A Level Chemistry – OCR A

Welcome to Chemistry! I'm hoping you're ready this with enthusiasm and looking forward to delving deeper into a subject you loved and worked hard at, at GCSE. If not… think again! Chemistry is by no means an easy option, but this work will help to ease the transition from GCSE to A level. Having a solid understanding of the foundation knowledge of chemistry is **essential** for success at A level, so this is what your bridging work will focus on: knowing the key facts and practicing the key skills so that your brain is like a well-oiled chemistry machine for September.

Please bring both pieces of work to a Chemistry lesson on, or before, the hand in date below.

Hand in date: First Chemistry lesson in September

Task 1 (5 hours)

As I'm sure you found with your GCSE chemistry (especially those of you who studied Triple Science) the maths demands are quite high! Your first task is to practice some of the very chemistry specific maths. Complete the practice questions (attached at the end of the document) to help gain confidence in using 'moles' in calculations. The links below may help you if you're struggling, but also email Mr Hurst for help with specific questions. You don't need to print the questions and write your answers on them, you can just write full workings on paper (your choice).

https://www.bbc.co.uk/bitesize/guides/zgcyw6f/revision/1

https://www.youtube.com/watch?v=RxHfggBNv5U

https://www.youtube.com/watch?v=s-Iu6mPkkPc

To submit this work, you need to answer all questions, mark them (mark scheme at the end of this document) and fill in the following feedback grid and bring to a chemistry lesson before the hand in date.

Question	Score	Comments (are there any specific aspects making you stuck, for example, which parts did you get wrong and have you figured out where you went wrong?)
Mass (a-d)	/4	
Volume (a-d)	/4	
What is a mole? (a-b)	/2	
How can you work out how many moles how have? A) From measurement of mass (1a-3e)	/15	
From a measurement of aqueous volume (1a-3e)	/15	
From a measurement of gaseous volume (1a-3e)	/15	
Part 2: using chemical equations (1-3)	/3	
Using chemical equations (a-c)	/3	
Equation 1 (a-b)	/2	
Equation 2 (a-b)	/2	
Equation 3 (a-b)	/2	
Calculating reacting quantities from chemical equations (1-14)	/42	

Task 2 (10 hours)

It is vital that you have a solid understanding of the periodic table atomic structure and how bonding affects properties, so your first task involves bringing together all your current GCSE knowledge (and some extra A level reading – see websites below – to further your knowledge).

You task is to create a learning resource (i.e. to look like a textbook spread, revision PowerPoint or any other bright ideas you have!) that covers:

Atomic structure –how this affects an elements position on the periodic table (include information about isotopes, group number, period number, atomic number, mass number, electron structure)

Chemical and physical properties of the following groups on the periodic table -

- Group 2
- Group 7

A comparison of the properties (with explanations about WHY they have these properties) for the following types of structure:

- Giant ionic lattices
- Giant metallic lattices
- Giant covalent lattices (refer particularly to diamond, graphite, graphene and silicon)
- Simple molecules

To help you with finding A level knowledge about these (hopefully) familiar concepts, here are some useful links:

Atomic structure:

https://www.youtube.com/watch?v=Pxfa41et2WU

http://docbrown.info/page04/4_71atom.htm

Periodic table:

https://www.youtube.com/watch?v=_6uPkjLJGhM

Group 2:

https://www.youtube.com/watch?v=o4ZirhYykGA

http://docbrown.info/page07/sblock.htm

Group 7 properties:

https://www.youtube.com/watch?v=JiI1P7Wpx_Y

http://docbrown.info/page07/ASA2group7.htm

https://www.youtube.com/watch?v=aPVu2maopyU

Structure and Bonding:

http://docbrown.info/page04/4_72bond2.htm

http://docbrown.info/page04/4_72bond3.htm

http://docbrown.info/page04/4_72bond5.htm

To submit this piece of work, bring a copy of the completed document to a chemistry lesson by the hand in date.

