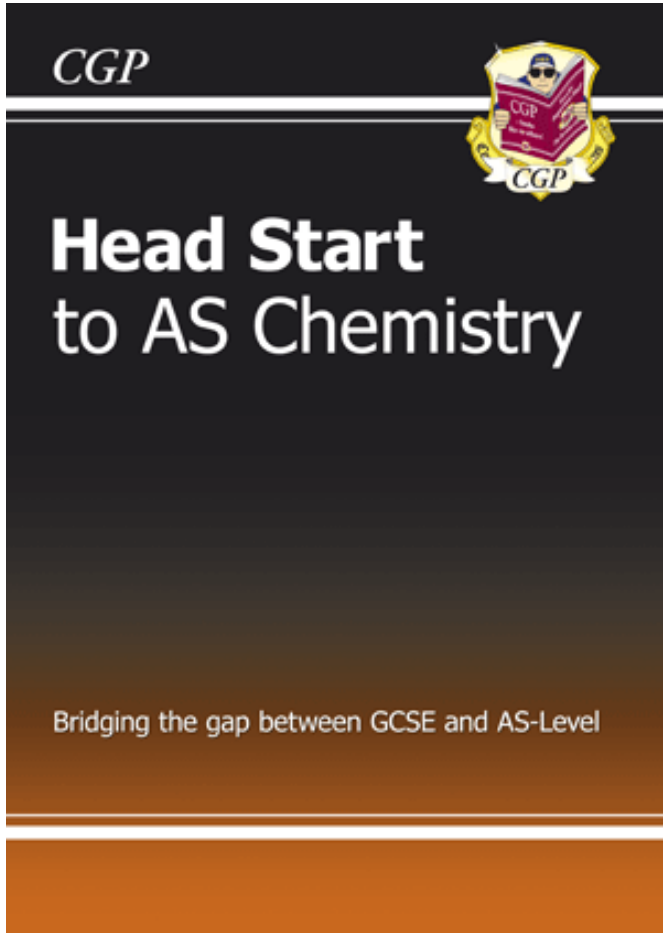
Bridging the Gap between GCSE and A level Chemistry

- You should use your GCSE revision guide and your class notes to complete the following questions
- You can check your answers at the end of the power point, with the answers section
- If you are unsure about anything, you should speak to your Chemistry teacher when you arrive at Upton-by-Chester High School in September
- Please bring a copy of the completed work to your first Chemistry lesson – it will be checked!

If you need to do more preparation……

- Try '**Head Start**' to AS Chemistry
- Buy on line at: https://www.cgpbooks.co.uk/
- ISBN 978 1 84762 116 0
- Only £4.95!



Make notes on the topics below, using your GCSE Revision Guide

- Atomic Structure
- Atomic Number, Atomic Mass & Isotopes
- Balancing Equations
- Chemical Calculations (inc. Mr, Empirical Formula, Molecular formulas, calculating reacting amounts)
- Ionic Bonding (inc. explaining the properties of giant ionic structures)
- Ionic Formula
- Covalent Bonding (inc. explaining the properties of simple molecules &giant covalent structures)
- Metallic bonding (inc. explaining the properties of giant metallic substances)
- Crude Oil
- Cracking
- Polymers

Now try the questions!

Atomic Structure – Complete the table below

Particle	Relative Mass	Relative charge
Proton		
Neutron		
Electron		

Atomic Number, Mass Number, Ions & Isotopes

Element or ion	Symbol	Z	A	Protons	Electrons	Neutrons
Sodium						
		6	12			
		12				12
Chlorine		17	35			
Chlorine		17	37			
Lithium ion	Li^+					
Chlorine ion	Cl^-		35.5			

1. Define an isotope.
2. There are 2 isotopes of Cl. ^{35}Cl and ^{37}Cl. What would you observe when they react?

Balance the following equations

1) $Mg + O_2 \rightarrow MgO$
2) $F_2 + KBr \rightarrow KF + Br_2$
3) $Al + O_2 \rightarrow Al_2O_3$
4) $Na + Cl_2 \rightarrow NaCl$
5) $CuCO_3 \rightarrow CuO + CO_2$
6) $K + O_2 \rightarrow K_2O$
7) $C_4H_8 + O_2 \rightarrow CO_2 + H_2O$
8) $Ba(OH)_2 + H_2SO_4 \rightarrow BaSO_4 + H_2O$
9) $FeCl_3 + NaOH \rightarrow Fe(OH)_3 + NaCl$
10) $HCl + Ba(OH)_2 \rightarrow BaCl_2 + H_2O$

