

Name:

Teacher:

# AQA A Level Chemistry Transition Booklet

## C4 Chemical Calculations

Topic Reflection:

Rate your confidence in this topic out of 10:

Areas of the topic I'm still struggling with:



**NEWLANDS SIXTH FORM**  
COURAGE COMMITMENT COMPLETION

Questions I need to ask my teacher about this topic:

Science and everyday life cannot and should not be separated

Rosalind Franklin was a pioneering British scientist whose ground-breaking work on X-ray crystallography played a crucial role in unravelling the structure of DNA, laying the foundation for our understanding of the molecule's double helix shape.



Rosalind Franklin  
1920-1958

## Isotopes and Relative Atomic Mass

1	What key word describes the sum of protons and neutrons in the nucleus of an atom?	
2	What is the relative charge of a neutron?	
3	What is the relative charge of an electron?	
4	What is the relative mass of a proton?	
5	What is the relative mass of a neutron?	
6	What is the relative mass of an electron?	
7	Where are protons found in an atom?	
8	Where are neutrons found in an atom?	
9	Where are electrons found in an atom?	
10	Why do atoms always have the same number of protons and electrons?	

## Isotopes

Isotopes are atoms of the same element, with the same number of protons but different numbers of neutrons and hence different mass numbers. Isotopes of the same element have the same arrangement of electrons so they react in exactly the same way.

→ Complete the table showing the number of protons, electrons and neutrons in each isotope of oxygen.

### Isotope Symbols

Mass Number →

$A$

(# of protons + # of neutrons)

$X$

Atomic Number →

$Z$

(# of protons)

← Element

	$^{16}_8\text{O}$	$^{17}_8\text{O}$	$^{18}_8\text{O}$	$^{19}_8\text{O}$	$^{20}_8\text{O}$
<b>Protons</b>					
<b>Electrons</b>					
<b>Neutrons</b>					

## Calculating Relative Atomic Mass (Ar or RAM)

**Relative atomic mass** = the **average mass** of an atom of an **element** compared to the mass of an atom of carbon 12.

Relative atomic mass =  $\frac{\text{sum of (\% of isotope} \times \text{mass number) of all isotopes}}{100}$

Work through the example with the free science lessons guy then answer the questions: [A Level Chemistry Revision "Relative Atomic Mass"](#)

Show all you working as shown in the first example:

Example Q1 75% of naturally occurring chlorine is  $^{35}\text{Cl}$  and the rest is  $^{37}\text{Cl}$ . Calculate the relative atomic mass.

$$\frac{75 \times 35 + (25 \times 37)}{100}$$

$$\text{RAM} = 35.5$$

Q3 Rubidium is a soft, silvery-white metal that has two common isotopes,  $^{85}\text{Rb}$  and  $^{87}\text{Rb}$ . If the abundance of  $^{85}\text{Rb}$  is 72.2% and the abundance of  $^{87}\text{Rb}$  is 27.8%, what is the relative atomic mass of rubidium?

You do:

Q4) Uranium is used in nuclear reactors and is a rare element on earth. Uranium has three common isotopes. If the abundance of  $^{234}\text{U}$  is 0.01%, the abundance of  $^{235}\text{U}$  is 0.71%, and the abundance of  $^{238}\text{U}$  is 99.28%, what is the relative atomic mass of uranium?

Q5) Titanium has five common isotopes:  $^{46}\text{Ti}$  (8.0%),  $^{47}\text{Ti}$  (7.8%),  $^{48}\text{Ti}$  (73.4%),  $^{49}\text{Ti}$  (5.5%),  $^{50}\text{Ti}$  (5.3%). What is the relative atomic mass of titanium?

Q6) Copper used in electric wires contains 2 isotopes:  $^{63}\text{Cu}$  and  $^{65}\text{Cu}$ .  $^{63}\text{Cu}$  has an abundance of 69.09%. Calculate the % abundance of  $^{65}\text{Cu}$  and hence calculate the RAM of copper.

Recap Questions:

1. Fill in the gaps:

Mass number is the sum of \_\_\_\_\_ and \_\_\_\_\_ in the nucleus of an atom.

Isotopes are atoms of the same element, with the same number of \_\_\_\_\_ but different numbers of \_\_\_\_\_ and hence different mass numbers. Isotopes of the same element have the same arrangement of \_\_\_\_\_ so they react in exactly the \_\_\_\_\_ way.

