

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-lu6mPkkPc>

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).

Your 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 element's 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=Jil1P7Wpx_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

$$1 \text{ mole} = 6.02 \times 10^{23} \text{ particles}$$

(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:

$$\text{number of moles} = \text{mass/molar mass}$$

$$n = m/M_r$$

Mass MUST be measured in grams!

Molar mass has units of g mol^{-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 $\text{Al}_2(\text{SO}_4)_3$	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:

$$\text{number of moles} = \text{aqueous volume} \times \text{molar concentration}$$
$$n = V \times c$$

Aqueous volume MUST be measured in dm^3 !

concentration has units of mol dm^{-3}

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

$$\text{Molar concentration (mol dm}^{-3}\text{)} \times M_r = \text{mass concentration (g dm}^{-3}\text{)}$$

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 mol dm^{-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 mol dm^{-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 mol dm^{-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 mol dm^{-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 mol dm^{-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:

$$\begin{array}{ccccccc} \text{number of moles} & = & \text{volume} & / & 24 \\ n & = & V & / & 24 \end{array}$$

24 dm³ is the volume occupied by 1 mole of any gas at room temperature and pressure

Volume MUST be measured in dm³!

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

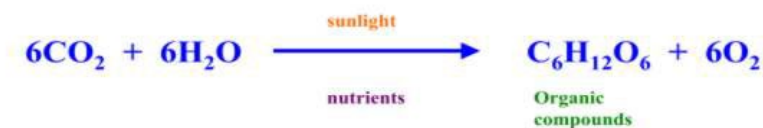
PART 2: USING CHEMICAL EQUATIONS

How many moles?

- 1) Jahin weighs a sample of CaCO₃ and records a mass of 5.0 g. How many moles of calcium carbonate are present?
- 2) Fatima measures out 50 cm³ of 0.1 moldm⁻³ hydrochloric acid. How many moles of hydrochloric acid are present?
- 3) Hussain collects 48 cm³ 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.



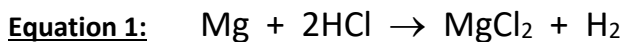
This equation shows that 6 moles carbon dioxide react with 6 moles of water to make 1 mole of glucose and 6 moles of oxygen.

6: 6: 1: 6

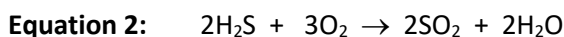
How many moles of water are needed to react with 0.03 moles of carbon dioxide?

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?



- 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?



- 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?



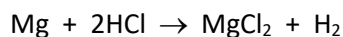
- a) How many moles of oxygen are needed to react with 0.05 moles of potassium?
- b) How many moles of potassium oxide can be made from 0.05 moles of potassium?

Calculating Reacting Quantities from Chemical Equations

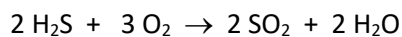
You perform these calculations in three steps:

- 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

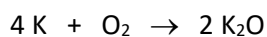
- 1) What mass of hydrogen is produced when 192 g of magnesium is reacted with hydrochloric acid? (3)



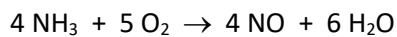
- 2) What mass of oxygen is needed to react with 8.5 g of hydrogen sulphide (H₂S)? (3)



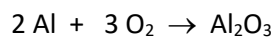
- 3) What mass of potassium oxide is formed when 7.8 g of potassium is burned in oxygen? (3)



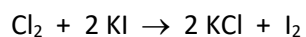
- 4) What mass of oxygen is required to oxidise 10 g of ammonia to NO? (3)



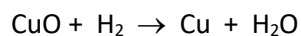
5) What mass of aluminium oxide is produced when 135 g of aluminium is burned in oxygen? (3)



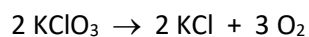
6) What mass of iodine is produced when 7.1 g of chlorine reacts with excess potassium iodide? (3)



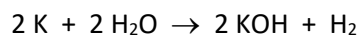
7) What volume of hydrogen is needed to react with 32 g of copper oxide? (3)



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



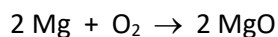
9) What volume of hydrogen is produced when 195 g of potassium is added to water? (3)



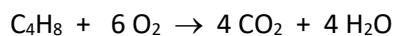
10) What mass of calcium carbonate is required to produce 1.2 dm³ of carbon dioxide? (3)



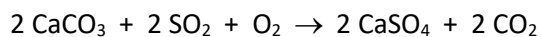
11) What mass of magnesium oxide is formed when magnesium reacts with 6 dm³ of oxygen? (3)



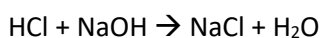
12) What volume of carbon dioxide is produced when 5.6 g of butene (C₄H₈) is burnt? (3)



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 dm³ of sulphur dioxide? (3)



