Preparing for A-Level: Chemistry

We have created this support resource to help students make the transition from GCSE to A-level Chemistry.

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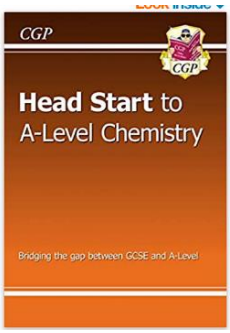

Head Start to A-Level Chemistry

Free accredited Chemistry courses

As part of preparation for our 6th form courses in Chemistry, click on the link below to access free accredited Chemistry courses (see suggestions for each course)

Link to Open Learning free qualifications -
https://www.open.edu/openlearn/free-courses/full-catalogue

Suggested Chemistry courses

Chemistry skills	Chemistry knowledge
Basic science: understanding experiments	Biofuels
Basic science: understanding numbers	Discovering Chemistry
Diagrams, charts and graphs	Drug Development (Advanced)
Health and safety in the laboratory and field	Metals in Medicine
Mathematics for science and technology	The Science of Alcohol
More working with charts, graphs and tables	What is a metal?
Numbers, units and arithmetic	What chemical compounds are present in water?
Presenting information	Understanding antibiotic resistance
Ratio, proportion and percentages	Polymers (Advanced)
Starting with maths: Patterns and formulas	The chemistry of the molecular world
Using a scientific calculator	Test kits for water analysis
Using numbers and handling data	Iron transport and storage (Advanced)
	Birth of a drug (Advanced)
	The three way catalytic convertor (Advanced)

You are not expected to complete all these courses. Choose the knowledge that you are most interested in or the skills that you feel you most need to develop. They are all relevant to A-Level Chemistry studies.

You're studying A-level Chemistry, congratulations!

Why study A-level Chemistry?

A-level Chemistry goes into much more detail than GCSE. It attempts to answer the big question 'what is this world made of' and it's the search for this answer that makes this subject so fascinating. From investigating how one substance can be changed drastically into another, to researching a new wonder drug to save millions of lives, the opportunities that Chemistry provides are endless.

Chemistry helps you to develop research, problem solving and analytical skills. It helps to you challenge ideas and show how you worked things out through logic and step-by-step reasoning. Chemistry often requires teamwork and communication skills too, which is great for project management.

At Cardinal Langley we follow the AQA Chemistry specification. It is designed to encourage candidates to develop:

An enthusiasm for Chemistry.

An understanding of concepts and skills augmented and supported by practical investigations.

The confidence to go on to higher education.

Possible degree options

The top five degree courses that Chemists study at University are:

Chemistry

Biology

Pre-clinical medicine

Mathematics

Pharmacology

Which career appeals to you?

Studying Biology at A-level or degree opens up all sorts of career opportunities, such as:

- doctor
- pharmacologist
- research scientist
- vet
- secondary school teacher
- dentist
- analytical chemist
- chemical engineer
- geochemist
- hazardous waste chemist
- material scientist
- toxicologist
- water chemist

3.1 Physical chemistry

- 3.1.1 Atomic structure
- 3.1.2 Amount of substance
- 3.1.3 Bonding
- 3.1.4 Energetics
- 3.1.5 Kinetics
- 3.1.6 Chemical equilibria, Le Chatelier's principle and K_c
- 3.1.7 Oxidation, reduction and redox equations
- 3.1.8 Thermodynamics (A-level only)
- 3.1.9 Rate equations (A-level only)
- 3.1.10 Equilibrium constant K_p for homogeneous systems (A-level only)
- 3.1.11 Electrode potentials and electrochemical cells (A-level only)
- 3.1.12 Acids and bases (A-level only)

3.2 Inorganic chemistry

- 3.2.1 Periodicity
- 3.2.2 Group 2, the alkaline earth metals
- 3.2.3 Group 7(17), the halogens
- 3.2.4 Properties of Period 3 elements and their oxides (A-level only)
- 3.2.5 Transition metals (A-level only)
- 3.2.6 Reactions of ions in aqueous solution (A-level only)

