Bullers Wood School

Chemistry Department

Transition to A' Level Chemistry Workbook

June 2018

This booklet contains questions for you to work through and answer over the summer to prepare for the A level Chemistry course. Much of the work is revision of content from the GCSE courses you have followed during years 10 and 11.
Completion of this work is *essential* as it will highlight areas of difficulty on which you need to work and it will ensure you do not fall behind during the first few weeks of classes.
There will be a test during the first few weeks of term based on the content covered in this booklet. The result from this test may decide whether your future remains with A' level chemistry.

The following websites may be useful.

http://www.docbrown.info/page01/ElCpdMix/EleCmdMix.htm
http://www.docbrown.info/page04/4_70index.htm
http://www.gcsescience.com/e9-substance-physical-state.htm
http://www.gcsescience.com/a-atomic-structure.htm
http://www.gcsescience.com/e1-element-compound-mixture.htm
http://www.bbc.co.uk/education/topics/z84k7ty
http://www.bbc.co.uk/education/guides/zccmn39/revision
http://www.s-cool.co.uk/gcse/chemistry/acids-and-alkalis
http://www.s-cool.co.uk/gcse/chemistry/chemical-bonding
http://www.s-cool.co.uk/gcse/chemistry/atomic-structure

Key Definitions

Write the correct definition for each term below.

Ion	
Ionic bonding	
Covalent bonding	
Metallic bonding	
Delocalised electrons	
Isotope	
Mole	
Avogadro's number	
Relative atomic mass (A_r)	
Relative formula mass (M_r)	
Molecular formula	
Empirical formula	
Percentage yield	
Reversible reaction	
Fractional distillation	
Exothermic reaction	
Endothermic reaction	
Alkali	
Acid	
Base	
Oxidation	
Reduction	

Naming and Formulae – GCSE Revision

Two types of substance **ionic** and **covalent. Type of substance governs the naming and formulae.**

Covalent

Naming	*Just name what is in the substance using mon, di, tri, tetra, etc.* SO_2 SO_3 Some are illogical and have to be learnt e.g. H_2O NH_3
Formula	*Work out from name* Carbon monoxide Carbon dioxide Carbon tetrachloride

DON'T FORGET
Many elements (non-metals) exist as **diatomic molecules**. E.g. O_2, N_2, Cl_2, Br_2, I_2, F_2, etc. This is **really important** when you are asked to write equations.

Write a balanced symbol equation for the combustion of magnesium to form magnesium oxide MgO?

Ionic
The charges on most ions can be worked out from the Periodic Table

Group	Charge on ion
1	
2	
3	
4	
5	
6	
7	
0	

Also some elements exist as more than one ion e.g. Fe^{2+}, Fe^{3+}

Here charges are always shown in roman numerals in the names e.g. Iron(II) chloride.

You *must* also learn the five compound ions

Compound ion name	Formulae
hydroxide	
carbonate	
sulphate	
nitrate	
ammonium	

Naming	If the element contains just two elements then the name of the second element changes to – ide. e.g. CuS is copper sulphide but if you have oxygen as well the name changes to - ate $CuSO_4$ is _____?
Formula	Write out the charges on the positive and negative ions. Bring the numbers down and swap. If they are the same cancel. Use brackets to make things make sense. *The key point to remember is that you use the charge to work out the formula but there are no charges shown in the final ionic formulae.* **What is the formula of:** Aluminium oxide Calcium hydroxide Ammonium nitrate?

Equations

The three steps when writing equation are always as follows:

1. Write a word equation.
2. Work out formulae, <u>don't guess.</u>
3. Balance.

When balancing you **cannot change formula** (the small numbers). H_2O cannot be changed to H_3O

But you can add **big numbers** in front of formulae, always start small and work up.

Always give the final equation in the <u>simplest form</u>.

Formulae and Naming

Write the formula of the following chemicals:

1. Oxygen gas
2. Water
3. Sodium chloride
4. Hydrogen sulphide
5. Magnesium hydroxide
6. Aluminium oxide
7. Sulphur trioxide
8. Copper (II) sulphate
9. Lead (II) sulphide
10. Copper (I) chloride
11. Nitrogen dioxide
12. Silver (I) chloride
13. Ammonium hydroxide
14. Silicon tetrachloride
15. Calcium carbonate
16. Iron (II) sulphate
17. Calcium sulphate
18. Carbon monoxide
19. Magnesium carbonate
20. Iron (II) hydroxide
21. Ammonium carbonate
22. Iron (III) sulphate
23. Lead (IV) chloride
24. Tin (II) chloride
25. Ammonium nitrate

Give the full names of the following:

1. KI
2. CO_2
3. $FeCl_2$
4. NH_4Cl
5. C_2H_6
6. Na_2CO_3
7. C_2H_4
8. $CuCl$
9. $(NH_4)_2CO_3$
10. C_3H_8
11. H_2SO_4
12. NH_3
13. $PbCl_2$
14. $Fe_2(SO_4)_3$
15. N_2
16. $PbSO_4$
17. CH_4
18. SO_2
19. HI
20. $Al(NO_3)_3$
21. $Mg(OH)_2$
22. HNO_3
23. $CuCl_2$
24. HCl
25. SO_3

Balancing Equations

Write the word equation and the write in the formulae underneath it

Sodium hydroxide + hydrochloric acid → sodium chloride + water

$NaOH + HCl \rightarrow NaCl + H_2O$

In a balanced equation there will be the same number of atoms of each element on both sides of the arrow. In this example there is one sodium atom in the sodium hydroxide and one in the sodium chloride. There is one atom of hydrogen on each side also. Count the hydrogens and the chlorine.

Try the following:

1. Calcium carbonate → calcium oxide + carbon dioxide
2. Hydrochloric acid + sodium hydroxide →sodium chloride + water
3. Magnesium + sulphuric acid → magnesium sulphate + hydrogen gas
4. Copper sulphate + zinc → zinc sulphate + copper

In more difficult equations you need to multiply some of the formulae to balance the elements;

Copper + oxygen gas → copper oxide

$\mathbf{Cu + O_2 \rightarrow CuO}$

*Start with what changes; there are 2 **O**'s in **O_2** and only one in **CuO**. To balance it you need 2 O's in the products. Don't be tempted to write **CuO_2**, you have found the formula and **you can't change it**. Instead double the **CuO***

$\mathbf{Cu + O_2 \rightarrow 2CuO}$

*Now you have balanced the oxygen, you have 2 **O**'s in **O_2** and in the **2CuO***
*But you now have 2**Cu**'s in the products but only one in the reactants, so double the **Cu***

$\mathbf{2Cu + O_2 \rightarrow 2CuO}$

Quickly double check each element, all done.

Try these harder ones; hydrogen gas is H_2, oxygen gas is O_2

1. Magnesium + oxygen gas → magnesium oxide
2. Aluminium + oxygen gas → aluminium oxide
3. Zinc + hydrochloric acid → zinc chloride + hydrogen gas
4. Copper oxide + nitric acid → copper nitrate + water
5. Calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide gas
6. Sodium + oxygen gas → sodium oxide
7. Sodium hydroxide + sulphuric acid → sodium sulphate + water
8. Aluminium + Iron (III) oxide → aluminium oxide + iron
9. Magnesium nitrate → magnesium oxide + oxygen gas + nitrogen dioxide (NO_2)

Bonding

Question 1
Define the following:

Covalent bonding

_____

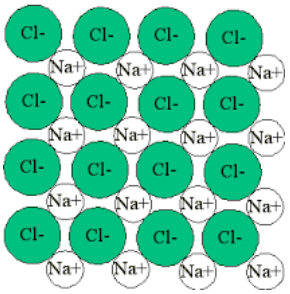
Ionic bonding

_____

Metallic bonding

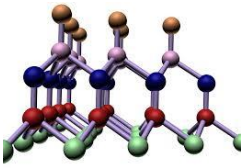
_____

Question 2
For each diagram, indicate the name or names of the type of bonding present from the list below: **metallic, covalent, ionic, none** (if there is no chemical bonding) or **don't know**.