**Relative atomic mass (RAM)** is the \_\_\_\_\_ mass of an atom of an **element** compared to the mass of an atom of \_\_\_\_\_.

## Relative formula mass (Mr)

The mass of a molecule is called the **relative formula mass** or Molecular mass (Mr)

This is calculated by adding up the relative atomic masses of all the atoms in the molecule.

Work through the example with the free science lessons guy then answer the questions: [GCSE Chemistry Revision "Relative Formula Mass"](#)

Show all your working as shown in the first example;

1	Calculate the relative formula mass of <b>CO</b>	Cx1 = 1 x 12 = 12 Ox1 = 16x1 = 16 = 28
2	Calculate the relative formula mass of <b>HNO<sub>3</sub></b>	
3	Calculate the relative formula mass of <b>NO<sub>2</sub></b>	
4	Calculate the relative formula mass of <b>CH<sub>4</sub>O</b>	
5	Calculate the relative formula mass of <b>Mg(OH)<sub>2</sub></b>	
6	Calculate the relative formula mass of <b>Na<sub>2</sub>SO<sub>4</sub></b>	
7	Calculate the relative formula mass of <b>K<sub>2</sub>CO<sub>3</sub></b>	

## Calculating Percentage Mass

$$\% \text{ mass of element in compound} = \frac{\text{RAM of element} \times \# \text{ of atoms of that element}}{\text{Relative formula mass (Mr) of compound}}$$

Work through the example with the free science lessons guy: [GCSE Chemistry Revision "Calculating Percentage by Mass"](#)

SHOW ALL YOUR WORKING EXACTLY AS SHOWN IN THE FIRST EXAMPLE:

1	Calculate the % mass of O in H <sub>2</sub> O <sub>2</sub> Give your answer to 1 decimal place	$\frac{\text{O} \times 2}{\text{H}_2\text{O}_2} \times 100 = \frac{32}{34} \times 100 = 94.1 \%$
2	Calculate the % mass of C in CO Give your answer to 1 decimal place	
3	Calculate the % mass of N in HNO <sub>3</sub> Give your answer to 1 decimal place	
4	Calculate the % mass of O in NO <sub>2</sub> Give your answer to 1 decimal place	
5	Calculate the % mass of C in CH <sub>4</sub> O Give your answer to 3 significant figures	
6	Calculate the % mass of O in Mg(OH) <sub>2</sub> Give your answer to 3 significant figures	

### Recap questions

1	Identify the elements in Na <sub>2</sub> O?	
2	What is the name of Na <sub>2</sub> O?	
3	Calculate the relative formula mass of Na <sub>2</sub> O	
4	Calculate the % mass of Na in Na <sub>2</sub> O. Give your answer to 2 decimal places	
5	Draw a diagram to illustrate the bonding in Na <sub>2</sub> O	

## Moles

A mole is just a way of measuring the number of particles. The number of particles in 1 mole is given by Avogadro's number.

Avogadro's number =  $6.02 \times 10^{23}$  = 6 02 000 000 000 000 000 000

This means that there are  $6.02 \times 10^{23}$  particles in 1 mole of any substance

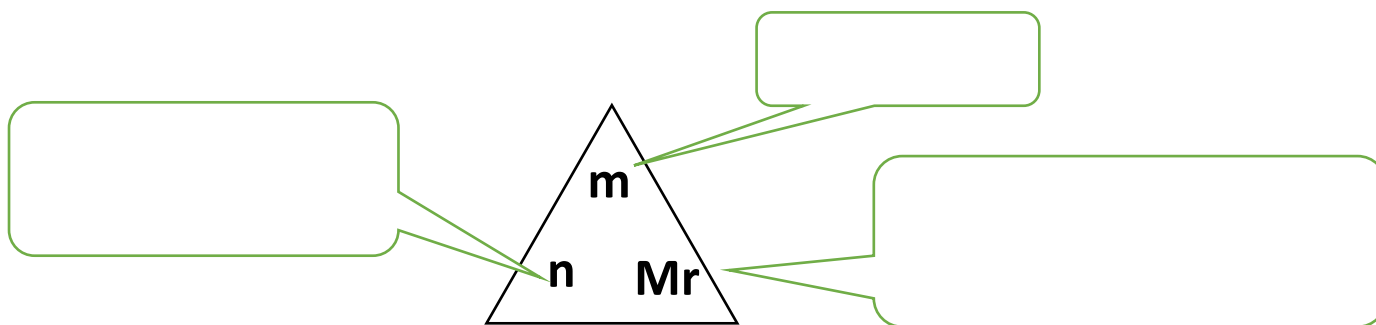
The relative atomic mass shown as the top number in the periodic table is actually the mass for 1 mole of that element.



