



Transition into A-level Chemistry Work

In order to prepare yourself for the start of your A-level Chemistry course, you must complete all of the work in this booklet and bring it with you to your first Chemistry lesson.

Sources of information to help you:

AQA Chemistry specification (a link to the specification you will be following):

<http://www.aqa.org.uk/subjects/science/as-and-a-level/chemistry-7404-7405>

A-level Chemistry website (collection of videos, explanations and practice questions):

<http://www.a-levelchemistry.co.uk/>

Chemguide (explanations of anything Chemistry-related):

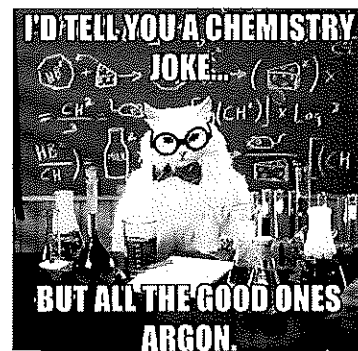
<https://www.chemguide.co.uk/>

Revisechemistry (useful revision guides for each topic):

<https://chemrevise.org/revision-guides/>

Royal Society of Chemistry (collection of Chemistry information – sign up to "Chemnet"):

<http://www.rsc.org/>



Tasks to Complete:

1. Research-based task:

Find a (current) Chemistry-related article and **summarise its contents and importance** in no more than **1 side of A4**. Ideas for where to start: New Scientist, Nature, Catalyst.

2. Worksheets to complete to prepare you for the start of Year 12:

Complete each of the worksheets in this booklet to the best of your ability.

Research Task:

Title of Article	Publication Name	Authors of Article

Worksheet Tasks:

Worksheet Titles	What Went Well	Areas to Improve
Atomic structure, atoms and ions, identify the particles and where in the periodic table		
Structure types and naming substances		
Balancing equations and calculations		



Research-based task:

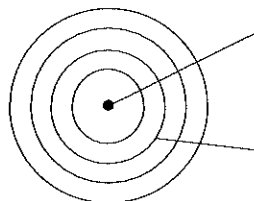
Find a (current) Chemistry-related article and **summarise its contents and importance** in no more than **1 side of A4**. Ideas for where to start: New Scientist, Nature, Catalyst.



ATOMIC STRUCTURE

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 The electrons are arranged in energy levels (.....).

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 =

Atoms can be represented as follows:

$\begin{matrix} \text{mass number} \\ \text{atomic number} \end{matrix} \text{Symbol}$ e.g. ${}_{9}^{19}\text{F}$ protons = neutrons = electrons =

Atoms of the same element have the same number of In fact, it is the number of that determines what type of atom it is (e.g. all atoms with 6 protons are carbon atoms). Atoms of different elements have different numbers of

Isotopes are atoms with the same number of but a different number of This means they are atoms of the same with the same number but a different number.

	${}_{17}^{35}\text{Cl}$	${}_{17}^{37}\text{Cl}$
protons		
neutrons		
electrons		

Atom	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons
${}_{11}^{23}\text{Na}$					
Li	3	7			
Ar		40	18		
K			19	20	
Al				14	13
${}_{92}^{235}\text{U}$					
${}_{92}^{238}\text{U}$					



ATOMS & IONS 1

1) 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	Electron structure
${}_{11}^{23}\text{Na}^+$	ion	11	23	11	12	10	2,8
${}_{15}^{31}\text{P}$							
		13	27			10	
	atom	2	4				
				12	12		2,8

2) a) Complete the table to show the electron structure of the following ions.

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

- b) i) Complete the table below to show the electronic structure of some Group 0 elements (noble gases).
 ii) Place the ions from part (a) into the correct row of the table.

Element	Electron structure	Ions from part (a) with the same electronic structure
He		
Ne		
Ar		

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

.....

d) i) Complete the table with the ions from part 2a (except H^+). Ions for Group 1 have been done for you.

Group	1	2	3	4	5	6	7	0
Ions	Li^+ Na^+ K^+							
Charge	+1							

ii) Predict the charge that the following ions would have using the Periodic Table and your table.

strontium ions iodide ions rubidium ions

Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Give electron structure of atoms			Link between ions and PT group		
Good SPG			Give electron structure of ions			Can predict ion charges		
Can work with PNE numbers			Link between ions and Group 0					



ATOMS & IONS 1

Atom / ion	Atomic number	Mass number	Number of protons	Number of neutrons	Number of electrons
^{14}N					
^{31}P					
	3	7			
	10			10	
		40	20		
		40		22	
			4	5	
	82			126	
	35			44	
	35			46	
$^{23}\text{Na}^+$					
^{16}O					
$^{16}\text{O}^{2-}$					
	17	35			18
	19			20	19
	19			20	18
			20	20	18
	1			0	0
	53			74	54
		14		7	10



IDENTIFY THE PARTICLE

In each case identify the particle. The first one has been done for you.

