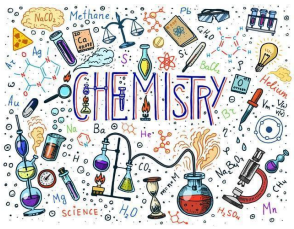


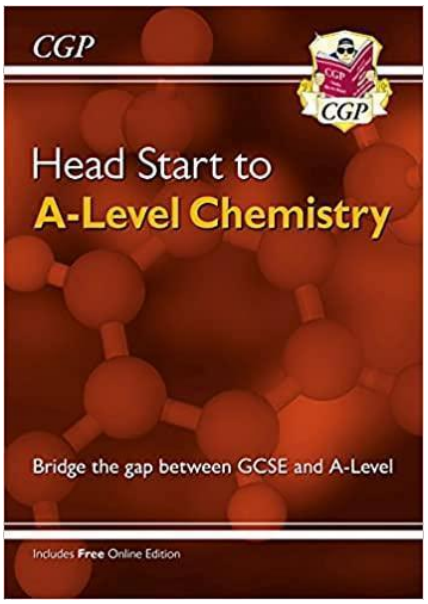
Coombe Wood School

Year 12 Chemistry Bridging Work

Name: _____ Date: _____

If you have any questions about this bridging work then please contact Mrs T Reid at this email address: **treid@cws.foliotrust.uk**

We recommend you purchase the following textbooks for this subject area:

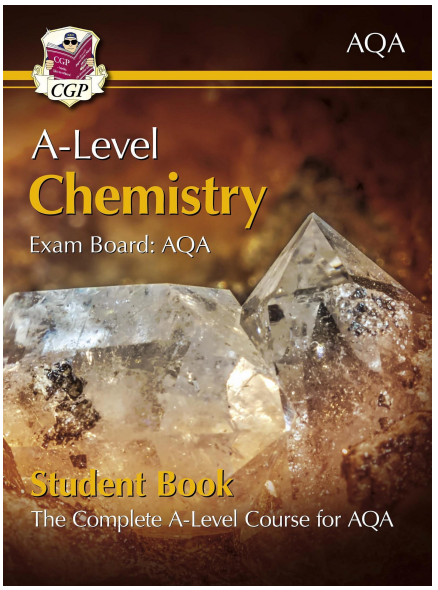


To prepare for the course over the summer before September: Head Start to A-Level Chemistry (with Online Edition) (CGP A-Level Chemistry)

ISBN-978-1782942801

To bring with you to your first Chemistry lesson in September: A-Level Chemistry for AQA: Year 1 & 2 Student Book with Online Edition

ISBN: 9781789080476



The aim of the bridging work is to help prepare you for the A Level Chemistry course. It is your responsibility to ensure that you are familiar with the entire Chemistry GCSE course and have the necessary knowledge and resources to begin learning A Level Chemistry by the first lesson in September.

All bridging work must be completed by **15th of September 2023** and forms part of your Pupil Passport at Coombe Wood Sixth Form.

Contents:

Transition work

Activity 1 Scientific vocabulary: Designing an investigation

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

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.

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

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

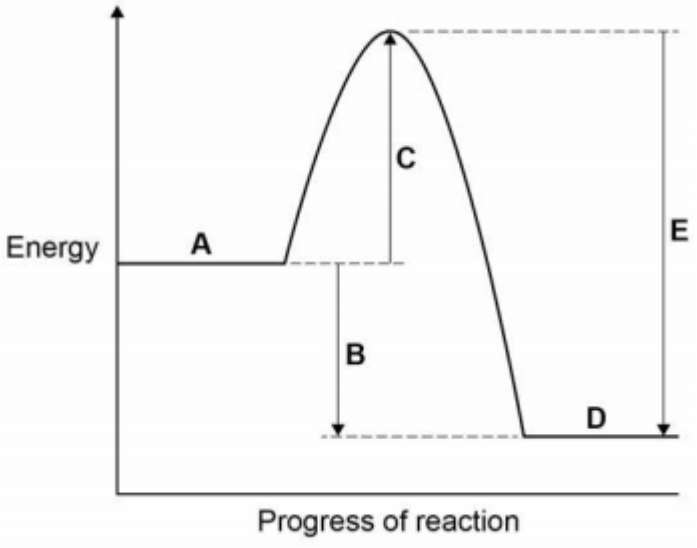
The delta symbol (Δ)

The delta symbol (Δ) is used to mean ‘change in’. You might not have seen this symbol before in your GCSE Chemistry course, although it is used in some equations in GCSE Physics.