3.3 Organic chemistry

- 3.3.1 Introduction to organic chemistry
- 3.3.2 Alkanes
- 3.3.3 Halogenoalkanes
- 3.3.4 Alkenes
- 3.3.5 Alcohols
- 3.3.6 Organic analysis
- 3.3.7 Optical isomerism (A-level only)
- 3.3.8 Aldehydes and ketones (A-level only)
- 3.3.9 Carboxylic acids and derivatives (A-level only)
- 3.3.10 Aromatic chemistry (A-level only)
- 3.3.11 Amines (A-level only)
- 3.3.12 Polymers (A-level only)
- 3.3.13 Amino acids, proteins and DNA (A-level only)
- 3.3.14 Organic synthesis (A-level only)
- 3.3.15 Nuclear magnetic resonance spectroscopy (A-level only)
- 3.3.16 Chromatography (A-level only)

The assessment for the A-level consists of three exams

Assessments

Paper 1	Paper 2	Paper 3
What's assessed • Relevant Physical chemistry topics (sections 3.1.1 to 3.1.4, 3.1.6 to 3.1.8 and 3.1.10 to 3.1.12) • Inorganic chemistry (Section 3.2) • Relevant practical skills	**What's assessed** • Relevant Physical chemistry topics (sections 3.1.2 to 3.1.6 and 3.1.9) • Organic chemistry (Section 3.3) • Relevant practical skills	**What's assessed** • Any content • Any practical skills
How it's assessed • written exam: 2 hours • 105 marks • 35% of A-level	**How it's assessed** • written exam: 2 hours • 105 marks • 35% of A-level	**How it's assessed** • written exam: 2 hours • 90 marks • 30% of A-level
Questions 105 marks of short and long answer questions	**Questions** 105 marks of short and long answer questions	**Questions** 40 marks of questions on practical techniques and data analysis 20 marks of questions testing across the specification 30 marks of multiple choice questions

Places to go for help

1. AQA website is a great place to start

AQA Chemistry pages are aimed at teachers, but you may find them useful too. Information includes:

- The specification – this explains exactly what you need to learn for your exams.
- Practice exam papers
- Lists of command words and subject specific vocabulary – so you understand the words to use in exams
- Practical handbookexplain the practical work you need to know
- Past paper questions including old spec. Some questions won't be relevant to the new A-level, so please check with your teacher.
- Maths skills support

2. Royal Society of Chemistry

"A single unified voice for chemistry". They work with everyone from government policy makers to students, as well as universities and researchers studying chemistry. Their website includes a dedicated student section. Have a look at RSC

3. The student room

Join the A-level Chemistry forums and share thoughts and ideas with other students if you're stuck with your homework. Just be very careful not to share any details about your assessments, there are serious consequences if you're caught cheating. Visit thestudentroom.co.uk

4. Textbooks

Our approved textbooks are published by Collins, Hodder and Oxford University Press. Textbooks from other publishers will also be suitable, but you'll need to double check that the content and formula symbols they use match our specification.

5. Revision guides

These are great if you want a quick overview of the course when you're revising for your exams. Remember to use other tools as well, as these aren't detailed enough on their own.

6. YouTube

YouTube has thousands of Chemistry videos e.g E Rintoul. Just be careful to look at who produced the video and why because some videos distort the facts. Check the author, date and comments – these help indicate whether the clip is reliable. If in doubt, ask your teacher.

7. Magazines

There are a number of journals about chemistry in school which you right can ask Mr Wright about.

8. Videos

We have a selection of course videos you can get your teeth stuck into to help you.

Useful information and activities

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

SI units

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

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

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

The seven SI base units are:

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

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

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

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

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

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

The most common prefixes you will encounter are:

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

Year 12 Chemistry Transition Work

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Task1: The structure of atoms

1 Complete the spaces to create a set of notes about the structure of atoms.

Atoms consist of a central _____containing protons and _____. The nucleus is _____compared to the size of the whole atom. The nucleus is surrounded by _____in energy levels (also called _____). Atoms have no electric charge because they contain the same number of protons and _____

Sub-atomic	Relative mass	Relative charge
Proton		
Neutron		
Electron		

Atomic number = number of _____.