- 1 An atom with 6 protons and the same number of neutrons as a ^{14}N atom ^{13}C
- 2 An atom with one more proton and the same number of neutrons than an atom of ^{39}K
- 3 An atom with 10 protons and the same number of neutrons as an atom of ^{24}Mg
- 4 An atom with one less proton and the same number of neutrons as an atom of ^{66}Zn
- 5 An atom with the same number of protons and two more neutrons as an atom of ^{79}Br
- 6 An atom with two fewer protons and the same number of neutrons as an atom of ^{50}Cr
- 7 An ion with one more proton and two more neutrons as an atom of ^{20}Ne but the same number of electrons
- 8 An ion with two fewer protons and two fewer neutrons as an atom of ^{40}Ar but the same number of electrons
- 9 An ion with two more protons and two more neutrons as an atom of ^{60}Ni but the same number of electrons
- 10 An ion with two more protons and three more neutrons as an atom of ^{20}Ne but the same number of electrons
- 11 An ion with one less proton, one less neutron and the same number of electrons as an atom of ^{129}Xe .
- 12 An ion with one more proton, two more neutrons, but the same number of electrons as an ion of $^{85}\text{Rb}^+$
- 13 A particle with two less protons, two less neutrons and the same number of electrons as an atom of ^{20}Ne
- 14 A particle with one less proton, two less neutrons and one more electron as a $^{48}\text{Ti}^{2+}$ ion
- 15 A particle with one less proton, two more neutrons and the same number of electrons as a $^{127}\text{I}^-$ ion



STRUCTURE TYPES

	Monatomic	Simple molecular	Giant covalent (sometimes called macromolecular)	Ionic	Metallic
Substances	Group 0 elements	Elements: H ₂ O ₂ N ₂ F ₂ Cl ₂ Br ₂ I ₂ S ₈ P ₄ Compounds: non-metal with non-metal	Elements: Si, diamond, graphite Compounds: SiO ₂	Compounds: metal with non-metal	Elements: metals
What the structure is	Individual atoms with very weak forces between them	Individual molecules with weak forces between them (atoms within molecules are joined by covalent bonds)	Lattice structure in which all atoms are joined to others by covalent bonds	Lattice structure of positive and negatively charged ions (ions are held together by attraction between the + and - ions (this +/- attraction is known as an ionic bond, though it is just an electrostatic attractive force))	Lattice structure of metal ions with outer shell electrons free to move through the structure
The formula	Just the symbol e.g. Ar	e.g. H ₂ O each molecule contains 1 O and 2H atoms	e.g. SiO ₂ ratio of Si:O atoms is 1:2 through the structure	e.g. MgCl ₂ ratio of Mg ²⁺ :Cl ⁻ ions is 1:2 through the structure	Just the symbol e.g. Fe
Melting and boiling points					
Conductivity					
Solubility in water					
Solid					
Liquid					
Gas					



NAMING SUBSTANCES 2

Name the following substances.

Formula	Name
O ₂	
CuO	
Cu	
CuSO ₄	
CuS	
CuCO ₃	
FeSO ₄	
Fe(NO ₃) ₂	
N ₂	
H ₂ SO ₄	
CO	
CO ₂	
NO ₂	
HCl	
KHCO ₃	
K ₂ CO ₃	
Mg	
AgF	
Ca(OH) ₂	
CaCO ₃	

Name	Formula
Al ₂ O ₃	
Na	
Al ₂ (SO ₄) ₃	
HNO ₃	
I ₂	
Ni	
Al	
Na ₂ O	
NaOH	
NaBr	
Na ₂ CO ₃	
He	
CH ₄	
NH ₃	
NH ₄ Br	
H ₂ Te	
SnCl ₄	
WO ₃	
HgO	
TiC	

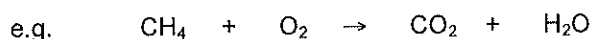


BALANCING EQUATIONS 1

- An equation is balanced when there are the same number of atoms of each type on both sides of the equation.
- An equation can only be balanced by putting numbers in front of formulas – you cannot change the formula itself.
- Equations can be written with state symbols: (s) = solid, (l) = liquid, (g) = gas, (aq) = aqueous (dissolved in water).

How to balance an equation:

- a) Calculate how many atoms of each type are on each side of the equation.
- b) If the numbers are the same then the equation is balanced.
- c) If the numbers are not the same, then numbers are put in front of the formulas (this adds more of that substance). You cannot change the formulas (this would make a different substance). Hint – start with unbalanced elements that only appear in one substance on each side of the equation.
- d) Keep doing this until the equation is balanced.



Questions

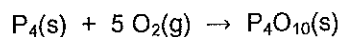
Put your final answers here although you may wish to do your working on a separate sheet of paper or on the back.

