Transition into A-level Chemistry 2026

A guide into the essential information you require to study OCR A Level Chemistry –where to find information, what you will need to purchase before September and a series of activities that you will need to complete ready for your first lesson after the summer.

OCR Specification at a glance

AS and first year of A-level

1 Development of practical skills in chemistry
2 Foundations in chemistry
3 Periodic table and energy
4 Core organic chemistry

A-level only

5 Physical chemistry and transition elements.
6 Organic chemistry and analysis

<table>
<tr><th>Content Overview</th><th colspan="2">Assessment Overview</th></tr>
<tr><td rowspan="4">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).</td><td>Periodic table, elements and physical chemistry (01)
100 marks
2 hours 15 minutes written paper</td><td>37%
of total A level</td></tr>
<tr><td>Synthesis and analytical techniques (02)
100 marks
2 hours 15 minutes written paper</td><td>37%
of total A level</td></tr>
<tr><td>Unified chemistry (03)
70 marks
1 hour 30 minutes written paper</td><td>26%
of total A level</td></tr>
<tr><td>Practical Endorsement in chemistry (04)
(non exam assessment)</td><td>Reported separately
(see Section 5)</td></tr>
</table>

SI units

Every measurement must have a size (eg 2.7) and a unit (eg metres or ^{o}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

Activity 2

Which SI unit and prefix would you use for the following quantities?

1. The mass of water in a test tube.

2. The time taken for a solution to change colour.

3. The radius of a gold atom.

4. The volume of water in a burette.

5. The amount of substance in a beaker of sugar.

6. The temperature of the blue flame from a Bunsen burner.

Sometimes, there are units that are used that are not combinations of SI units and prefixes.

These are often multiples of units that are helpful to use. For example, one litre is 0.001 m^3.

Activity 3

Rewrite the following in SI units.

1. 5 minutes

2. 2 days

3. 5.5 tonnes

Activity 4

Rewrite the following quantities.

1. 0.00122 metres in millimetres

2. 104 micrograms in grams

3. 1.1202 kilometres in metres

4. 70 decilitres in millilitres

5. 70 decilitres in litres

6. 10 cm^3 in litres

Important vocabulary for practical work

There are many words used in practical work. You will have come across most of these words in your GCSE studies. It is important you are using the right definition for each word.

Activity 5

Join the boxes to link the word to its definition.

Accurate	A statement suggesting what may happen in the future.
Data	An experiment that gives the same results when a different person carries it out, or a different technique or set of equipment is used.
Precise	A measurement that is close to the true value.
Prediction	An experiment that gives the same results when the same experimenter uses the same method and equipment.
Range	Physical, chemical or biological quantities or characteristics.
Repeatable	A variable that is kept constant during an experiment.
Reproducible	A variable that is measured as the outcome of an experiment.
Resolution	This is the smallest change in the quantity being measured (input) of a measuring instrument that gives a perceptible change in the reading.
Uncertainty	The interval within the true value can be expected to lie.
Variable	The spread of data, showing the maximum and minimum values of the data.
Control variable	Measurements where repeated measurements show very little spread.
Dependent variable	Information, in any form, that has been collected.

Precise language

It is essential at AS and A-level to use precise language when you write reports and when you answer examination questions. You must always demonstrate that you understand a topic by using the correct and appropriate terms.

For example, you should take care when discussing bonding to refer to the correct particles and interactions between them.

Also, when discussing the interaction between particles in an ionic solid, you would demonstrate a lack of understanding if you referred to the particles as atoms or molecules instead of ions or the interaction between these ions as intermolecular forces rather than electrostatic forces. In this case, use of the incorrect terms would result in the loss of all the marks available for that part of a question.

Take care also to use the word ‘chloride’ and not ‘chlorine’ when referring to the ions in a compound such as sodium chloride. The word ‘chlorine’ should only be used for atoms or molecules of the element.

The periodic table

The periodic table of elements is shown on the back page of this booklet. The A-level course will build on what you’ve learned in your GCSE studies.

