A LEVEL CHEMISTRY

CORE PREPARATION: You must complete all of these tasks:

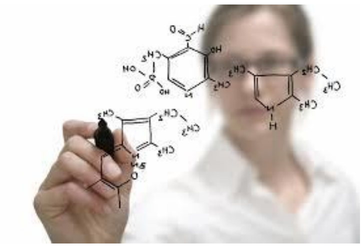
- Look at the OCR Chemistry A specification, available on their website. We will be starting with Module 2: Foundations in Chemistry so read over this Module so you know what to expect from your course
- One of the most important skills you will need to develop as an A level Chemistry student is how to learn independently, and make good notes. We often set homework to make notes on a topic so we can use class time to apply the information. The Cornell notes method helps you to better engage with material and learn it better as a result. This video shows you how to take them
- Use the Cornell notes method to make notes on the structure of the atom using this video up to 8min 50s, and then make another set about electrons using this video. You will need to bring these notes to your first Chemistry lesson, *and* use them help you complete the **summer bridging work booklet** below.
- And finally, the A level Chemistry course contains at least 20% maths. It is advised that you purchase Maths Skills for Chemistry. Please work through the following application of maths tasks:

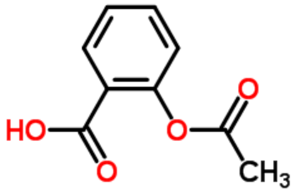
ENRICHMENT: You should complete at least two of these:

- You might want to purchase the CGP Head Start to A level Chemistry for £4.95 and work through the book, completing the questions on each page.
- Choose 2 papers that interest you from http://scienceintheclassroom.org/?tid=All and use the annotations function to help you understand them
- Use the Royal Society of Chemistry website and look at the virtual chemistry tools that they have on offer. Read chemistry articles from 'The Mole'.

<u>Summer Bridging Work GCSE to A Level CHEMISTRY</u>

Well done – you have passed GCSE Science with a good grade.



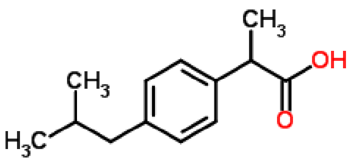


A Level Chemistry is the next step on YOUR exciting journey.

We are pleased that you have chosen Strode's College to continue with your chemistry studies.

In order to be as successful as possible you should complete the following tasks.

Please make sure you bring them to your first chemistry lesson



Electrons, protons and neutrons

Task 1 (a) complete the table below

particle	symbol	Mass(amu)	charge
proton			
Neutron			
electron			

Task 1 (b) Complete the table below.

Species	Number of protons	Number of neutrons	Number of electrons
^{16}O			
$^{16}O^{2-}$			
$^{56}Fe^{2+}$			
$^{55}Fe^{3+}$			
$^{27}Al^{3+}$			

Formulae and ions

You need to know the charges on all of the common ions on the course.

You can work out lots of these from the Periodic Table but some you must learn

<u>Ones you can work out:</u>

1+ all ions of the Group I metals (Li^+, Na^+, K^+, Rb^+, Cs^+)

2+ all ions of the Group II metals (Mg^{2+}, Ca^{2+}, Sr^{2+}, Ba^{2+})

3+ all ions of the Group III metals (not B)

1- all ions of Group VII elements (F^-, Cl^-, Br^-, I^-)

2- all ions of Group VI elements (O^{2-}, S^{2-})

3- all ions of Group V elements (N^{3-}, P^{3-})

Sometimes the element can form more than one ion, so to specify which ion is in the formula, a Roman numeral is used.

I = 1, II = 2, III = 3, IV = 4 , V = 5, VI = 6, VII = 7

Iron (II) chloride has Fe^{2+} in it but iron (III) chloride has Fe^{3+} in it.

The Roman numeral tells you the charge on the ion.

Copper (I) iodide has Cu^+ in it but copper (II) oxide has Cu^{2+} in it.

Single negative ions end in –ide e.g. iodide for I^-

Negative ions which also have O may end in –ate e.g. sulfate for SO_4^{2-}

Some you must learn

silver ion Ag^+	**zinc ion Zn^{2+}**	**ammonium ion NH_4^+**
hydroxide OH^-	**sulfate SO_4^{2-}**	**nitrate NO_3^-**
carbonate CO_3^{2-}		

Task 2 – When you have learnt charges on ions then try this self-test.

Ion of	ion	Ion of	Ion
Na	Na^+	iron in iron (II) oxide	
Ca		copper in copper (I) oxide	
Al		sulfate	
Hydroxide		nitrate	
Cl		carbonate	
Ammonium		Br	
Nitride		iodide	
Sulphide		oxide	

Learning how to combine ions to write a formula.

When you combine positive ions and negative ions together to write a formula, you choose the minimum number of each ion to make the formula neutral overall.

