Peak Wildlife Park, International Centre for Birds of Prey (York), Blackpool Zoo, Beale Park (Reading)

There are also hundreds of nature reserves (some of which are free) located all over the country including:
RSPB sites at Lochwinnoch, Saltholme, Fairburn Ings, Old Moor, Conwy, Minsmere, Rainham Marshes, Pulborough Brooks, Radipole Lake, Newport Wetlands.
Wildlife Trust Reserves and others at Rutland Water, Pensthorpe, Insh Marshes, Attenborough Centre, Inversnaid, Skomer, Loch Garten, Donna Nook, Chapmans Well, Woodwalton Fen, London Wetland Centre, Martin Down and Woolston Eyes Reserve.

Many organisations also have opportunities for people to volunteer over the summer months, this might include working in a shop/café/visitor centre, helping with site maintenance or taking part in biological surveys. Not only is this great experience, it looks great on a job or UCAS application.

For opportunities keep an eye out in your local press, on social media, or look at the websites of organisations like the RSPB, Wildlife Trust, National Trust or Wildlife & Wetland Trust.

There are also probably lots of smaller organisations near you who would also appreciate any support you can give!

Science on Social Media

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

Follow on Twitter:
Commander Chris Hadfield – former resident aboard the International Space Station @cmdrhadfield

Royal Society of Chemistry @RoySocChem

NASA's Voyager 2 – a satellite launched nearly 40 years ago that is now travelling beyond our Solar System
@NSFVoyager2

Chemistry World @ChemistryWorld

Nature Chemistry @Nature Chemistry

The SETI Institute – The Search for Extra Terrestrial Intelligence, be the first to know what they find!
@setiinstitute

Carl Zimmer – Science writer Carl blogs about the life sciences
@carlzimmer

Phil Plait – tweets about astronomy and bad science
@badastronomer

Derek Lowe – drug discovery chemist in industry @Dereklowe

Jen Dougan – Nanoscience and bioanalytical chemistry @JenDtweeting

David Smith – professor of nanotechnology @professor_dave

Find on Facebook:
Royal Society of Chemistry

Nature Chemistry

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

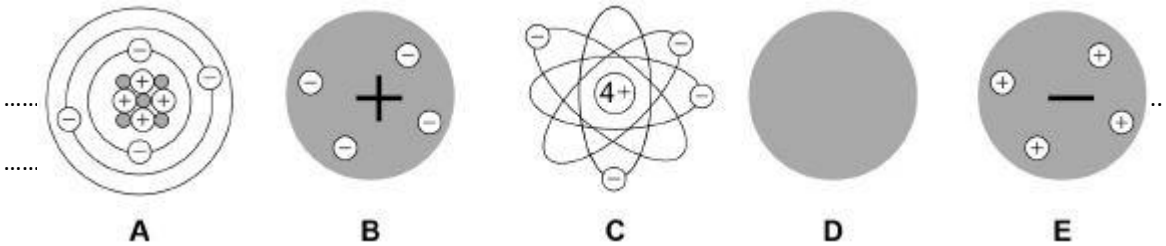
BBC Science News - The latest BBC Science and Environment News: breaking news, analysis and debate on science and nature around the world.

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.

Q1.

The diagram below represents different models of the atom.



(a) Which diagram shows the plum pudding model of the atom?

Tick **one** box.

A		B		C		D		E	

(1)

(b) Which diagram shows the model of the atom developed from the alpha particle scattering experiment?

Tick **one** box.

A		B		C		D		E	

(1)

(c) Which diagram shows the model of the atom resulting from Bohr's work?

Tick **one** box.

A		B		C		D		E	

(1)

(d) Define the mass number of an atom.

_____

_____

(1)

(e) Element **X** has two isotopes. Their mass numbers are 69 and 71

The percentage abundance of each isotope is:

- 60% of ^{69}**X**
- 40% of ^{71}**X**

Estimate the relative atomic mass of element **X**.

Tick **one** box.

< 69.5	☐
Between 69.5 and 70.0	☐
Between 69.5 and 70.0	☐
Between 70.0 and 70.5	☐
> 70.5	☐

(1)

(f) Chadwick's experimental work on the atom led to a better understanding of isotopes.

Explain how his work led to this understanding.

_____

_____

_____

_____

_____

_____

(3)

(Total 8 marks)

Q2.

This question is about sodium chloride and iodine.

(a) Describe the structure and bonding in sodium chloride.

_____

_____

_____

_____

_____

.....

_____ (1)

_____

_____

(4)

(b) When sodium chloride solution is electrolysed, one product is chlorine.

Name the **two** other products from the electrolysis of sodium chloride solution.

_____

_____

(2)

(c) Many people do not have enough iodine in their diet.

Sodium chloride is added to many types of food. Some scientists recommend that sodium chloride should have a compound of iodine added.

Give **one** ethical reason why a compound of iodine should **not** be added to sodium chloride used in food.

_____

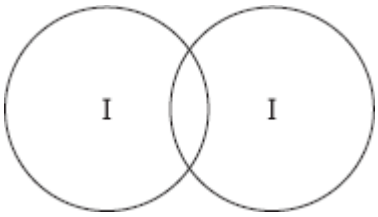
_____

(1)

(d) The bonding in iodine is similar to the bonding in chlorine.

(i) Complete the diagram below to show the bonding in iodine.

Show the outer electrons only.



(2)

(ii) Explain why iodine has a low melting point.

_____

_____

_____

_____

_____

_____

(3)

(iii) Explain, in terms of particles, why liquid iodine does not conduct electricity.

_____

_____

_____

_____

(2)

(Total 14 marks)

Q3.

Sodium hydroxide neutralises sulfuric acid.

The equation for the reaction is:

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

(a) Sulfuric acid is a strong acid.

What is meant by a strong acid?

_____

_____

_____

(2)

(b) Write the ionic equation for this neutralisation reaction. Include state symbols.

_____

(2)

(c) A student used a pipette to add 25.0 cm^3 of sodium hydroxide of unknown concentration to a conical flask.

The student carried out a titration to find out the volume of 0.100 mol / dm^3 sulfuric acid needed to neutralise the sodium hydroxide.

Describe how the student would complete the titration.

You should name a suitable indicator and give the colour change that would be seen.

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

(4)

(d) The student carried out five titrations. Her results are shown in the table below.

	Titration 1	Titration 2	Titration 3	Titration 4	Titration 5
Volume of 0.100 mol / dm^3 sulfuric acid in cm^3	27.40	28.15	27.05	27.15	27.15

Concordant results are within 0.10 cm^3 of each other.

Use the student's concordant results to work out the mean volume of 0.100 mol / dm^3 sulfuric acid added.

_____

_____

_____

_____

Mean volume = _____ cm^3

(2)

(e) The equation for the reaction is:

$$2NaOH + H_2SO_4 \rightarrow Na_2SO_4 + 2H_2O$$

Calculate the concentration of the sodium hydroxide.

Give your answer to three significant figures.

_____

_____

_____

_____

_____

_____

_____

Concentration = _____ mol / dm^3

(4)

(f) The student did another experiment using 20 cm^3 of sodium hydroxide solution with a concentration of 0.18 mol / dm^3.

Relative formula mass (M_r) of NaOH = 40

Calculate the mass of sodium hydroxide in 20 cm^3 of this solution.

_____

_____

_____

_____

Mass = _____ g

(2)

(Total 16 marks)