Activity 6 Using the delta symbol

In exothermic and endothermic reactions there are energy changes.

The diagram below shows the reaction profile for the reaction between zinc and copper sulfate solution.



1. Which letter represents the products of the reaction?

2. Which letter represents the activation energy?

3. Complete the sentence using the words below.

The reaction is _____ and therefore ΔH is _____

endothermic exothermic negative positive

Practical skills

The practical skills you learnt at GCSE will be further developed through the practicals you undertake at A-level. Your teacher will explain in more detail the requirements for practical work in Chemistry.

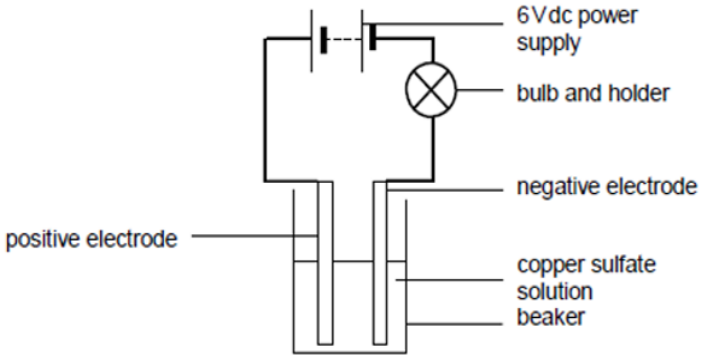
There is a practical handbook for Chemistry, which has lots of very useful information to support you in developing these important skills. You can download a copy here:

Activity 7 Electrolysis

Students were investigating if the time the current flows through an electrolyte affects the amount of copper deposited on the negative electrode.

Equipment:

Measuring cylinder
Balance
Two suitable electrodes eg carbon rods
6V bulb and holder
0.5 moles per dm^3 copper sulfate solution
Stopwatch
Wires
Power supply
100 cm^3 beaker



Method:

1. Measure 50 cm^3 of the copper sulfate solution into the beaker.
2. Measure and record the mass of the negative electrode.
3. Set up the circuit, setting the power pack at 6V dc.
4. Turn on the power supply for the time you have been given, then turn the power pack off.
5. Remove and carefully dry the negative electrode.
6. Measure and record the mass of the negative electrode.

1. Write a hypothesis for this investigation.

---

2. What do you predict will be the result of this investigation?

---

3. For this investigation, give

   a. the independent variable _____

   b. the dependent variable _____

   c. a control variable _____

4. What is the difference between repeatable and reproducible results?

---

5. What would be the most likely resolution of the balance you use in a school lab?

---

6. How could you make the reading more precise?

---

7. Random errors cause readings to be spread about the true value.

   How could you reduce the effect of random errors and make the results more accurate?