Activity 6

On the periodic table on the following page:

- Draw a line showing the metals and non-metals.
- Colour the transition metals blue.
- Colour the halogens yellow.
- Colour the alkali metals red.
- Colour the noble gases green.
- Draw a blue arrow showing the direction of periods.
- Draw a red arrow showing the direction of groups.
- Draw a blue ring around the symbols for all gases.
- Draw a red ring around the symbols for all liquids.

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	[98] 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	[268] Db dubnium 105	[271] Sg seaborgium 106	[272] Bh bohrium 107	[270] Hs hassium 108	[276] Mt meitnerium 109	[281] Ds darmstadtium 110	[280] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

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	173.1 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 7

Use the periodic table to find the following:

1. The atomic number of: osmium, sodium, lead, chlorine.

2. The relative atomic mass of: helium, barium, europium, oxygen.

3. The number of protons in: mercury, iodine, calcium.

4. The symbol for: gold, lead, copper, iron.

5. The name of: Sr, Na, Ag, Hg.

6. THInK can be written using a combination of the symbols for Thorium, Indium and Potassium (ThInK). Which combinations of element symbols could be used to make the following words?

   AMERICA, FUN, PIRATE, LIFESPAN, FRACTION, EROSION, DYNAMO

Activity 8: research activity

Research either:

The history of the periodic table

OR

The history of models of atomic structure.

Present your findings as a timeline. You should include the work of at least four people. For each, explain what evidence or experiments they used and how this changed the understanding of chemistry.

Relative atomic mass (A_r)

If there are several isotopes of an element, the relative atomic mass will take into account the proportion of atoms in a sample of each isotope.

For example, chlorine gas is made up of 75% of chlorine-35 $^{35}_{17}C$ and 25% of chlorine-37 $^{37}_{17}C$.

The relative atomic mass of chlorine is therefore the mean atomic mass of the atoms in a sample, and is calculated by:

$$= \left(\frac{75.0}{100} \times 35\right) + \left(\frac{25.0}{100} \times 37\right) = 26.25 + 9.25 = 35.5$$

Activity 9

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

2. Neon has three isotopes. ^{20}Ne accounts for 90.9%, ^{21}Ne accounts for 0.3% and the last 8.8% of a sample is ^{22}Ne. What is the relative atomic mass of neon?

3. Magnesium has the following isotope abundances: ^{24}Mg: 79.0%; ^{25}Mg: 10.0% and ^{26}Mg: 11.0%. What is the relative atomic mass of magnesium?

Harder:

4. Boron has two isotopes, ^{10}B and ^{11}B. The relative atomic mass of boron is 10.8. What are the percentage abundances of the two isotopes?

5. 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?

Relative formula mass (M_r)

Carbon dioxide, CO_2 has 1 carbon atom (A_r = 12.0) and two oxygen atoms (A_r = 16.0). The relative formula mass is therefore

$M_r = (12.0 \times 1) + (16.0 \times 2) = 44.0$

Magnesium hydroxide $Mg(OH)_2$ has one magnesium ion (A_r = 24.3) and two hydroxide ions, each with one oxygen (A_r = 16.0) and one hydrogen (A_r = 1.0).

The relative formula mass is therefore:

$(24.3 \times 1) + (2 \times (16.0 + 1.0)) = 58.3$

Activity 10

Calculate the relative formula mass of the following compounds:

1. Magnesium oxide MgO

2. Sodium hydroxide NaOH

3. Copper sulfate $CuSO_4$

4. Ammonium chloride NH_4Cl

5. Ammonium sulfate $(NH_4)_2SO_4$

Common ions

Positive ions (cations)		Negative ions (anions)	
Name	Symbol	Name	Symbol
Hydrogen	H^+	Hydroxide	OH^-
Sodium	Na^+	Chloride	Cl^-
Lithium	Li^+	Bromide	Br^-
Silver	Ag^+	Oxide	O^{2-}
Magnesium	Mg^{2+}	Hydrogencarbonate	HCO_3^-
Calcium	Ca^{2+}	Nitrate	NO_3^-
Zinc	Zn^{2+}	Sulfate	SO_4^{2-}
Aluminium	Al^{3+}	Carbonate	CO_3^{2-}
Ammonium	NH_4^+	Phosphate	PO_4^{3-}

Some elements have more than one charge. For example, iron can form ions with a charge of +2 or +3. Compounds containing these are named Iron(II) and Iron(III) respectively.