Chemical Calculations

1) a) Calculate the M_r of: i) Br_2 ii) K_2CO_3 iii) $(NH_4)_2SO_4$ (3)

b) Calculate the percentage of oxygen in K_2CO_3. (1)

2) a) Define the terms *empirical formula* and *molecular formula*. (2)

b) A hydrocarbon was found to contain 82.8% by mass of carbon. It has an M_r of 58. Find the **empirical** and **molecular** formulas of this compound. (3)

c) 1 g of sulphur was burned forming 2.5 g of an oxide. Find the empirical formula of the oxide. (2)

3) What mass of calcium oxide is formed from the decomposition of 180 g of calcium carbonate?

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g) \qquad (3)$$

Structure and Bonding

1) Explain each of the following about melting and boiling points:

a) Simple molecular substances have low melting and boiling points. (2)

b) Giant covalent substances have very high melting and boiling points. (2)

b) Ionic substances have high melting and boiling points. (2)

c) Metals have quite high melting and boiling points. (2)

2) Explain each of the following about electrical conductivity:

a) Simple molecular substances do not conduct at all. (1)

b) Giant covalent substances do not conduct, apart from graphite. (3)

c) Ionic substances conduct when melted or dissolved, but not when solid. (3)

d) Metals conduct as solids and when melted. (2)

What type of Structure is it?

	Melting point (°C)	Boiling point (°C)	Electrical conductivity as solid	Electrical conductivity as liquid	Electrical conductivity as aqueous solution	Type of Structure (simple or giant) & Bonding (covalent, ionic or metallic)
A	54	120	poor	poor	poor	
B	403	567	good	good	not soluble	
C	-210	-196	poor	poor	poor	
D	1610	2230	poor	poor	not soluble	
E	615	876	poor	good	good	
F	3727	4827	good		not soluble	
G	56	342	good	good	good	
H	934	1568	poor	good	insoluble	
I	-105	-45	poor	poor	good	

Ionic Formula – Work out the ionic formula of the following:

1. silver nitrate
2. iron (III) hydroxide
3. ammonium chloride
4. lithium oxide
5. copper carbonate
6. sodium sulphate
7. iron (II) sulphate
8. calcium hydroxide

Positive ions	**Negative Ions**
Silver, Ag^{+}	Nitrate, NO_3^{-}
Ammonium, NH_4^{+}	Hydroxide, OH^{-}
Lithium, Li^{+}	Chloride, Cl^{-}
Sodium, Na^{+}	Oxide, O^{2-}
Copper, Cu^{2+}	Carbonate, CO_3^{2-}
Calcium, Ca^{2+}	Sulphate, SO_4^{2-}
Iron (II), Fe^{2+}	
Iron (III), Fe^{3+}	

Crude Oil

The alkanes are a homologous series of saturated hydrocarbons.

a) What is a *hydrocarbon*? (2)

b) What is a *homologous series*? (2)

c) What is meant by the word *saturated* in this context? (1)

d) Draw the structure of propane. (1)

e) Octane is a straight chain alkane containing eight carbon atoms.

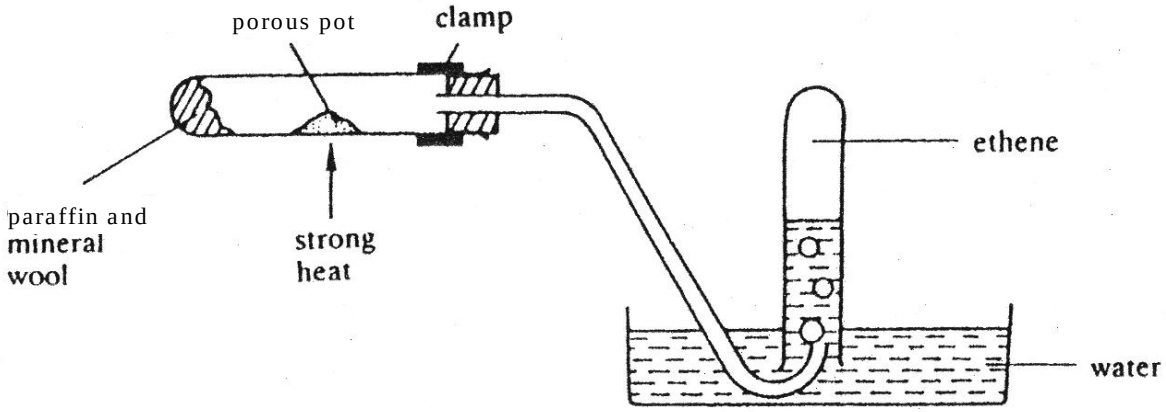
i) Write its molecular formula. (1)