QUESTIONS FOR TASK 1

PART 1: MEASURING AMOUNT OF SUBSTANCE

1) **Mass**

Convert the following into grams:

a) 0.25 kg
b) 15 kg
c) 100 tonnes
d) 2 tonnes

2) **Volume**

Convert the following into dm^3:

a) 100 cm^3
b) 25 cm^3
c) 50 m^3
d) 50000 cm^3

Tip – always use standard form for very large and very small numbers!

What is a mole?

Atoms and molecules are very small – far too small to count individually!

It is important to know how much of something we have, but we count particles in MOLES because you get simpler numbers

1 mole = 6.02×10^{23} particles

(6.02×10^{23} is known as Avogadro's number)

a) If you have 2.5×10^{21} atoms of magnesium, how many moles do you have?

b) If you have 0.25 moles of carbon dioxide, how many molecules do you have?

How can you work out how many moles you have?

A) From a measurement of MASS:

You can find the number of moles of a substance if you are given its mass and you know its molar mass:

number of moles = mass/molar mass

$n = m/M_r$

Mass MUST be measured in grams!

Molar mass has units of $gmol^{-1}$

1. Calculate the number of moles present in:	2. Calculate the mass of:	3. Calculate the molar mass of the following substances:
a) 2.3 g of Na	a) 0.05 moles of Cl_2	a) 0.015 moles, 0.42 g
b) 2.5 g of O_2	b) 0.125 moles of KBr	b) 0.0125 moles, 0.50 g
c) 240 kg of CO_2	c) 0.075 moles of $Ca(OH)_2$	c) 0.55 moles, 88 g
d) 12.5 g of $Al(OH)_3$	d) 250 moles of Fe_2O_3	d) 2.25 moles, 63 g
e) 5.2 g of PbO_2	e) 0.02 moles of $Al_2(SO_4)_3$	e) 0.00125 moles, 0.312 g

B) From a measurement of AQUEOUS VOLUME:

You can find the number of moles of a substance dissolved in water (aqueous) if you are given the volume of solution and you know its molar concentration:

number of moles = aqueous volume x molar concentration

$n = V \times c$

Aqueous volume MUST be measured in dm^3!

concentration has units of $moldm^{-3}$

If you know the molar mass of the substance, you can convert the molar concentration into a mass concentration:

Molar concentration ($moldm^{-3}$) x M_r = mass concentration (gdm^{-3})

1. Calculate the number of moles of substance present in each of the following solutions:	2. Calculate the molar concentration and the mass concentration of the following solutions:	3. Calculate the molar concentration and the mass concentration of the following solutions:
a) 25 cm^3 of 0.1 $moldm^{-3}$ HCl	a) 0.05 moles of HCl in 20 cm^3	a) 35 g of NaCl in 100 cm^3
b) 40 cm^3 of 0.2 $moldm^{-3}$ HNO_3	b) 0.01 moles of NaOH in 25 cm^3	b) 20 g of $CuSO_4$ in 200 cm^3
c) 10 cm^3 of 1.5 $moldm^{-3}$ NaCl	c) 0.002 moles of H_2SO_4 in 16.5 cm^3	c) 5 g of HCl in 50 cm^3
d) 5 cm^3 of 0.5 $moldm^{-3}$ $AgNO_3$	d) 0.02 moles of $CuSO_4$ in 200 cm^3	d) 8 g of NaOH in 250 cm^3
e) 50 cm^3 of 0.1 $moldm^{-3}$ H_2SO_4	e) 0.1 moles of NH_3 in 50 cm^3	e) 2.5 g of NH_3 in 50 cm^3

C) From a measurement of GASEOUS VOLUME:

You can find the number of moles of a gas if you are given the volume of the gas:

number of moles = volume / 24

n = V / 24

24 dm^3 is the volume occupied by 1 mole of any gas at room temperature and pressure

Volume MUST be measured in dm^3!