14) 25 cm³ of a solution of sodium hydroxide reacts with 15 cm³ of 0.1 mol/dm³ HCl. What is the molar concentration of the sodium hydroxide solution? (3)



ANSWERS TO 5 hour Task

MEASUREMENTS IN CHEMISTRY

Mass

- a) $0.25 \times 1000 = 250 \text{ g}$
- b) $15 \times 1000 = 15000 \text{ g}$
- c) $100 \times 10^6 = 1 \times 10^8 \text{ g}$
- d) $2 \times 10^6 \text{ g}$

Volume

- a) $100/100 = 0.1 \text{ dm}^3$
- b) $25/1000 = 0.025 \text{ dm}^3$
- c) $50 \times 1000 = 50000 \text{ dm}^3$
- d) $50000/1000 = 50 \text{ dm}^3$

What is a mole?

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

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) 2.5×10^{-3} b) 8×10^{-3} c) 0.015 d) 2.5×10^{-3} e) 5×10^{-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) 2.5×10^{-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 = $192/24.3 = 7.90\text{mol}$

Moles H₂ = 7.90mol (1:1 ratio with Mg)

Mass H₂ = moles x Mr = $7.90 \times 2 = 15.80\text{g}$

2) Moles H₂S = $8.5/34.1 = 0.249\text{mol}$

Moles O₂ = $0.249 \times 3/2 = 0.3735\text{mol}$

Mass O₂ = $0.3735 \times 32 = 12.0\text{g}$ (to 3 sig fig)

3) Moles K = $7.8/39.1 = 0.199\text{ mol}$

Moles K₂O = $0.199/2 = 0.0995\text{mol}$

Mass K₂O = $0.0995 \times 94.2 = 9.37\text{g}$

4) Moles NH₃ = $10/17 = 0.588\text{mol}$

Moles O₂ = $0.588 \times 5/4 = 0.735\text{mol}$

Mass O₂ = $0.735 \times 32 = 23.5\text{g}$

5) Moles Al = $135/27.0 = 5\text{mol}$

Moles Al₂O₃ = $5/2 = 2.5\text{mol}$

Mass Al₂O₃ = $2.5 \times 102 = 255\text{g}$

6) Moles Cl₂ = $7.1/71 = 0.1\text{ mol}$

Moles I₂ = 0.1mol (1:1 ratio)

Mass I₂ = $0.1 \times 253.8 = 25.4\text{g}$

7) Moles CuO = $32/79.5 = 0.402\dots\text{mol}$

Moles H₂ = 0.402... (1:1 ratio)

Vol H₂ = $n \times 24 = 0.402\dots \times 24 = 9.65\text{dm}^3$

8) Moles $\text{KClO}_3 = 735/122.6 = 5.995\dots\text{mol}$

Moles $\text{O}_2 = 5.995\dots \times 3/2 = 8.992\dots\text{mol}$

Vol $\text{O}_2 = 8.992\dots \times 24 = 216\text{dm}^3$ (3 sigfig)

9) Moles $\text{K} = 195/39.1 = 4.987\dots\text{mol}$

Moles $\text{H}_2 = 4.987\dots /2 = 2.49 \text{ mol}$

Vol $\text{H}_2 = 2.49 \times 24 = 59.8\text{dm}^3$

10) Moles $\text{CO}_2 = V/24 = 1.2/24 = 0.05\text{mol}$

Moles $\text{CaCO}_3 = 0.05\text{mol}$ (1:1 ratio)

Mass $\text{CaCO}_3 = 0.05 \times 100.1 = 5.01\text{g}$ (3 sig fig)

11) Moles $\text{O}_2 = V/24 = 6/24 = 0.25\text{mol}$

Moles $\text{MgO} = 0.25 \times 2 = 0.5\text{mol}$

Mass $\text{MgO} = 0.5 \times 40.3 = 20.2\text{g}$ (3 sig fig)

12) Moles butene = $5.6/56 = 0.1\text{mol}$

Moles $\text{CO}_2 = 0.1 \times 4 = 0.4\text{mol}$

Vol $\text{CO}_2 = n \times 24 = 0.4 \times 24 = 9.6\text{dm}^3$

13) Moles $\text{SO}_2 = V/24 = 480/24 = 20\text{mol}$

Moles of $\text{CaCO}_3 = 20\text{mol}$ (1:1 ratio)

Mass of $\text{CaCO}_3 = 20 \times 100.1 = 2002\text{g} = 2.002\text{kg}$

14) Moles $\text{HCl} = c \times V$ (in dm^3) = $0.1 \times 0.015\text{dm}^3 = 0.0015\text{mol}$

Moles $\text{NaOH} = 0.0015$ (1:1 ratio)

Conc $\text{NaOH} = n/V$ (in dm^3) = $0.0015/0.025 = 0.06\text{mol dm}^{-3}$