ii) Draw its structural formula. (1)

f) Write a balanced equation for the complete combustion of propane. (1)

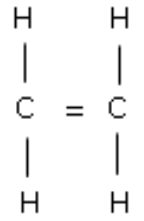
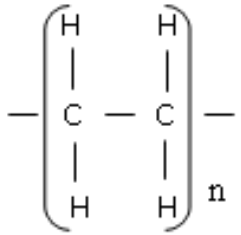
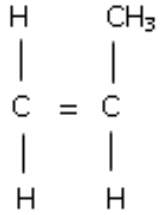
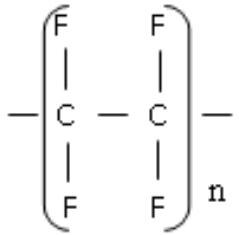
g) Write a balanced equation for the incomplete combustion of propane, where a toxic gas is formed. (1)

Cracking



1) Cracking is a thermal decomposition reaction. Define *thermal decomposition.* (2)
2) What is produced when long alkanes are cracked and explain they are cracked. (3)
3) Why is the porous pot used in Cracking? (1)
4) Why would “suck back” have happened if the tube had not been removed at the end? (2)
5) What happened when bromine water was added to the tube of gas collected? (1)

Polymers

monomer	structure	polymer	structure
ethene		poly (ethene)	
propene		A	B
C	D	poly(tetrafloroethene)	

1. Complete the table opposite
2. What is meant by the term ‘Monomer’?
3. What is meant by the term ‘ Polymer?
4. What is the formula of tetrafluoroethane?
5. What feature allows these molecules to be polymerised?

Answer section

Remember, if you are still unsure after checking your answers, speak to your Chemistry Teacher!

Atomic Structure – Complete the table below

Particle	Relative Mass	Relative charge
Proton	1	$^{+}1$
Neutron	1	None
Electron	$^{1}/_{1840}$ or neglible	$^{-}1$

Atomic Number, Mass Number, Ions & Isotopes

Element or ion	Symbol	Z	A	Protons	Electrons	Neutrons
Sodium	**Na**	**11**	**23**	**11**	**11**	**12**
Carbon	**C**	6	12	**6**	**6**	**6**
Magnesium	**Mg**	12	**24**	**12**	**12**	12
Chlorine	**Cl**	17	35	**17**	**17**	**18**
Chlorine	**Cl**	17	37	**17**	**17**	**20**
Lithium ion	Li^+	**3**	**7**	**3**	**2**	**4**
Chlorine ion	Cl^-	**17**	35.5	**17**	**18**	**18.5**

1. Define an isotope. **Same number of protons and electron, but a different number of neutrons**
2. There are 2 isotopes of Cl. ^{35}Cl and ^{37}Cl. What would you observe when they react? **There is no difference because both isotopes have the same number of electrons in their outer shell**

Balance the following equations

1) $2Mg + O_2 \rightarrow 2MgO$
2) $F_2 + 2KBr \rightarrow 2KF + Br_2$
3) $4Al + 3O_2 \rightarrow 2Al_2O_3$
4) $2Na + Cl_2 \rightarrow 2NaCl$
5) $CuCO_3 \rightarrow CuO + CO_2$ already balanced!
6) $4K + O_2 \rightarrow 2K_2O$
7) $C_4H_8 + 6O_2 \rightarrow 4CO_2 + 4H_2O$
8) $Ba(OH)_2 + H_2SO_4 \rightarrow BaSO_4 + 2H_2O$
9) $FeCl_3 + 3NaOH \rightarrow Fe(OH)_3 + 3NaCl$
10) $2HCl + Ba(OH)_2 \rightarrow BaCl_2 + 2H_2O$