Other common elements with more than one charge include:

Chromium(II) and chromium(III)

Copper(I) and copper(II)

Lead(II) and lead(IV)

Activity 11

On the periodic table on the following page, colour elements that form one atom ions (eg Na^+ or O^{2-}) according to the following key:

Charge	Colour
+1	red
+2	yellow
+3	green
-1	blue
-2	brown

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	[98] 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	[268] Db dubnium 105	[271] Sg seaborgium 106	[272] Bh bohrium 107	[270] Hs hassium 108	[276] Mt meitnerium 109	[281] Ds darmstadtium 110	[280] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

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	173.1 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

Ionic compounds must have an overall neutral charge. The ratio of cations to anions must mean that there is as many positives as negatives.

For example:

NaCl	
Na^+	Cl^-
+1	-1

MgO	
Mg^{2+}	O^{2-}
+2	–2

$MgCl_2$	
Mg^{2+}	Cl^-
	Cl^-
+2	–2

Activity 12

Work out what the formulas for the following ionic compounds should be:

1. Magnesium bromide

2. Barium oxide

3. Zinc chloride

4. Ammonium chloride

5. Ammonium carbonate

6. Aluminium bromide

7. Iron(II) sulfate

8. Iron(III) sulfate

Diatomic molecules

A number of atoms exist in pairs as diatomic (two atom) molecules.

The common ones that you should remember are:

Hydrogen H_2, Oxygen O_2, Fluorine F_2, Chlorine Cl_2, Bromine Br_2, Nitrogen N_2 and Iodine I_2

Common compounds

There are several common compounds from your GCSE studies that have names that do not help to work out their formulas. For example, water is H_2O.

Activity 13: Research activity

What are the formulas of the following compounds?

1. Methane
2. Ammonia
3. Hydrochloric acid
4. Sulfuric acid
5. Sodium hydroxide
6. Potassium manganate(VII)
7. Hydrogen peroxide

Balancing equations

Chemical reactions never create or destroy atoms. They are only rearranged or joined in different ways.

When hydrogen and oxygen react to make water:

hydrogen + oxygen → water

$H_2 + O_2 \rightarrow H_2O$

There are two hydrogen atoms on both sides of this equation, but two oxygen atoms on the left and only one on the right. This is not balanced.

This can be balanced by writing:

$2H_2 + O_2 \rightarrow 2H_2O$

The reactants and products in this reaction are known and you can't change them. The compounds can't be changed and neither can the subscripts because that would change the compounds. So, to balance the equation, a number must be added in front of the compound or element in the equation. This is a coefficient. Coefficients show how many atoms or molecules there are.

Activity 14

Write balanced symbol equations for the following reactions. You'll need to use the information on the previous pages to work out the formulas of the compounds. Remember some of the elements may be diatomic molecules.

1. Aluminium + oxygen → aluminium oxide
2. Methane + oxygen → carbon dioxide + water
3. Aluminium + bromine → aluminium bromide
4. Calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide
5. Aluminium sulfate + calcium hydroxide → aluminium hydroxide + calcium sulfate Harder:
6. Silver nitrate + potassium phosphate → silver phosphate + potassium nitrate More challenging:
7. Potassium manganate(VII) + hydrochloric acid → potassium chloride + manganese(II) chloride + water + chlorine

Moles

A mole is the amount of a substance that contains 6.02×10^{23} particles.

The mass of 1 mole of any substance is the relative formula mass (M_r) in grams.