For example, the relative atomic mass of carbon is 12, so **one mole of carbon atoms weighs 12g.**

This means that the relative formula mass ( $M_r$ ) of a compound is the mass of 1 mole of that compound.

### Calculating moles –



Work through the example with the free science lessons guy: [GCSE Chemistry Revision "Calculating Moles of an Element"](#) [GCSE Chemistry Revision "Calculating Moles of a Compound"](#)

SHOW ALL YOUR WORKING EXACTLY AS SHOWN IN THE FIRST EXAMPLE:

	Mr =Relative formula mass (g/mol)	Mass (g)
1. Calculate the mass of 2 moles of H <sub>2</sub> O	Hx2= 1 x2 = 2 Ox1 = 16 x1 =16 =18	m = n x mr m=2x 18 m = 36 g
2. Calculate the mass of 3 moles of CO <sub>2</sub>		
3. Calculate the mass of 2.8 moles of NH <sub>3</sub>		

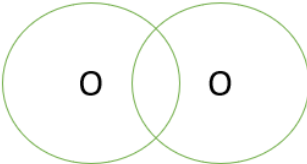
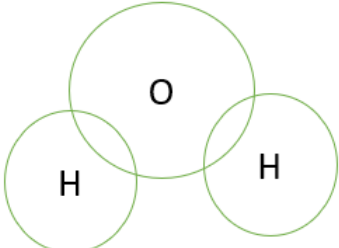
4. Calculate the mass of 0.5 moles of C <sub>2</sub> H <sub>6</sub> O		
5. Calculate the mass of 1.2 moles of C <sub>2</sub> H <sub>4</sub>		
6. Calculate the mass of 0.64 moles of SO <sub>2</sub>		

Work through the example with the free science lessons guy: [GCSE Chemistry Revision "Calculating Mass of a Number of Moles"](#)

SHOW ALL YOUR WORKING EXACTLY AS SHOWN IN THE FIRST EXAMPLE:

HINT – USE THE Mr FROM THE PREVIOUS TABLE	<b>n = Amount of substance (moles)</b>
1. Calculate the number of moles in 9g of H <sub>2</sub> O	N=m/mr N=9/18 N=0.5 moles
2. Calculate the number of moles in 88g of CO <sub>2</sub>	
3. Calculate the number of moles in 1.7g of NH <sub>3</sub>	
4. Calculate the number of moles in 230g of C <sub>2</sub> H <sub>6</sub> O	
5. Calculate the number of moles in 560g of C <sub>2</sub> H <sub>4</sub>	

Recap questions

1	What key word describes a substance made up of only 1 type of atom?	
2	What key word describes a substance made of 2 or more different atoms chemically bonded together?	
3	Is O <sub>2</sub> an element or a compound?	
4	Is H <sub>2</sub> O an element or a compound?	
5	What is the relative formula mass (Mr) of O <sub>2</sub> ?	
6	What is the relative formula mass (Mr) of H <sub>2</sub> O?	
7	Calculate the % mass of O in H <sub>2</sub> O Give your answer to 1 decimal place	
8	Balance the equation: H <sub>2</sub> + O <sub>2</sub> → H <sub>2</sub> O	
9	Calculate the number of moles in 4g of O <sub>2</sub> give your answer to 3 significant figures	
10	Calculate the mass of 0.2 moles of H <sub>2</sub> O give your answer to 3 significant figures	
11	Add the outer shell electrons onto the diagram to illustrate the bonding in O <sub>2</sub> What type of bonding is this?	
12	Add the outer shell electrons onto the diagram to illustrate the bonding in H <sub>2</sub> O. What type of bonding is this?	

# EXAM QUESTION

**Q1.** This question is about atoms.

(a) What does the number 19 represent in  ${}^{19}_9\text{F}$  ?