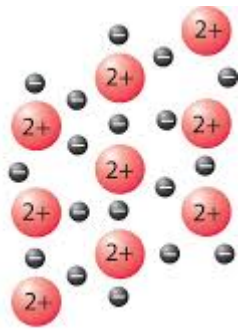
a. Sodium chloride lattice

b. _____



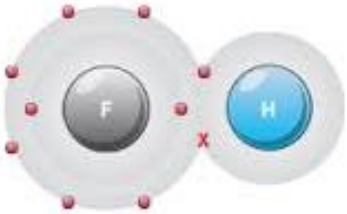
b. Diamond lattice

_____



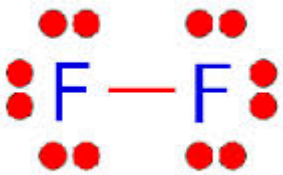
c. Copper metal lattice

_____



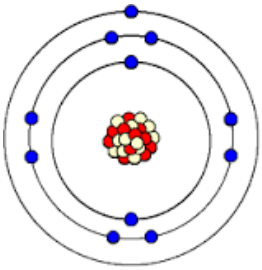
d. Hydrogen fluoride molecule

_____



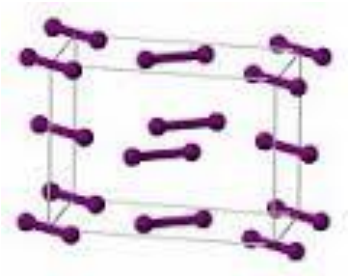
e. Fluorine molecule

_____



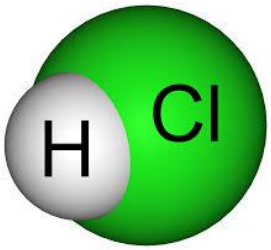
f. Sodium atom

_____



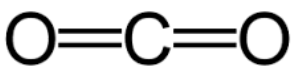
g. Iodine lattice

_____



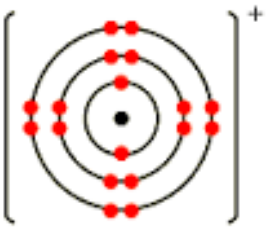
h. Hydrogen chloride

_____



i. Carbon dioxide molecule

_____



j. A potassium ion

_____

a. Which of the above is an example of a simple molecule?

_____

b. Which of the above is an example of a giant ionic structure?

_____

c. Give an example of a giant covalent structure:

_____

Question 3

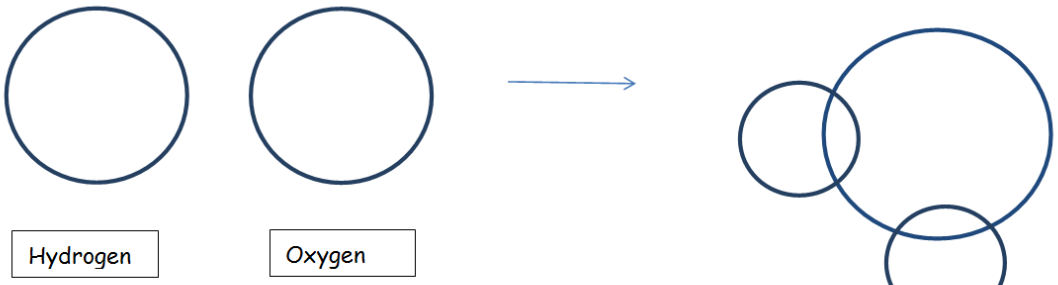
Complete the dot and cross diagrams below for both ionic and covalent compounds.

a. Complete the 'dot and cross' diagram for hydrogen:

Hydrogen Hydrogen

b. Now draw a ‘dot and cross’ diagram for methane (CH_4):

c. Complete the ‘dot and cross’ diagram for water (H_2O):



d. Draw a ‘dot and cross’ diagram to show the bonding in magnesium chloride ($MgCl_2$):

Question 4

The table below shows the melting temperatures (in Kelvin, K) of some elements.

Element	M_r	Melting temperature / K
Helium (He)	4.0	4
Carbon (C)	12.0	
Neon (Ne)	20.2	25
Fluorine (F_2)	38.0	53
Chlorine (Cl_2)	71.0	172
Bromine (Br_2)	159.8	266
Iodine (I_2)	253.8	387
Sulphur (S_8)	256.8	392

The melting point of carbon is not given in the table.

a. Predict the melting point of carbon

_____ K

Experiments show that solid carbon is difficult to melt and only changes into a liquid at very high temperatures. The melting temperature of carbon is 3823K. How close was your prediction? (Tick one box)

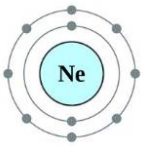
b.

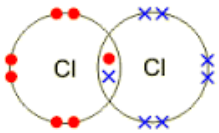
Just about right ☐

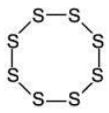
A little bit out ☐

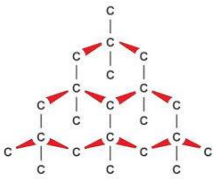
A long way out ☐

Use the diagrams below to help you answer the questions that follow.









In explaining why carbon has such a high melting temperature, read the following statements

i. The intermolecular forces between carbon atoms are very strong

ii. The covalent bonds are stronger in carbon than in sulphur or chlorine

iii. Carbon has a giant covalent structure

iv. In carbon each carbon atom always shares electrons with 4 others

c. **Tick** the correct box below

The second and third statements are correct ☐

The last three statements are correct ☐

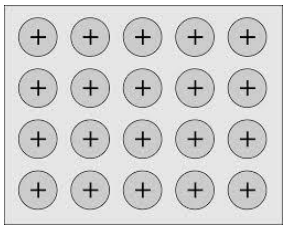
Only the third statement is correct ☐

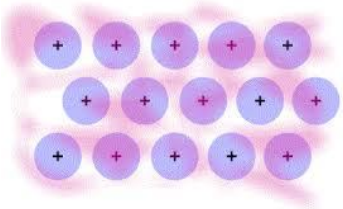
Question 5

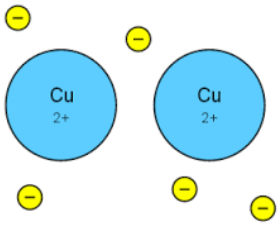
a. In the list of elements below, **circle** those which are metals

Sodium
Sulphur
Aluminium
Silicon
Phosphorus
Magnesium
Chlorine
Tin

Look at the diagrams below showing the arrangement of atoms in a metal

i. 

ii. 

iii. 

b. Which of the diagrams do you think BEST represents metallic bonding? Why?