Examples:
One mole of carbon contains 6.02×10^{23} particles and has a mass of 12.0 g
Two moles of copper contains 12.04×10^{23} particles, and has a mass of 127 g 1 mole of water contains 6.02×10^{23} particles and has a mass of 18 g

The amount in moles of a substance can be found by using the formula:

$$\text{Amount in moles of a substance} = \frac{\text{mass of substance}}{\text{relative formula mass}}$$

Activity 15

Fill in the table.

Substance	Mass of substance	Amount/moles	Number of particles
Helium			18.12×10^{23}
Chlorine	14.2		
Methane		4	
Sulfuric acid	4.905		

Empirical formula

If you measure the mass of each reactant used in a reaction, you can work out the ratio of atoms of each reactant in the product. This is known as the empirical formula. This may give you the actual chemical formula, as the actual formula may be a multiple of this. For example, hydrogen peroxide is H_2O_2 but would have the empirical formula HO.

Use the following to find an empirical formula:

1. Write down reacting masses
2. Find the amount in moles of each element
3. Find the ratio of moles of each element

Example:

A compound contains 2.232 g of ion, 1.284 g of sulfur and 1.920 g of oxygen. What is the empirical formula?

Element	Iron	Sulfur	Oxygen
mass/relative atomic mass	2.232/55.8	1.284/32.1	1.920/16.0
Amount in moles	0.040	0.040	0.120
Divide by smallest value	0.040/0.040	0.040/0.040	0.120/0.040
Ratio	1	1	3

So the empirical formula is $FeSO_3$.

If the question gives the percentage of each element instead of the mass, replace mass with the percentage of an element present and follow the same process.

Activity 16

Work out the following empirical formulas:

1. The smell of a pineapple is caused by ethyl butanoate. A sample is known to contain only 0.180 g of carbon, 0.030 g of hydrogen and 0.080 g of oxygen. What is the empirical formula of ethyl butanoate?

2. Find the empirical formula of a compound containing 0.0578 g of titanium, 0.288 g of carbon, 0.012 g of hydrogen and 0.384 g of oxygen.

3. 300 g of a substance are 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?

C2.1b The structure of atoms

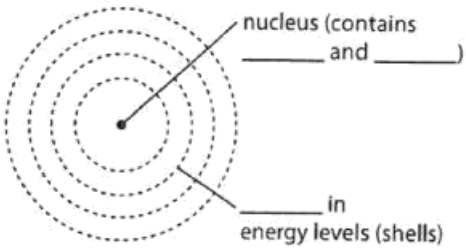
H

Name _____ *Class* _____ *Date* _____

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 particle	Relative mass	Relative charge
Proton		
Neutron		
Electron		



Atomic number = number of _____.

Mass number = number of _____ + number of _____ .

The number of protons, neutrons and electrons in an atom can be worked out using the atomic number and mass number.

Number of protons = _____

Number of neutrons = _____

Number of electrons = _____

mass number
Symbol e.g. $^{19}_{9}F$
atomic number

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 _____. In other words, they have the same atomic number but a different _____ number.

Sheet 1 of 2

C2.2d Electronic structure

FH

Name _____ *Class* _____ *Date* _____

Atoms are made up of three smaller particles called protons, neutrons and electrons. At the centre of the atom is a tiny nucleus, which is far smaller than the atom. The nucleus contains protons and neutrons.

Outside the nucleus are the electrons which orbit the nucleus in energy levels (shells). Each energy level can hold a certain number of electrons. Two electrons can fit in the first energy level and eight electrons in the second energy level. The next eight electrons are in the third energy level and the next two in the fourth energy level.

There is a link between the position of an element in the Periodic Table and its electronic structure. Elements in the same group have the same number of electrons in their highest energy level (their outer shell). For example, all the elements in Group 1 have one electron in the highest energy level; all the elements in Group 7 have seven electrons in the highest energy level.

1 Lithium has the atomic number 3 and mass number 7.

a How many protons, neutrons and electrons does it contain?

protons = _____ neutrons = _____ electrons = _____

b What is its electronic structure? _____

c Draw a diagram in the space to show the structure of a lithium atom.