- 1) $\text{Ca} + \text{O}_2 \rightarrow \text{CaO}$
- 2) $\text{Na}_2\text{O} + \text{H}_2\text{O} \rightarrow \text{NaOH}$
- 3) $\text{Al} + \text{O}_2 \rightarrow \text{Al}_2\text{O}_3$
- 4) $\text{Na} + \text{Cl}_2 \rightarrow \text{NaCl}$
- 5) $\text{Na}_2\text{CO}_3 \rightarrow \text{Na}_2\text{O} + \text{CO}_2$
- 6) $\text{K} + \text{O}_2 \rightarrow \text{K}_2\text{O}$
- 7) $\text{C}_4\text{H}_8 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- 8) $\text{Fe}_2\text{O}_3 + \text{HCl} \rightarrow \text{FeCl}_3 + \text{H}_2\text{O}$
- 9) $\text{F}_2 + \text{KBr} \rightarrow \text{KF} + \text{Br}_2$
- 10) $\text{C}_5\text{H}_{12} + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$
- 11) $\text{NH}_3 + \text{O}_2 \rightarrow \text{NO} + \text{H}_2\text{O}$
- 12) $\text{HNO}_3 \rightarrow \text{NO}_2 + \text{H}_2\text{O} + \text{O}_2$



BALANCING EQUATIONS 2

- 1) Explain in as much detail as possible what the following balanced equation tells you. Your answer should include information from the state symbols.



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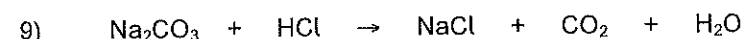
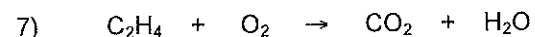
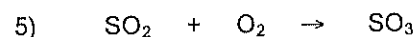
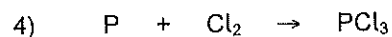
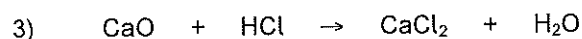
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Now balance the following equations.





RELATIVE FORMULA MASS

Calculate the relative formula mass of the following substances.

- 1 F_2
- 2 Fe
- 3 H_2SO_4
- 4 Al_2O_3
- 5 $Mg(OH)_2$
- 6 $Al(NO_3)_3$
- 7 $(NH_4)_2SO_4$
- 8 $CuCO_3$
- 9 $AgNO_3$
- 10 NH_4NO_3
- 11 $CuSO_4 \cdot 5H_2O$
- 12 magnesium
- 13 oxygen
- 14 sodium bromide
- 15 calcium fluoride
- 16 potassium sulfate
- 17 chlorine
- 18 chromium(III) oxide
- 19 sodium
- 20 iron(III) sulfate

Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Can work out M_r from complex formula		
Can work out M_r from simple formula			Can write write formulae		



AVOGADRO CONSTANT

The Avogadro constant is the number of particles in one mole of particles. It has a value of 6.022×10^{23} .

- 1 a) One dozen golf balls have a mass of 551.16 g. Calculate the mass of one golf ball (give your answer to 3 significant figures).

.....
.....

- b) Three dozen table tennis (ping pong) balls have a mass of 97.20 g. Calculate the mass of one table tennis ball (give your answer to 3 significant figures).

.....
.....

- c) One mole of ^{12}C atoms balls have a mass of 12.000 g. Calculate the mass of one ^{12}C atom (give your answer to 3 significant figures).

.....
.....

- d) 5.0 moles of ^{197}Au atoms balls have a mass of 984.8 g. Calculate the mass of one ^{197}Au atom (give your answer to 3 significant figures).

.....
.....

- 2 a) One cricket ball has a mass of 162.0 g. Calculate the mass of two dozen cricket balls (give your answer to 4 significant figures).

.....
.....

- b) One ^{63}Cu atom has a mass of 1.045×10^{-22} g. Calculate the mass of 3.0 moles of ^{63}Cu atoms (give your answer to 4 significant figures).

.....
.....

- c) One ^{109}Ag atom has a mass of 1.808×10^{-22} g. Calculate the mass of 0.02500 moles of ^{109}Ag atoms (give your answer to 4 significant figures).

.....
.....



MOLES

1) Calculate the number of moles of each of the following substances. Give your answers to 3 sig figs.

- a) 90.0 g of H_2O
- b) 20.0 g of C_4H_{10}
- c) 685 g of NH_3
- d) 102 tons of O_2
- e) 2.00 kg of Al_2O_3
- f) 20.6 mg of Au

2) Calculate the mass of each of the following substances. Give your answers to 3 sig figs.

- a) 4.00 moles of N_2
- b) 0.100 moles of HNO_3
- c) 0.0200 moles of K_2O
- d) 2.50 moles of PH_3
- e) 0.400 moles of $\text{C}_2\text{H}_5\text{OH}$
- f) 10.0 moles of $\text{Ca}(\text{OH})_2$

3) 0.0200 moles of a compound is found to have a mass of 1.64 g. Find the formula mass of the compound. Give your answers to 3 sig figs.

Area	Strength	To develop	Area	Strength	To develop	Area	Strength	To develop
Done with care and thoroughness			Can find moles from mass			Can convert units		
Shows suitable working			Can find mass from moles			Can find M_r from mass and moles		
Can work out M_r			Can use sig figs			Gives units		