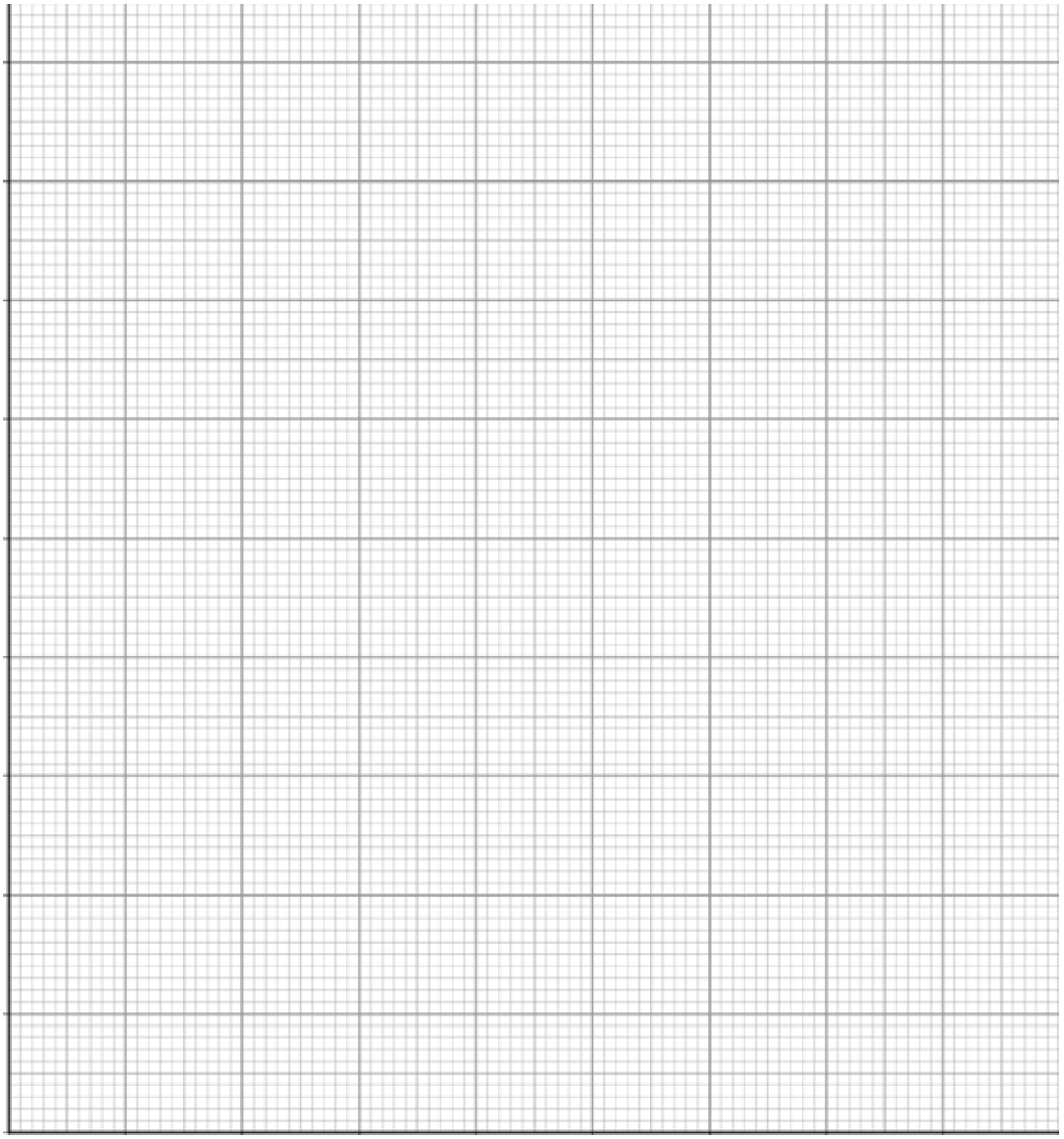
---

8. The results the student recorded are given in the table.

Time / minutes	Increase in mass / g			Mean
2	0.62	0.64	0.45	
4	0.87	0.83	0.86	
6	0.99	1.02	0.97	
8	1.06	1.05	1.08	
10	1.10	1.12	1.10	

Calculate the mean increase in mass for each time measurement.

9. Plot a graph of your results.



Using maths skills

Throughout your A-level Chemistry course you will need to be able to use maths skills you have developed in your GCSE Chemistry and GCSE maths courses, such as using standard form, rounding correctly and quoting your answer to an appropriate number of significant figures.

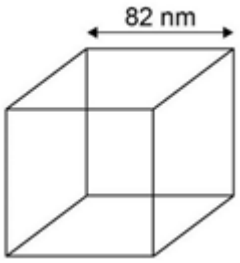
Activity 8 Using maths skills

1. Write the following numbers in standard form:

   a. 4000
   b. 1 000 000

2. Zinc oxide can be produced as nanoparticles.

   A nanoparticle of zinc oxide is a cube of side 82nm.