Example 1: Sodium chloride

Na^+ with Cl^-. You only need one of each ion for the positive and negative charges to cancel making a neutral formula. NaCl

Example 2 :magnesium oxide

Mg^{2+} with O^{2-} You only need one of each ion for the positive and negative charges to cancel making a neutral formula. MgO

Example 3 : magnesium chloride

Mg^{2+} and Cl^-. For each Mg^{2+} you will need two Cl^- ions to get 2 minus charges to cancel out the one 2+ charge on the magnesium ion. $MgCl_2$

Example 4 :sodium oxide

Na^+ and O^{2-} . As each oxide ion has a charge of 2-, you will need two Na^+ ions to match the charges. Na_2O

Example 5: aluminium chloride

Al^{3+} and Cl^- Each Al has 3+, so you need three Cl^- ions as each has only one minus charge $AlCl_3$

Example 6 : aluminium oxide

Al^{3+} and O^{2-} . As each oxide ion has a charge of 2-and each Al has a charge of 3+, the only way to balance the charges is to have two Al^{3+} ions (6+) and three O^{2-} (6-) Al_2O_3

Example 7: sodium sulfate

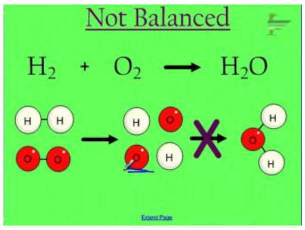
Na^+ with SO_4^{2-} . Each SO_4^{2-} needs two Na^+ so Na_2SO_4

Example 8: ammonium carbonate

NH_4^+ with CO_3^{2-} so we need two ammonium ions for every one carbonate ion. $(NH_4)_2CO_3$

Task 3 Now try to write your own formulae.

Name	Formula	Name	Formula
calcium oxide		strontium sulfate	
magnesium hydroxide		lithium bromide	
sodium sulphide		rubidium nitrate	
aluminium iodide		aluminium sulfate	
aluminium hydroxide		magnesium sulfide	
magnesium nitride		potassium sulfate	
calcium carbonate		iron (III) nitrate	



Balancing equations - read these examples

Example 1

$C + O_2 \rightarrow CO_2$ 1x C atom on each side; 2 x O atoms on each side. The equation is balanced.

Example 2

$Mg + O_2 \rightarrow MgO$ 1 atom of Mg, but 2 atoms of O. Therefore not balanced. Put 2 in front of MgO

$Mg + O_2 \rightarrow 2MgO$ 2x O on each side; but one Mg on the L and 2 Mg on the R. Put 2 in front of Mg

$2Mg + O_2 \rightarrow 2MgO$ Now the equation is balanced.

State symbols are used to show the following:

(aq) for aqueous solution (dissolved in water), (g) for gas, (l) for liquid and (s) for solid

$2Mg(s) + O_2(g) \rightarrow 2MgO(s)$ This equation is now balanced and shows state symbols.

Task 4 - Balancing equations

Balance the following equations. Remember you <u>MUST NOT</u> change a correct formula!

1	H_2	+	O_2		$\rightarrow$	H_2O				
2	$BaCl_2$	+	$NaOH$		$\rightarrow$	$Ba(OH)_2$		+	$NaCl$	
3	H_2SO_4	+	KOH		$\rightarrow$	K_2SO_4	+	H_2O		
4	K_2CO_3	+	HCl		$\rightarrow$	KCl	+	H_2O	+	CO_2
5	$CaCO_3$	+	HNO_3		$\rightarrow$	$Ca(NO_3)_2$	+	H_2O	+	CO_2
6	Ca	+	H_2O		$\rightarrow$	$Ca(OH)_2$		+	H_2	
7	$Pb(NO_3)_2$		+	NaI	$\rightarrow$	PbI_2	+	$NaNO_3$		
8	$Al(OH)_3$			+	$NaOH$	$\rightarrow$	$NaAlO_2$		+	H_2O
9	NH_4NO_3			$\rightarrow$	N_2O	+	H_2O			
10	C_4H_{10}	+	O_2	$\rightarrow$	CO_2	+	H_2O			

Significant Figures and decimal places

Sometimes we give the answer to the nearest whole number, sometimes to a given number of decimal places and sometimes to a given number of significant figures.

Whole number rounding:

If the 1st number after the decimal place is 5 or more, then round up.

e.g. 34.7 rounds to 35; 34.415 rounds to 34; 34.456 rounds to 34.

Decimal places

e.g. 23.457890 to 2 decimal place is 23.46; 23.457890 to 1 d. pl. is 23.5

Significant figures

The first significant figure of a number is the first digit which is not zero.

The second significant figure of a number is the digit after the first significant figure. This is true even if the digit is zero.

e.g. 0.00089 has only 2 sig fig;

0.000001 has only 1 sig fig

1.000000001 has 10 sig fig.

Rounding of sig fig is done in the same way as d pl. and whole numbers.

Task 5

Give the following to the nearest whole number

1 **123.4**

2 **109.5**

3 **1.09**

Give the following to 4 decimal places

4 **56.7688**	**5** **0.03542210**
6 **0.0041032**	**7** **45.989**

Give the following numbers to three sig. fig.

8 **654.389**	**9** **65.4389**
10 **654 389**	**11** **0.045612**
12 **0.012589**	**13** **1.00000007**
14 **2.00445**	**15** **2.99501**

Molar mass from relative atomic mass data (M_r from A_r)

Molar mass can be found by adding together the relative atomic masses of the elements in the molecule.