_____
_____
_____

Below is a list of statements about the element iron. Please read each statement carefully.*(Suggestion: write an **F** next to the statements you think are incorrect and a **T** next to the ones you think are correct; it may help you in the following question).*

- "Iron atoms do not have a full outer shell of electrons, and this makes them very reactive."
- "Iron can conduct electricity because some of the iron atoms can slip over their neighbours and move through the solid."
- "Iron conducts electricity because all atoms of iron are electrical conductors."
- "The reason iron becomes a liquid when heated is because the bonds melt."
- "The general bonding in iron is metallic however the individual atoms in iron are held together by strong ionic bonds."
- "Metals such as iron expand when they are heated because the atoms get bigger."
- "Sodium has a higher melting point than aluminium because it is more reactive and so the electrostatic force between its protons and the delocalised electrons is greater."

c. Tick the correct box below

All of the statements above are roughly correct however they're not detailed enough to get you the full mark in an exam. ☐

Four of the statements above are correct. The rest are incorrect. ☐

Only one statement is correct. The rest are incorrect. ☐

All statements are incorrect. ☐

d. *All* of the statements above are in fact incorrect. Read through the following passage on the electrical conductivity of metals. Delete the incorrect descriptions where appropriate.

Metallic bonding describes the **electrostatic force/ionic bond** between a lattice of positive ions surrounded by **electrons/more positive ions**.
Electrons in the **highest/lowest** occupied energy levels of metal atoms are delocalised. These delocalised electrons allow metals to **conduct electricity/have a low melting point** as electrons are free to move throughout the structure of the metal.
Aluminium has a higher melting point than sodium. This is because there is a **decreasing/increasing** electron density which means **less/more** electrons are donated per atom. This means the delocalised electrons are more able to hold the positive ions in a regular lattice.

Oxidation and reduction

Define oxidation and reduction in terms of electrons.

Complete these half equations by balancing them, and then adding electron(s) (+ e^-) or removing electron(s)(- e^-) from the left hand side.
Decide whether each example is oxidation or reduction, and whether it would be happening at the positive electrode or the negative electrode during electrolysis.

$Cu^{2+}_{(aq)} \rightarrow Cu_{(s)}$ (oxidation/reduction)

$O^{2-}_{(aq)} \rightarrow O_{2(g)}$ (oxidation/reduction)

$Li^{+}_{(l)} \rightarrow Li_{(s)}$ (oxidation/reduction)

$H^{+}_{(aq)} \rightarrow H_{2(g)}$ (oxidation/reduction)

$Mg^{2+}_{(aq)} \rightarrow Mg_{(s)}$ (oxidation/reduction)

$Al^{3+}_{(l)} \rightarrow Al_{(s)}$ (oxidation/reduction)

Acids and Bases

Complete the sentences:

1. Acidic solutions turns universal indicator _____.
2. The pH of an acid is always _____ than 7.
3. When an acid and an alkali react 'to cancel each other out' we call it a _____ reaction.
4. Some solutions were tested with Universal Indicator paper. Their pH values were 1, 5, 7, 10 and 14. Match these pH values to the correct solution in the table:

Solution tested	pH
Distilled water	
Sulphuric acid	
Sodium hydroxide	
Ammonia solution	
Vinegar	

Complete the equations

5. Acid + Metal $\rightarrow$ a Salt + _____.
6. Acid + Carbonate $\rightarrow$ a Salt + Water +_____.
7. Acid + Base $\rightarrow$ a Salt + _____.

8. Below are some chemical equations. Complete the equations by linking the arrow to the correct products.

a) Potassium + hydrochloric acid →

b) Sodium carbonate + nitric acid →

c) Iron + sulphuric acid →

d) Copper oxide + hydrochloric acid→

e) Magnesium + sulphuric acid →

f) Sodium hydroxide + hydrochloric acid →

Iron sulphate +

Sodium chloride

Sodium nitrate + carbon

Copper chloride +

Potassium chloride + hydrogen

Magnesium sulphate + hydrogen

☺ Well Done.

You have completed this booklet. See you in September.