   Calculate the surface area of a nanoparticle of zinc oxide. Give your answer in standard form

3. Express the following numbers to 3 significant figures:

   a. 57 658
   b. 0.045346

4. Toothpaste may contain sodium fluoride (NaF).

   The concentration of sodium fluoride can be expressed in parts per million (ppm). 1 ppm represents a concentration of 1 mg in every 1 kg of toothpaste.

   A 1.00 g sample of toothpaste was found to contain 2.88×10^{-5} mol of sodium fluoride.

   Calculate the concentration of sodium fluoride, in ppm, for the sample of toothpaste.

   Give your answer to 3 significant figures.

   Use the following information to help you

To convert moles to grams use g = moles × relative formula mass

Relative formula mass of NaF = 42

Using the periodic table

During your course you will need to become familiar with the periodic table of the elements, and be able to use information from the table to answer questions.

There is a copy of the periodic table that you will be given to use in your exams on the next page.

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
																	(18)
							1.0 H hydrogen 1										4.0 He helium 2
(1)	(2)		Key									(13)	(14)	(15)	(16)	(17)	
6.9 Li lithium 3	9.0 Be beryllium 4		relative atomic mass symbol name atomic (proton) number									10.8 B boron 5	12.0 C carbon 6	14.0 N nitrogen 7	16.0 O oxygen 8	19.0 F fluorine 9	20.2 Ne neon 10
23.0 Na sodium 11	24.3 Mg magnesium 12	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	27.0 Al aluminium 13	28.1 Si silicon 14	31.0 P phosphorus 15	32.1 S sulfur 16	35.5 Cl chlorine 17	39.9 Ar argon 18
39.1 K potassium 19	40.1 Ca calcium 20	45.0 Sc scandium 21	47.9 Ti titanium 22	50.9 V vanadium 23	52.0 Cr chromium 24	54.9 Mn manganese 25	55.8 Fe iron 26	58.9 Co cobalt 27	58.7 Ni nickel 28	63.5 Cu copper 29	65.4 Zn zinc 30	69.7 Ga gallium 31	72.6 Ge germanium 32	74.9 As arsenic 33	79.0 Se selenium 34	79.9 Br bromine 35	83.8 Kr krypton 36
85.5 Rb rubidium 37	87.6 Sr strontium 38	88.9 Y yttrium 39	91.2 Zr zirconium 40	92.9 Nb niobium 41	96.0 Mo molybdenum 42	[97] Tc technetium 43	101.1 Ru ruthenium 44	102.9 Rh rhodium 45	106.4 Pd palladium 46	107.9 Ag silver 47	112.4 Cd cadmium 48	114.8 In indium 49	118.7 Sn tin 50	121.8 Sb antimony 51	127.6 Te tellurium 52	126.9 I iodine 53	131.3 Xe xenon 54
132.9 Cs caesium 55	137.3 Ba barium 56	138.9 La * lanthanum 57	178.5 Hf hafnium 72	180.9 Ta tantalum 73	183.8 W tungsten 74	186.2 Re rhenium 75	190.2 Os osmium 76	192.2 Ir iridium 77	195.1 Pt platinum 78	197.0 Au gold 79	200.6 Hg mercury 80	204.4 Tl thallium 81	207.2 Pb lead 82	209.0 Bi bismuth 83	[209] Po polonium 84	[210] At astatine 85	[222] Rn radon 86
[223] Fr francium 87	[226] Ra radium 88	[227] Ac † actinium 89	[267] Rf rutherfordium 104	[270] Db dubnium 105	[269] Sg seaborgium 106	[270] Bh bohrium 107	[270] Hs hassium 108	[278] Mt meitnerium 109	[281] Ds darmstadtium 110	[281] Rg roentgenium 111	[285] Cn copernicium 112	[286] Nh nihonium 113	[289] Fl flerovium 114	[289] Mc moscovium 115	[293] Lv livermorium 116	[294] Ts tennessine 117	[294] Og oganesson 118