1. Calculate the number of moles present in:	2. Calculate the volume of gas occupied by:	3. Calculate the mass of the following gas samples:
a) 48 dm^3 of O_2	a) 0.05 moles of Cl_2	a) 48 dm^3 of O_2
b) 1.2 dm^3 of CO_2	b) 0.25 moles of CO_2	b) 1.2 dm^3 of CO_2
c) 200 cm^3 of N_2	c) 28 g of N_2	c) 200 cm^3 of N_2
d) 100 dm^3 of Cl_2	d) 3.2 g of O_2	d) 100 dm^3 of Cl_2
e) 60 cm^3 of NO_2	e) 20 g of NO_2	e) 60 cm^3 of NO_2

PART 2: USING CHEMICAL EQUATIONS

How many moles?

1) Jahin weighs a sample of $CaCO_3$ and records a mass of 5.0 g. How many moles of calcium carbonate are present?

2) Fatima measures out 50 cm^3 of 0.1 $moldm^{-3}$ hydrochloric acid. How many moles of hydrochloric acid are present?

3) Hussain collects 48 cm^3 of carbon dioxide in a gas syringe. How many moles of carbon dioxide are present?

Using Chemical Equations

Chemical Equations show the ratio in which different species react in a chemical reaction.

$$6CO_2 + 6H_2O \xrightarrow[\text{nutrients}]{\text{sunlight}} \underset{\text{Organic compounds}}{C_6H_{12}O_6} + 6O_2$$

This equation shows that 6 moles carbon dioxide of react with 6 moles of water to make 1 mole of glucose and 6 moles of oxygen.

6: 6: 1: 6

How many moles of water are needed to react with 0.03 moles of carbon dioxide?

How many moles of glucose can you make from 0.03 moles of carbon dioxide?

How many moles of oxygen can you make from 0.03 moles of carbon dioxide?

Equation 1: $Mg + 2HCl \rightarrow MgCl_2 + H_2$

a) How many moles of magnesium would be needed to react with 0.01 moles of hydrochloric acid?

b) How many moles of hydrogen could be produced from 0.01 moles of hydrochloric acid?

Equation 2: $2H_2S + 3O_2 \rightarrow 2SO_2 + 2H_2O$

a) How many moles of oxygen is needed to react with 0.5 moles of hydrogen sulphide?

b) How many moles of sulphur dioxide can be made from 0.5 moles of hydrogen sulphide?

Equation 3: $4K + O_2 \rightarrow 2K_2O$

a) How many moles of oxygen are needed to react with 0.05 moles of potassium?

b) How many moles of potassium oxide can be made from 0.05 moles of potassium?

Calculating Reacting Quantities from Chemical Equations

You perform these calculations in three steps:

- calculate the number of moles of one of the substances (you will either be given the mass, or the aqueous volume and the concentration, or the gaseous volume)

- use the equation to work out the number of moles of the other substance (mole ratio)

- use one of the mole relationships to work out the quantity you need

1) What mass of hydrogen is produced when 192 g of magnesium is reacted with hydrochloric acid? (3)

$$Mg + 2HCl \rightarrow MgCl_2 + H_2$$

2) What mass of oxygen is needed to react with 8.5 g of hydrogen sulphide (H_2S)? (3)

$$2\,H_2S + 3\,O_2 \rightarrow 2\,SO_2 + 2\,H_2O$$

3) What mass of potassium oxide is formed when 7.8 g of potassium is burned in oxygen? (3)

$$4\,K + O_2 \rightarrow 2\,K_2O$$

4) What mass of oxygen is required to oxidise 10 g of ammonia to NO? (3)

$$4\,NH_3 + 5\,O_2 \rightarrow 4\,NO + 6\,H_2O$$

5) What mass of aluminium oxide is produced when 135 g of aluminium is burned in oxygen? (3)