- Use different colours for protons, neutrons and electrons (make a key).
- Your diagram should show how the electrons are arranged.
- You should label the nucleus.

2 Complete the table below to show which group of the Periodic Table each element belongs to.

Electronic structure	2, 3	2, 8, 8, 2	2, 8, 7	2, 7	2, 8, 4
Group number					

3 Complete the following table about the structure of atoms.

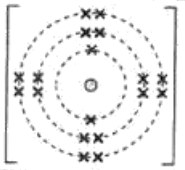
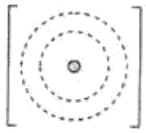
Atom	**Atomic number**	**Mass number**	**Number of protons**	**Number of neutrons**	**Number of electrons**	**Electronic structure**
$^{14}_{7}N$						
$^{19}_{9}F$						
He	2	4				
Na			11	12		
Al	13			14		
P			15	16		
S		32				2, 8, 6

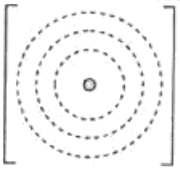
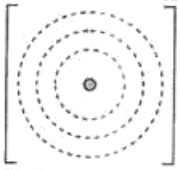
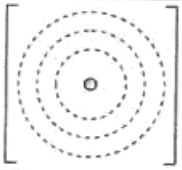
C2.4c The electronic structure of ions

H

Name _____ *Class* _____ *Date* _____

1 Complete the table below to show the electronic structure of some common ions. The first one has been done for you. You will need to use the Periodic Table to help.

Ion	Cl^-	Li^+	F^-	Mg^{2+}
Protons	17			
Electrons	18			
Electron structure (drawing)				
Electron structure (written)	[2, 8, 8]$^-$			

Ion	K^+	S^{2-}	H^+	P^{3-}
Protons				
Electrons				
Electron structure (drawing)				
Electron structure (written)				

2 Look at the electronic structures of all the ions. List everything that they have in common.

_____

_____

3 Complete the following table about some atoms and ions. The first row has been done for you.

Particle	Atom or ion	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons	Electronic structure
$^{23}Na^+$	ion	11	23	11	12	10	$[2, 8]^+$
^{23}Na							
$^{40}Ca^{2+}$							
	atom	9	19				
				17	20	18	
				17	18	18	
		19	39			18	
				18	22	18	
		1	1			0	
					5		$[2]^{2+}$
		10			10		2, 8

C2.4d Atoms and ions

F

Name _____ *Class* _____ *Date* _____

You will need to look at the Periodic Table to help you answer the following questions.

1 Fill in the passage below using these words: (electrons) (gain) (lose) (negative) (positive)

Ions are particles that have a different number of protons and _____. Ions are electrically charged. Ions can be formed when a metal reacts with a non-metal. Metal atoms _____ electrons to form _____ ions. Non-metals _____ electrons to form _____ ions.

2 **a** Complete the table to show the electronic structure of the following ions. The first one has been done for you.

Ion	F^-	Na^+	Al^{3+}	K^+	S^{2-}	H^+	O^{2-}	Ca^{2+}	Li^+	Mg^{2+}	Cl^-	Be^{2+}
Electronic structure	2, 8											

b The table shows the electronic structure of some Group 0 elements (noble gases). Place the ions from part **a** into the correct row of the table. One has been done for you.

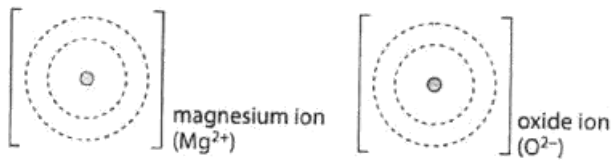
Element	**Electronic structure**	**Ions with the same electronic structure**
He	2	
Ne	2, 8	F^-
Ar	2, 8, 8	

c What is the link between the electronic structure of ions and the electronic structure of Group 0 elements (noble gases)?