140.1 Ce cerium 58	140.9 Pr praseodymium 59	144.2 Nd neodymium 60	[145] Pm promethium 61	150.4 Sm samarium 62	152.0 Eu europium 63	157.3 Gd gadolinium 64	158.9 Tb terbium 65	162.5 Dy dysprosium 66	164.9 Ho holmium 67	167.3 Er erbium 68	168.9 Tm thulium 69	173.0 Yb ytterbium 70	175.0 Lu lutetium 71
232.0 Th thorium 90	231.0 Pa protactinium 91	238.0 U uranium 92	[237] Np neptunium 93	[244] Pu plutonium 94	[243] Am americium 95	[247] Cm curium 96	[247] Bk berkelium 97	[251] Cf californium 98	[252] Es einsteinium 99	[257] Fm fermium 100	[258] Md mendelevium 101	[259] No nobelium 102	[262] Lr lawrencium 103

* **58 – 71** Lanthanides

† **90 – 103** Actinides

Activity 9 Atoms

1. Give the atomic number of:

    a. Osmium
    b. Lead
    c. Sodium
    d. Chlorine

2. Give the relative atomic mass (A_r) of:

    a. Helium
    b. Francium
    c. Barium
    d. Oxygen

3. What is the number of neutrons in each of the following elements?

    a. Fluorine
    b. Beryllium
    c. Gold

Activity 10 Formulae of common compounds

State the formulae of the following compounds:

1. Methane
2. Sulfuric acid
3. Potassium manganate (VII)
4. Water

Activity 11 Ions and ionic compounds

The table below lists the formulae of some common ions.

Positive ions		Negative ions	
Name	**Formula**	**Name**	**Formula**
Aluminium	Al^{3+}	Bromide	Br^-
Ammonium	NH_4^+	Carbonate	CO_3^{2-}
Barium	Ba^{2+}	Chloride	Cl^-
Calcium	Ca^{2+}	Fluoride	F^-
Copper(II)	Cu^{2+}	Iodide	I^-
Hydrogen	H^+	Hydroxide	OH^-
Iron(II)	Fe^{2+}	Nitrate	NO_3^-
Iron(III)	Fe^{3+}	Oxide	O_2^-
Lead	Pb^{2+}	Sulfate	SO_4^{2-}
Lithium	Li^+	Sulfide	S^{2-}
Magnesium	Mg^{2+}		
Potassium	K^+		
Silver	Ag^+		
Sodium	Na^+		
Zinc	Zn^{2+}		

Use the table to state the formulae for the following ionic compounds.

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

Activity 12 Empirical formula

Use the periodic table on page 21 to help you answer these questions.

1. The smell of a pineapple is caused by ethyl butanoate.
   A sample is known to contain:

   0.360 g of carbon
   0.060 g of hydrogen
   0.160 g of oxygen.

   What is the empirical formula of ethyl butyrate?

2. What is the empirical formula of a compound containing:

   0.479 g of titanium
   0.180 g of carbon
   0.730 g of oxygen

3. A 300g sample of a substance is analysed and found to contain only carbon, hydrogen and oxygen.
   The sample contains 145.9 g of carbon and 24.32 g of hydrogen.

   What is the empirical formula of the compound?

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

   What is the empirical formula of the compound?

Activity 13 Balancing equations

1. Write balanced symbol equations for the following reactions.

   You'll need to use the information on the previous pages to work out the formulae of the compounds.

   Remember some of the elements may be diatomic molecules.

   a. Aluminium + oxygen □ aluminium oxide

   b. Methane + oxygen □ carbon dioxide + water

   c. Calcium carbonate + hydrochloric acid □ calcium chloride + water + carbon dioxide

2. Chalcopyrite is a sulfide mineral with formula $CuFeS_2$.

   Chalcopyrite is the most important copper ore. It is a sulfide mineral, a member of iron (2+) sulfides and a copper sulfide.

   Copper can be produced from rock that contains $CuFeS_2$ in two stages.

   Balance the equations for the two stages in this process.
   Hint: remember that sometimes fractions have to be used to balance equations.