Example 1

Calculate the Molar Mass (M_r) of sulfuric acid H2SO4

A_r (H) = 1.0	**Therefore 2 x 1.0**	**= 2.0**
A_r (S) = 32.1	**Therefore 1 x 32.1**	**= 32.1**
A_r (O) = 16	**Therefore 4 x 16**	**= 64.0**
Mr, Molar mass		**= 98.1**

Example 2

Calculate the Molar Mass of lead nitrate Pb(NO3)2

Care! This substance contains TWO nitrate groups

Ar (Pb) = 207.2	**Therefore 1 x 207.2**	**= 207.2**
Ar (N) = 14	**Therefore 2 x 14.0**	**= 28.0**
Ar (O) = 16	**Therefore 6 x 16.0**	**= 96.0**
Mr, Molar mass		**= 331.2**

Example 3

Calculate the Molar Mass of CuSO4.5H2O

Care! This substance has 5 molecules of water attached to each formula unit of copper sulfate.

A_r (Cu) = 63.5 **Therefore 1 x 63.5 = 63.5**

A_r (O) = 16 **Therefore 4 x 16.0 = 64.0**

A_r (H) = 1 In 5H2O there are 10 atoms of H **Therefore 10 x 1.0 = 10.0**

A_r (O) = 16 In 5H2O there are 5 atoms of O

Therefore 5 x 16.0 = 80.0 M_r, molar mass = 249.6

Here is an alternative way of showing the same calculation:

$CuSO_4.5H_2O$ = [63.5 + 32.0 + (4 x 16.0) + 5{(2x1.0) + 16.0 }] = 249.6

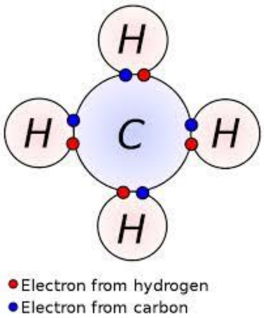
Task 6

Substance	Formula mass	Formula mass	Formula mass	Formula mass	Formula mass
H_2O		CO_2		C_2H_5OH	
C_2H_4		HBr		HNO_3	
$NaCl$		$NaNO_3$		Na_2CO_3	
$CaCl_2$		$Ca(OH)_2$		$Al(NO3)_3$	
$Fe_2(SO_4)_3$		$PbCl_2$		$CuSO_4.5H_2O$	
$FeSO_4.7H_2O$		$(NH_4)_2SO_4.Fe_2(SO_4)_3.24H_2O$			

Bonding - ionic and covalent

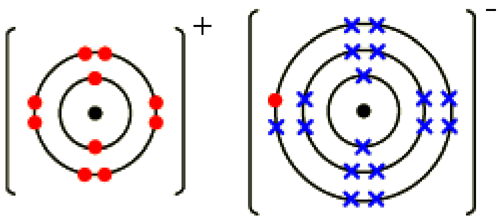
Covalent bond:

This is a shared pair of electrons



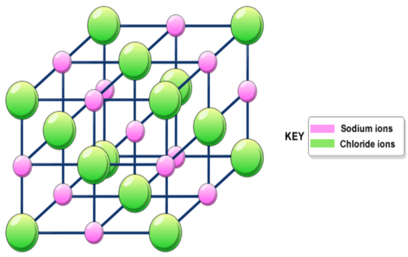
Ionic bond :

This is the electrostatic attraction between oppositely charged ions.



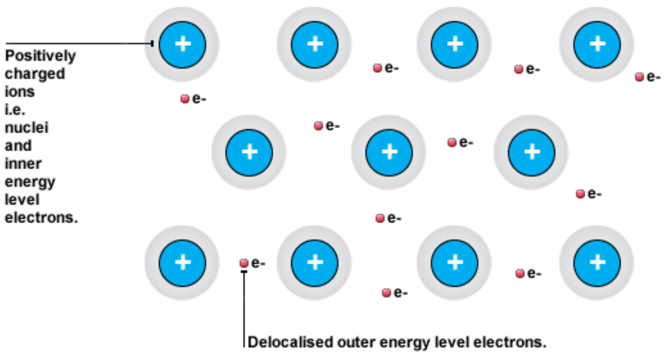
sodium ion, Na^{+} [2,8] $^{+}$

chloride ion, Cl^{-} [2,8,8] $^{-}$



Metallic bond:

This is the electrostatic attraction between positive metal ions and delocalised electrons.



Task 7(a)

'*Dot-and-cross*' diagrams can be used to show covalent or ionic bonding:

Fluorine has a covalent oxide called oxyfluoride, F_2O. The oxygen atom is covalently bonded to each fluorine atom.

Draw a '*dot-and-cross*' diagram of a molecule of F_2O.
Show outer electron shells only.

Task 7 (b)

Draw a '*dot-and-cross*' diagram to show the covalent bonding in NH_3.

Task 7 (c)

Magnesium has metallic bonding.

Draw a diagram of Mg to show what is meant by *metallic* bonding.

Task 7 (d)

Draw a '*dot-and-cross*' diagram to show the ionic bonding in CaF_2.

END