_____

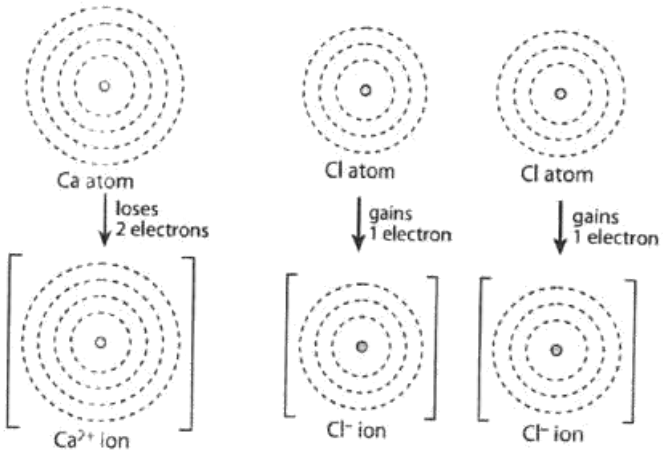
_____

3 Magnesium oxide (MgO) contains magnesium ions (Mg^{2+}) and oxide ions (O^{2-}). Draw the electronic structure of these ions on the diagram.



4 Calcium atoms react with chlorine atoms to form the ionic compound calcium chloride. Calcium atoms each lose two electrons to form calcium ions. Chlorine atoms each gain one electron to form chloride ions. This means that calcium atoms react with chlorine atoms in the ratio of one calcium atom for every two chlorine atoms.

Complete the diagram on the right to show the electronic structure of the calcium and chlorine atoms and the calcium and chloride ions.



Covalent bonds 2

H

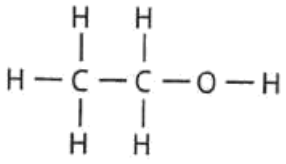
Name _____ *Class* _____ *Date* _____

1 The table shows different non-metal atoms and molecules, along with some dot and cross diagrams. Complete the table. The first row has been done for you.

Atom	Group	Number of electrons in outer shell	Number of electrons needed to fill outer shell	Molecule	Dot and cross diagram
F	7	7	1	F_2	
O	6			O_2	
Cl	7			Cl_2	
C H	4 –	1		CH_4	
C O	4 6			CO_2	

2 Draw dot and cross diagrams to show how the electrons are shared in these compounds.

a ethanol



b tetrafluoromethane, CF_4

3 Why can carbon form large complex molecules?

_____

_____

C2.9e Structure types 2

H

Name _____ *Class* _____ *Date* _____

1 Complete the table to show the properties of the five different types of substances. The answers to choose from are in the last column.

Property	Monatomic	Ionic	Simple molecular	Giant covalent	Metallic	
Melting and boiling points						Very high High High Low Very low
Conductivity as solid						conducts does not conduct does not conduct does not conduct does not conduct
Conductivity when melted						conducts conducts does not conduct does not conduct does not conduct
Solubility in water						soluble (usually) insoluble (usually) insoluble insoluble insoluble
Conductivity of solution						conducts insoluble (usually) insoluble insoluble insoluble

2 Which type of structure does each of the following substances have? Complete the table with your answers.

Substance	Melting point (°C)	Boiling point (°C)	Electrical conductivity as			Type of structure
			Solid	Liquid	Solution (aq)	
A	963	1560	does not conduct	conducts	conducts	
B	1063	2967	conducts	conducts	insoluble	
C	123	187	does not conduct	does not conduct	insoluble	
D	−7	59	does not conduct	does not conduct	does not conduct	
E	3527	4027	does not conduct	does not conduct	insoluble	
F	30	2397	conducts	conducts	insoluble	
G	1713	2230	does not conduct	does not conduct	insoluble	
H	−138	0	does not conduct	does not conduct	insoluble	
I	−189	−188	does not conduct	does not conduct	insoluble	
J	1100	1501	does not conduct	conducts	insoluble	

Please complete a max of 3 hours on the GCSE topics you feel were your weakest!