   Stage 1: $CuFeS_2 + O2 + SiO_2 \rightarrow Cu_2S + Cu_2O + SO_2 + FeSiO$ □

   Stage 2: $Cu_2S + CuO \rightarrow Cu + SO2$ □

Activity 14 Moles

The amount of a substance is measured in moles (the SI unit). The mass of one mole of a substance in grams is numerically equal to the relative formula mass of the substance. One mole of a substance contains the same number of the stated particles, atoms or ions as one mole of any other substance. The number of atoms, molecules or ions in a mole of a given substance is the Avogadro constant. The value of the Avogadro constant is

6.02×10^{23} per mole.

Complete the table. Use the periodic table on page 21 to help you.

Substance	Mass of substance in grams	Amount in moles	Number of particles
Helium			18.12×10^{23}
Chlorine (Cl)	14.2		
Methane		4	
Sulfuric acid	4.905		

Activity 15 Isotopes and calculating relative atomic mass

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

2. A sample of neon is made up of three isotopes:

   ^{20}Ne accounts for 90.9%
   ^{21}Ne accounts for 0.3%
   ^{22}Ne accounts for 8.8%.

   What is the relative atomic mass of neon?
   Give your answer to 4 significant figures.

3. Copper's isotopes are ^{63}Cu and ^{65}Cu.

   If the relative atomic mass of copper is 63.5, what are the relative abundances of these isotopes?

Extended writing

The ability to write coherently in a logical, well-structured way is an essential skill to develop. At GCSE the 6-mark extended response questions are used so students can demonstrate this skill. At A-level you will still need to write precise answers using the correct scientific language.

The command word in a question, like at GCSE, is important as it gives you an indication of what to include in your answers. For example, 'explain' means you must give reasons why things are happening, not just give a description. A comparison needs advantages and disadvantages or points for and against.

Activity 16 Types of bonding

Compare the similarities and differences between ionic, covalent and metallic bonding.

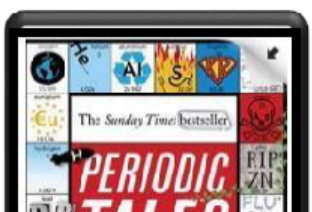
Student Evaluation

Identify 3 areas of strength.

Identify 3 areas you need to improve on

Book Recommendations

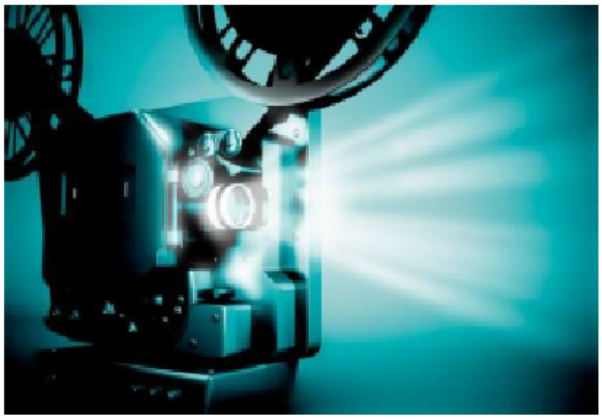
Kick back this summer with a good read. The books below are all popular science books and great for extending your understanding of chemistry

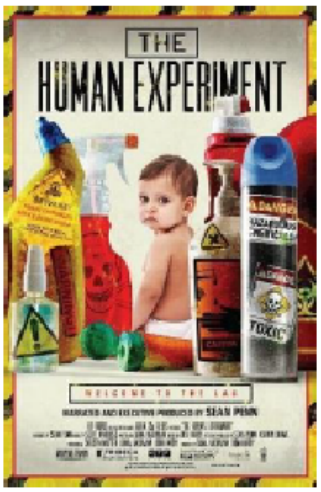


The Science of Everyday Life: Why Teapots Dribble, Toast Burns and Light Bulbs Shine

The title says it all really,

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.