\_\_\_\_\_ (1)

(b) How many atoms are present in one mole of fluorine atoms?

Tick (✓) **one** box.

$2.03 \times 10^{26}$

$6.02 \times 10^{23}$

$2.06 \times 10^{23}$

$6.02 \times 10^{26}$

(c) The plum pudding model of the atom was replaced by the nuclear model. (1)

The nuclear model was developed after the alpha particle scattering experiment.

Compare the plum pudding model with the nuclear model of the atom.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_ (4)

(d) An element has three isotopes.

The table shows the mass numbers and percentage of each isotope.

	Isotope 1	Isotope 2	Isotope 3
Mass number	24	25	26
Percentage (%)	78.6	10.1	11.3

Calculate the relative atomic mass ( $A_r$ ) of the element.

Give your answer to 3 significant figures.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

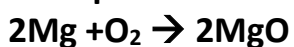
Relative atomic mass = \_\_\_\_\_

(2)(Total 8 marks)

## Reacting Mass Calculations

A **reacting mass** is the amount of a substance required to produce the stated amount of product.

**Example: calculate the mass of Mg required to react with 80g of oxygen:**



	Mass (g)	$M_r$ (g/mol)	N (mol)	ratio
$\text{O}_2$	80g	$16 \times 2 = 32$	$N = m/m_r$ $N = 80/32$ $N = 2.5$	1
$\text{Mg}$	$M = n \times m_r$ $M = 5 \times 24$ $M = 120$	24	$2.5 \times 2 = 5$	2

Complete the following questions. You must fill in all your working in the table as shown in the example above.

1. Calculate the mass of Mg that is needed to react with 150g of  $\text{O}_2$ .  $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$

Q1	Mass (g)	$M_r$ (g/mol)	N (mol)	ratio

2. Calculate the mass of HCl that is needed to react with 0.5g of Mg.



Q2	Mass (g)	$M_r$ (g/mol)	N (mol)	ratio

## Yield Calculations

The **yield** is the **amount of product** made in the reaction.

**Example:** calculate the mass of calcium oxide (CaO) that can be made from **50g of calcium carbonate (CaCO<sub>3</sub>)**:  $\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$

	Mass (g)	$M_r$ (g/mol)	N (mol)	ratio
CaCO <sub>3</sub>	50g	100	$N = m/m_r$ $N = 100/50$ $n = 0.5$	1
CaO	$M = n \times m_r$ $M = 0.5 \times 56$ $M = 23g$	56	0.5	1

Complete the following questions. You must fill in all your working in the table as shown in the example above.

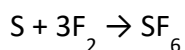
1. Calculate the mass of MgO that can be made from 15g of Mg.  $2\text{Mg} + \text{O}_2 \rightarrow 2\text{MgO}$

Q1	Mass (g)	$M_r$ (g/mol)	N (mol)	ratio
Mg				
MgO				

2. Calculate the mass of MgCl<sub>2</sub> that can be made from 21g of Mg.  $\text{Mg} + 2\text{HCl} \rightarrow \text{MgCl}_2 + \text{H}_2$

Q2	Mass (g)	$M_r$ (g/mol)	N (mol)	ratio

3. Fluorine reacts with sulfur to produce sulfur hexafluoride (SF<sub>6</sub>).

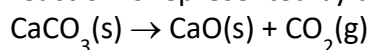


Relative formula masses,  $M_r$ :  $\text{F}_2 = 38$   $\text{SF}_6 = 146$

Calculate the mass of sulfur hexafluoride produced when 0.950 g of fluorine is reacted with an excess of sulfur.

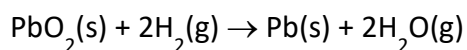
Q4	Mass (g)	$M_r$ (g/mol)	N (mol)	ratio
F <sub>2</sub>				
SF <sub>6</sub>				

4. When calcium carbonate is heated, it decomposes to form calcium oxide and carbon dioxide. This reaction is represented by the following equation:



Calculate the mass of calcium oxide produced if 25 g of calcium carbonate is heated


5. When lead dioxide is heated with hydrogen, the following reaction occurs:



If 478 g of lead dioxide is heated calculate the mass of lead produced.