Chemical Calculations 1

1) a) Calculate the M_r of: i) Br_2 160 ii) K_2CO_3 132 iii) $(NH_4)_2SO_4$ 134

b) Calculate the percentage of oxygen in K_2CO_3. (16 x 3) / 132 = 0.36 x 100 = 36%

2) a) Define the terms *empirical formula:* Simplest ratio of atoms

molecular formula: Actual number of Atoms

b) A hydrocarbon was found to contain 82.8% by mass of carbon. It has an M_r of 58. Find the **empirical (see working below) C_2H_5** and **molecular** formulas of this compound. The empirical formula has a mass of 29. 58/29 = 2, so we need double the molecular formula C_4H_{10}

	C	H
Mass (g)	82.8g	100 – 82.8 = 17.2
Divide by Mr	82.8/12	17.2/1
=	6.9	17.2
Divide by smallest no.	6.9/6.9 = 1	17.2 / 6.9 = 2.5
Answer	2C	5H

Chemical Calculations 2

c) 1 g of sulphur was burned forming 2.5 g of an oxide. Find the empirical formula of the oxide. (2)

	S	O
Mass (g)	1g	2.5 - 1= 1.5
Divide by Mr	1/32	1.5 / 16
=	0.03	0.09
Divide by smallest no.	0.03/0.03 = 1	0.03 / 0.09 = 3
Answer	1 S	3 O

3)What mass of calcium oxide is formed from the decomposition of 180 g of calcium carbonate?

$$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$$

$nCaCO_3$ = M / Mr = 180 / (40 + 12 + 16 x 3) = 1.8 moles

$nCaCO_3$ = nCaO = 1.8 moles

M CaO= n x Mr = 1.8 x (40 + 16) = 100.8g

Structure and Bonding Question 1

Explain each of the following about melting and boiling points:

a) Simple molecular substances have low melting and boiling points.
Weak forces (1) between the molecules (**not atoms!)** (1)

b) Giant covalent substances have very high melting and boiling points.
Many strong (1) covalent bonds between the atoms (**not molecules**!) (2)

b) Ionic substances have high melting and boiling points.
Ionic compounds are held together by many strong electrostatic attractions or attractions between **oppositely charged ions(1**)

Lots energy is needed to overcome them (1) (**no mention of molecules**!)

c) Metals have quite high melting and boiling points.

Metals are held together by many strong electrostatic attractions or attractions between **positive ions and negative electrons(1**)

Lots of energy is needed to overcome these attractions(1) (**no mention of molecules**!)

Structure and Bonding Question 2

Explain each of the following about electrical conductivity:

a) Simple molecular substances do not conduct at all.

No free electrons or movement of charge (1)

b) Giant covalent substances do not conduct, apart from graphite.

No free electrons or movement of charge (1)

In graphite only 3 electrons are used in bonding (1)

Leaves a free electron to conduct electricity (1)

c) Ionic substances conduct when melted or dissolved, but not when solid.

When solid the ions are in fixed positions, so there is no movement of charge (1)

when the ions are dissolved in water or melted they are free to move (1)

This allows charge to flow (1)

No mention of moving electrons – there are no free electrons

d) Metals conduct as solids and when melted.

Have delocalised / free moving electrons (1)

charge can be carried through the structure (1)

What type of Structure is it?

	Melting point (°C)	Boiling point (°C)	Electrical conductivity as solid	Electrical conductivity as liquid	Electrical conductivity as aqueous solution	Type of structure & bonding
A	54	120	poor	poor	poor	Simple molecular, covalent
B	403	567	good	good	not soluble	Giant metallic
C	-210	-196	poor	poor	poor	Simple molecular, covalent
D	1610	2230	poor	poor	not soluble	Giant covalent
E	615	876	poor	good	good	Giant ionic
F	3727	4827	good		not soluble	Giant metallic
G	56	342	good	good	good	Giant ionic
H	934	1568	poor	good	insoluble	Giant ionic
I	-105	-45	poor	poor	good	Simple molecular, covalent