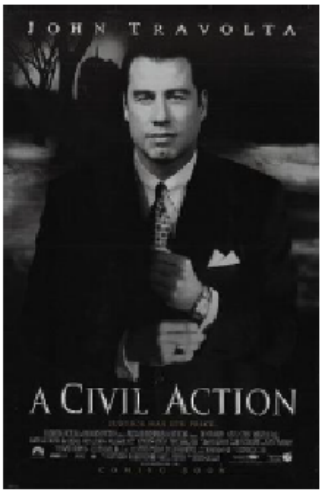


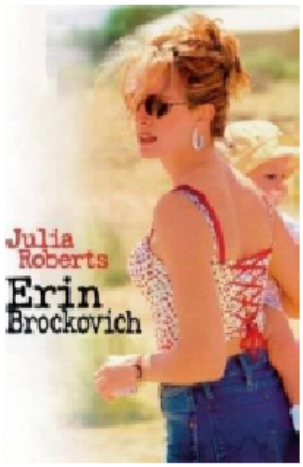


The Human Experiment (2013)
A documentary that explores chemicals found in everyday household products.

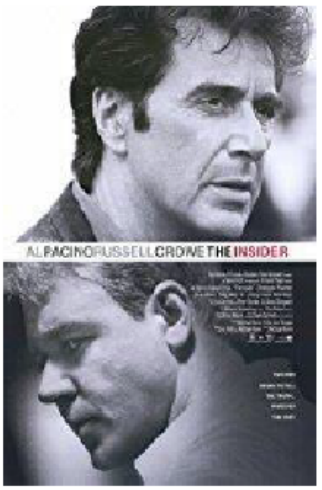
An Inconvenient Truth (2006)
Al Gore, former presidential candidate campaigns to raise public awareness of the dangers of global warming and calls for immediate action to curb its destructive effects on the environment.
(See also: An Inconvenient Sequel, 2017)

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.

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?

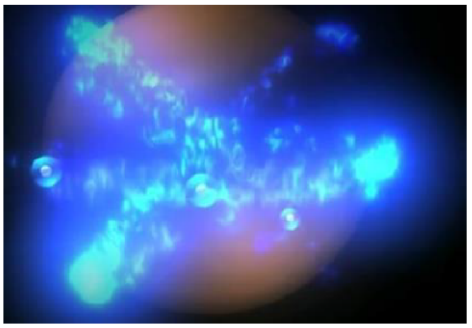
Available at : https://www.ted.com/talks/just_how_small_is_an_atom

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.



Science on Social Media

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

Follow on Twitter:

Satlers' Institute - Our activities include Festivals of Chemistry; Chemistry Camps; Curricula; Awards for Technicians, Graduates, A Level Students; and Seminars

@salters_inst

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

@chemAlevels

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

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

@compoundchem

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

@ChemistryWorld

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

@RoySocChem

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

@periodicvideos

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

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

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

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

Scientific American - Scientific American is the authority on science and technology for a

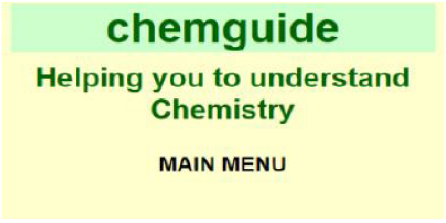
Science Websites

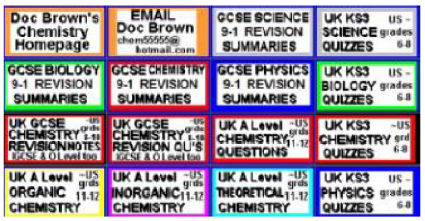
This website is very detailed and identifies other resources which are sharing incorrect or outdated information and suggests the correct materials to use. The site also contains links to the syllabuses of many exam boards which means it is accessible and useful to all students. https://www.chemguide.co.uk/

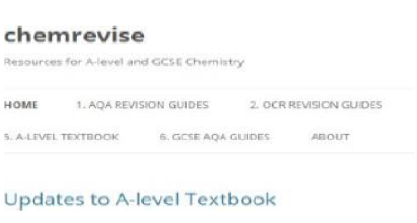
Doc Brown is a website dedicated to all three science subjects; physics, chemistry and biology. It provides the user with summarized notes (useful for making flash cards) and practice questions to further their knowledge and understanding.

The site provides resources from a wide range of exam boards including AQA, Edexcel, Chemistry, CCEA, OCR, WJEC, CIE and Salters from GCSE level to A2. http://www.docbrown.info/

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







S-cool the revision website

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

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