$$2\ Al + 3\ O_2 \rightarrow Al_2O_3$$

6) What mass of iodine is produced when 7.1 g of chlorine reacts with excess potassium iodide? (3)

$$Cl_2 + 2\ KI \rightarrow 2\ KCl + I_2$$

7) What volume of hydrogen is needed to react with 32 g of copper oxide? (3)

$$CuO + H_2 \rightarrow Cu + H_2O$$

8) What volume of oxygen is formed when 735 g of potassium chlorate decomposes? (3)

$$2\ KClO_3 \rightarrow 2\ KCl + 3\ O_2$$

9) What volume of hydrogen is produced when 195 g of potassium is added to water? (3)

$$2\ K + 2\ H_2O \rightarrow 2\ KOH + H_2$$

10) What mass of calcium carbonate is required to produce 1.2 dm^3 of carbon dioxide? (3)

$CaCO_3 \rightarrow CaO + CO_2$

11) What mass of magnesium oxide is formed when magnesium reacts with 6 dm^3 of oxygen? (3)

$2 Mg + O_2 \rightarrow 2 MgO$

12) What volume of carbon dioxide is produced when 5.6 g of butene (C_4H_8) is burnt? (3)

$C_4H_8 + 6 O_2 \rightarrow 4 CO_2 + 4 H_2O$

13) The pollutant sulphur dioxide can be removed from the air by reaction with calcium carbonate in the presence of oxygen. What mass of calcium carbonate is needed to remove 480 dm^3 of sulphur dioxide? (3)

$2 CaCO_3 + 2 SO_2 + O_2 \rightarrow 2 CaSO_4 + 2 CO_2$

14) 25 cm^3 of a solution of sodium hydroxide reacts with 15 cm^3 of 0.1 mol/dm^3 HCl. What is the molar concentration of the sodium hydroxide solution? (3)

$HCl + NaOH \rightarrow NaCl + H_2O$

ANSWERS TO 5 hour Task

MEASUREMENTS IN CHEMISTRY

Mass

a) 0.25 x 1000 = 250 g
b) 15 x 1000 = 15000 g
c) 100 x 10^6 = 1 x 10^8 g
d) 2 x 10^6 g

Volume

a) 100/100 = 0.1 dm^3
b) 25/1000 = 0.025 dm^3
c) 50 x 1000 = 50000 dm^3
d) 50000/1000 = 50 dm^3

What is a mole?

a) (2.5 x 10^{21})/(6.02 x 10^{23}) = 4.15 x 10^{-3}
b) 0.25 x 6.02 x 10^{23} = 1.51 x 10^{23}

How can you work out how many moles you have?

a) From a measurement of **MASS**:

1.	a) 0.10	b) 0.078	c) 5500	d) 0.16	e) 0.022
2.	a) 3.6 g	b) 14.9 g	c) 5.6 g	d) 39.9 kg	e) 6.8 g
3.	a) 28	b) 40	c) 160	d) 28	e) 249.6

b) From a measurement of AQUEOUS VOLUME:

1. a) 2.5 x 10^{-3} b) 8 x 10^{-3} c) 0.015 d) 2.5 x 10^{-3} e) 5 x 10^{-3}
2. a) 2.5 $moldm^{-3}$, 91.3 gdm^{-3} b) 0.4 $moldm^{-3}$, 16 gdm^{-3}
   c) 0.121 $moldm^{-3}$, 11.9 gdm^{-3} d) 0.1 $moldm^{-3}$, 16.0 gdm^{-3}
   e) 2 $moldm^{-3}$, 34 gdm^{-3}
3. a) 350 gdm^{-3}, 5.98 $moldm^{-3}$ b) 100 gdm^{-3}, 0.627 $moldm^{-3}$
   c) 100 gdm^{-3}, 2.74 $moldm^{-3}$ d) 32 gdm^{-3}, 0.8 $moldm^{-3}$
   e) 50 gdm^{-3}, 1.47 $moldm^{-3}$

c) From a measurement of GASEOUS VOLUME:

1.	a) 2	b) 0.05	c) 0.022	d) 4.0	e) 2.5x10^{-3}
2.	a) 1.2 dm^3	b) 6 dm^3	c) 24 dm^3	d) 2.4 dm^3	e) 10.4 dm^3
3.	a) 64 g	b) 2.2 g	c) 0.23 g	d) 296 g	e) 0.115 g

How many moles?