Ionic Formula – Work out the ionic formula of the following:

1. silver nitrate
2. iron (III) hydroxide
3. ammonium chloride
4. lithium oxide
5. copper carbonate
6. sodium sulphate
7. iron (II) sulphate
8. calcium hydroxide

1. $AgNO_3$
2. $Fe(OH)_3$
3. NH_4Cl
4. Li_2O
5. $CuCO_3$
6. Na_2SO_4
7. $FeSO_4$
8. $Ca(OH)_2$

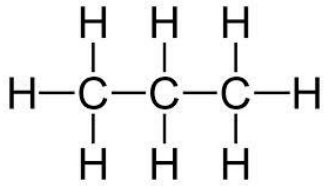
Crude Oil

a) What is a *hydrocarbon*? Only – 1 Compound containing H & C - 1

b) What is a *homologous series*? series of compounds that have **similar properties - 1** and the same general formula. - 1

c) What is meant by the word *saturated* in this context? No C=C bond

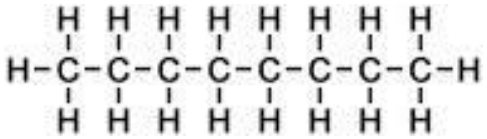
d) Draw the structure of propane.



e) Octane is a straight chain alkane containing eight carbon atoms.

i) Write its molecular formula. C_8H_{18}

ii) Draw its structural formula.



iii) f) Write a balanced equation for the complete combustion of propane.

$C_3H_8 + 4.5O_2 \rightarrow 3CO_2 + 4H_2O$ to get rid of halves, double everything! $2C_3H_8 + 9O_2 \rightarrow 6CO_2 + 8H_2O$

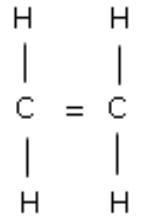
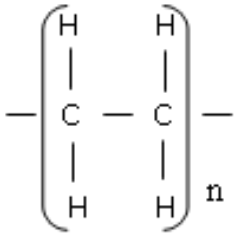
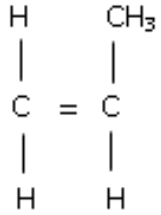
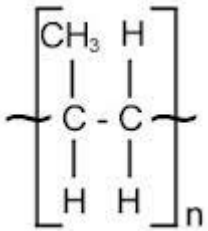
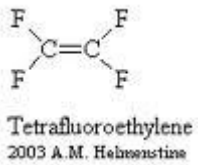
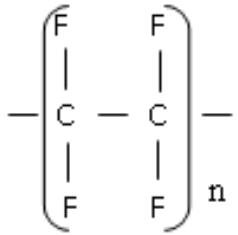
g) Write a balanced equation for the incomplete combustion of propane, where a toxic gas is formed.

$C_3H_8 + 3.5O_2 \rightarrow 3CO + 4H_2O$ to get rid of halves, double everything! $2C_3H_8 + 7O_2 \rightarrow 6CO + 8H_2O$

Cracking

1) Cracking is a thermal decomposition reaction. Define *thermal decomposition.*
   Thermal – using heat (1)
   To break down the compound (1)
2) What is produced when long alkanes are cracked and explain they are cracked. Short chain alkane (1) Short chain Alkenes (1) These molecules are in higher demand than long chain alkanes (1)
3) Why is the porous pot used in Cracking? Catalyst (1)
4) Why would "suck back" have happened if the tube had not been removed at the end? The hot air in the heated test tube would have contracted (1) this would have sucked cold water into the hot test tube, causing it to shatter (1)
5) What happened when bromine water was added to the tube of gas collected? Turned colourless (NOT clear!) (1)

Polymers

monomer	structure	polymer	structure
ethene		poly (ethene)	
propene		A **polypropene**	
C **Tetrafluoro ethane**	D  Tetrafluoroethylene 2003 A.M. Hebnenstine	poly(tetrafloroethene)	

1. Complete the table opposite
2. What is meant by the term ‘Monomer’?

Identical small molecules, than often contain a C=C bond

3. What is meant by the term ‘ Polymer?

Large molecule made up of many identical repeat units called monomers

4. What is the formula of tetrafluoroethane? C_2H_4
5. What feature allows these molecules to be polymerised?

C=C double bond