Mass number = number of _____ + number of _____.

mass number 19

Symbol F

atomic number 9

protons = _____

neutrons = _____

electrons = _____

Atoms of the same element have the same number of _____. It is the number of _____that determines what type of atom it is (e.g. all atoms with six protons are carbon atoms). Atoms of different elements have different numbers of _____. Isotopes are atoms of the same element. They contain the same number of ___but a different number of _____.

2 Complete the table about some atoms.

Atom	Atomic	Mass number	Number of	Number of	Number of
$^{23}_{11}$Na					
Li	3	7			
Ar		40	18		
K			19	20	

Al 14
13
Cl 17 18

Task 2: Writing formulae

Use the table of ions from your GCSE data sheet (AQA GCSE) to write the formula of the following ionic compounds.

a potassium iodide

b sodium oxide

c aluminium bromide

d magnesium chloride

e silver oxide

f iron (II) oxide

g iron (III) oxide

h calcium sulfide

i copper (II) chloride

j lithium fluoride

k barium chloride

l lead sulfide

Task 3: Relative masses

Element		A_r
aluminium	Al	27
bromine	Br	80
calcium	Ca	40
carbon	C	12
chlorine	Cl	35.5
copper	Cu	63.5
fluorine	F	19

Element		A_r
hydrogen	H	1
iodine	I	127
iron	Fe	56
magnesium	Mg	24
nitrogen	N	14
oxygen	O	16

Element		A_r
phosphorus	P	31
potassium	K	39
silver	Ag	108
sodium	Na	23
sulfur	S	32
zinc	Zn	65

1. Calculate the relative formula mass of the following substances You will need to use the relative atomic masses (A_r) shown above.

(HINTS: 1.If there is formulae in brackets everything in the brackets need to be multiplied by the number outside.)

. The dot means to add. So for $CuSO_4.5H_2O$ add $CuSO_4$ to 5 lots of H_2O).

$Mg(OH)_2$

$Ca(HCO_3)_2$

$(NH_4)_2SO_4$

$Fe(NH_4)_2(SO_4)_2.6H_2O$

$Na_2CO_3.10H_2O$

2. Calculate the percentage by mass of the element shown in each of the following substances.

O in $Mg(OH)_2$

O in $Al(NO_3)_3$

O in $Fe_2(SO_4)_3$

H in $Ca(HCO_3)_2$

Task 4: Balancing equations

Balance the following equations.

N_2 + _____ $H_2 \rightarrow$ _____NH_3

_____Ca + $O_2 \rightarrow$ _____CaO

Br_2 + _____ KI $\rightarrow$ _____KBr + I_2

_____ Fe + _____$H_2O \rightarrow Fe_3O_4$ + ___ H_2

C_3H_8 + _____$O_2 \rightarrow$ _____CO_2 + _____ H_2O

_____ NH_3 + _____$O_2 \rightarrow$ _____NO + ____ H_2O

Task 5: Writing symbol equations from words

Write symbol equations for the following reactions taking place. You will first need to convert the names of the materials into formulae and then balance the equation.

. Zinc metal reacts with copper sulfate solution to produce solid copper metal and zinc sulphate solution.

Solid calcium hydroxide reacts with solid ammonium chloride on heating to produce solid calcium chloride, steam and ammonia gas.

When octane (C_8H_{18}) vapour is burned with excess air in a car engine carbon dioxide and water vapour are produced.

Task 6:Themole

Use research resources to find the definition of a mole and then apply it to these questions. Use the following values for A_r

Element		A_r
aluminium	Al	27
bromine	Br	80
calcium	Ca	40
carbon	C	12
chlorine	Cl	35.5
copper	Cu	63.5
fluorine	F	19

Element		A_r
hydrogen	H	1
iodine	I	127
iron	Fe	56
magnesium	Mg	24
nitrogen	N	14
oxygen	O	16

Element		A_r
phosphorus	P	31
potassium	K	39
silver	Ag	108
sodium	Na	23
sulfur	S	32
zinc	Zn	65

1 Complete the blank parts of the following table.

Substance	Formula	M_r	Mass	Moles
carbon monoxide	CO		560 g	
propane	C_3H_8			0.2
unknown solid	unknown		0.104 g	0.0005
methane	CH_4		6 kg	
sodium	Na_2CO_3			2.5
unknown gas	unknown		0.1 g	0.0025

Space for rough working

Task 7: %Yields

1 Write the equation for the thermal decomposition of limestone

a Calculate the maximum theoretical mass of quicklime that can be made by heating

50 g of limestone (relative atomic masses: C = 12, O = 16, Ca = 40).

b In the reaction, only 26 g of quicklime was produced. Calculate the percentage yield.