1) 0.05
2) 5×10^{-3}
3) 2×10^{-3}

Using Chemical Equations

Equation 0:	a) 0.03	b) 0.005	c) 0.03
Equation 1:	a) 0.005	b) 0.005	
Equation 2:	a) 0.75	b) 0.5	
Equation 3:	a) 0.0125	b) 0.025	

Calculating Reacting Quantities from Chemical Equations

1) Moles Mg = 192/24.3 = 7.90mol

   Moles H_2 = 7.90mol (1:1 ratio with Mg)

   Mass H_2 = moles x Mr = 7.90 x 2 = 15.80g

2) Moles H_2S = 8.5/34.1 = 0.249mol

   Moles O_2 = 0.249 x 3/2 = 0.3735mol

   Mass O_2 = 0.03735 x 32 = 12.0g (to 3 sig fig)

3) Moles K = 7.8/39.1 = 0.199 mol

   Moles K2O = 0.199/2 = 0.0995mol

   Mass K2O = 0.0995 x 94.2 = 9.37g

4) Moles NH3 = 10/17 = 0.588mol

   Moles O2 = 0.588 x 5/4 = 0.735mol

   Mass O2 = 0.735 x 32 = 23.5g

5) Moles Al = 135/27.0 = 5mol

   Moles Al2O3 = 5/2 = 2.5mol

   Mass Al2O3 = 2.5 x 102 = 255g

6) Moles Cl2 = 7.1/71 = 0.1 mol

   Moles I2 = 0.1mol (1:1 ratio)

   Mass I2 = 0.1 x 253.8 = 25.4g

7) Moles CuO = 32/79.5 = 0.402…mol

   Moles H2 = 0.402… (1:1 ratio)

   Vol H2 = n x 24 = 0.402… x 24 = 9.65dm3

8) Moles $KClO_3$ = 735/122.6 = 5.995…mol

Moles O_2 = 5.995… x 3/2 = 8.992…mol

Vol O_2 = 8.992… x 24 = 216dm3 (3 sigfig)

9) Moles K = 195/39.1 = 4.987…mol

Moles H_2 = 4.987… /2 = 2.49 mol

Vol H_2 = 2.49 x 24 = 59.8dm3

10) Moles CO_2 = V/24 = 1.2/24 = 0.05mol

Moles $CaCO_3$ = 0.05mol (1:1 ratio)

Mass $CaCO_3$ = 0.05 x 100.1 = 5.01g (3 sig fig)

11) Moles O_2 = V/24 = 6/24 = 0.25mol

Moles MgO = 0.25 x 2 = 0.5mol

Mass MgO = 0.5 x 40.3 = 20.2g (3 sig fig)

12) Moles butene = 5.6/56 = 0.1mol

Moles CO_2 = 0.1 x 4 = 0.4mol

Vol CO_2 = n x 24 = 0.4 x 24 = 9.6dm3

13) Moles SO_2 = V/24 = 480/24 = 20mol

Moles of $CaCO_3$ = 20mol (1:1 ratio)

Mass of $CaCO_3$ = 20 x 100.1 = 2002g = 2.002kg

14) Moles HCl = c x V (in dm3) = 0.1 x 0.015dm3 = 0.0015mol

Moles NaOH = 0.0015 (1:1 ratio)

Conc NaOH = n/V(in dm3) = 0.0015/0.025 = 0.06moldm-3