2 Hydrazine (N_2H_4) was used as the rocket fuel for the Apollo missions to the moon. It is made by the reaction of ammonia (NH_3) with sodium chlorate (NaOCl) (relative atomic masses:

ammonia + sodium chlorate → hydrazine + sodium chloride + water

$2\ NH_3 + NaOCl \rightarrow N_2H_4 + NaCl + H_2O$

a Calculate the maximum theoretical mass of hydrazine that can be made by reacting

340 g of ammonia with an excess of sodium chlorate.

b In the reaction, only 280 g of hydrazine was produced. Calculate the percentage yield.

Task 8: Empirical and molecular formulae

Empirical formula is the simplest whole number ratio of elements. Divide the percentage or mass by the Mr of each element in the compound, divide by the smallest number and simplify to give a whole number ratio.

Element		A_r
aluminium	Al	27
bromine	Br	80
calcium	Ca	40
carbon	C	12
chlorine	Cl	35.5
copper	Cu	63.5
fluorine	F	19

Element		A_r
hydrogen	H	1
iodine	I	127
iron	Fe	56
lead	Pb	207
magnesium	Mg	24
nitrogen	N	14
oxygen	O	16

Element		A_r
phosphorus	P	31
potassium	K	39
silver	Ag	108
sodium	Na	23
sulfur	S	32
zinc	Zn	65

1 Copy and complete the table.

Empirical	M_r	Molecular
CH_2	42	
		C_5H_{10}
		C_4H_8
C_3H_8	44	
		H_2O
CH	78	

2 Find the empirical formula of each of the following substances using the data about composition by mass.

a H 5% F 95%

b Na 3.71 g O 1.29 g

c Pb 90.7% O 9.3%

d C 60.0% H 13.3% O 26.7%

3 3.53 g of iron reacts with chlorine to form 10.24 g of iron chloride. Find the empirical formula for the iron chloride.

4 Analysis of a compound consisting of carbon, hydrogen and oxygen showed it to contain 0.273 g C,
0.046 g H, and 0.182 g O. It has a relative formula mass (M_r) of 88. a

Calculate the empirical formula of the compound.

b Calculate the molecular formula of the compound.

Task 9: Different types of structures

At GCSE you have covered different examples of bonding and should know how to link the bonding type to their physical properties
e.g. melting point, boiling point and conduction of electricity.

Using your GCSE notes and any additional resources make a summary chart for each type of bonding using the following headings:

Type of bonding	
Example	
Melting point High/Low	
Boiling point High/Low	
Conduction of electricity	

Just to remind you the main groups of compounds are;

Simple molecular substances

Giant covalent structures

Metallic structures

Ionic compound

Retrieval questions

You need to be confident about the definitions of terms that describe measurements and results in A Level Chemistry.

Learn the answers to the questions below then cover the answers column with a piece of paper and write as many answers as you can. Check and repeat.

Practical science key terms

When is a measurement valid?	when it measures what it is supposed to be measuring
When is a result accurate?	when it is close to the true value
What are precise results?	when repeat measurements are consistent/agree closely with each other
What is repeatability?	how precise repeated measurements are when they are taken by the *same* person, using the *same* equipment, under the *same* conditions
What is reproducibility?	how precise repeated measurements are when they are taken by *different* people, using *different* equipment
What is the uncertainty of a measurement?	the interval within which the true value is expected to lie
Define measurement error	the difference between a measured value and the true value
What type of error is caused by results varying around the true value in an unpredictable way?	random error
What is a systematic error?	a consistent difference between the measured values and true values
What does zero error mean?	a measuring instrument gives a false reading when the true value should be zero
Which variable is changed or selected by the investigator?	independent variable
What is a dependent variable?	a variable that is measured every time the independent variable is changed
Define a fair test	a test in which only the independent variable is allowed to affect the dependent variable
What are control variables?	variables that should be kept constant to avoid them affecting the dependent variable