## Recap questions

1	Which key word describes atoms with the same number of protons and a different number of neutrons?	
2	Which key word describes the sum of protons and neutrons in the nucleus of an atom?	
3	Which key word describes the average mass of an atom compared to Carbon 12. (The top number in the periodic table)	
4	Which key word describes the number of particles in 1 mole. <b><math>6.02 \times 10^{23}</math> of particles</b>	
5	What is the formula used to calculate number of moles using mass and relative formula mass	
6	How many g are in 1 kg?	
7	How many mg are in 1 g?	
8	What is conservation of mass?	
9	Which key word describes the amount of product formed in a reaction, in g or moles?	
10	Which key word describes the amount of a reactant needed to produce the required amount of product?	
11	Calculate the relative formula mass of $\text{NH}_3$	
12	Balance the equation: $\text{N}_2 + \text{H}_2 \rightarrow \text{NH}_3$	
13	If 28g of nitrogen reacts with 6g of hydrogen, what mass of $\text{NH}_3$ will be formed?	
14	Calculate the % mass of N in $\text{NH}_3$ Give your answer to 1 decimal place	
15	Calculate the number of moles in 2.5g of $\text{NH}_3$ Give your answer to 3 significant figures	
16	Calculate the mass of 0.75 moles of $\text{NH}_3$ Give your answer to 3 significant figures	

## The Limiting Reactant – Higher Tier

- Often in reactions we add more than we need of one of the reactants, to maximise the yield of the reaction. We say this reactant is in excess, this means there will be some of this reactant left over at the end of the reaction.
- The reactant which is not in excess limits the yield of the reaction so we call it the limiting reactant. All of the limiting reactant will be used up at the end of the reaction
- To determine which reactant is in excess and which is the limiting reactant we use a similar process as the other calculations we have done

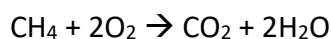
Label the statements below to show whether they refer to the limiting reactant or the reactant which is in excess:

- You have more than you need of this reactant
- This reactant limits the yield of the reaction
- All of this reactant will be used up at the end of the reaction
- There will be some of this reactant left over at the end of the reaction.

### Calculations to determine which is the limiting reactant

Example:

16g of methane (CH<sub>4</sub>) reacts with 50g of oxygen.



What is the limiting reagent?

	mass	RFM	Moles (actual)	Mole ratio	Moles (needed)
CH <sub>4</sub>	16	16	N = m/ mr N = 16/16 N=1	1	
O <sub>2</sub>	50	32	N = m/ mr N = 50/32 N=1.5625	2	1 x 2 = 2

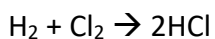
Oxygen is the limiting reactant because 2 moles of oxygen would be needed for the methane to react completely, however we only have 1.5625 moles of oxygen.

This means that all of the oxygen will be used up.

Therefore methane must be in excess.

Question 2.

If you have 4g of hydrogen reacting with 4g of chlorine. Which reactant is in excess?



	mass	Mr	Moles (actual)	Mole ratio	Moles (needed)
H <sub>2</sub>					
Cl <sub>2</sub>					

\_\_\_\_\_ is in excess because \_\_\_\_\_ moles of \_\_\_\_\_ would be needed for the \_\_\_\_\_ to react completely

This means that all of the \_\_\_\_\_ will be used up.

(Therefore \_\_\_\_\_ must be the limiting reactant)

Question 3

9 g of sodium reacts with 9g of water, to form NaOH and H<sub>2</sub>.



What is the limiting reagent?

	mass	RFM	Moles (actual)	Mole ratio	Moles (needed)
Na					
H <sub>2</sub> O					



(e) Calculate the percentage (%) by mass of iron in  $\text{Fe}_3\text{O}_4$

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Percentage by mass of iron = \_\_\_\_\_ % (3)

## Recap Questions

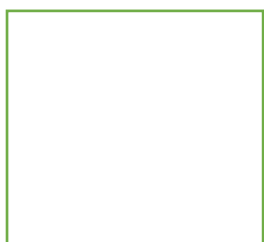
1	Which key word describes atoms with the same number of protons and a different number of neutrons?	
2	Which key word describes the sum of protons and neutrons in the nucleus of an atom?	
3	Which key word describes the average mass of an atom compared to Carbon 12. (The top number in the periodic table)	
4	Which key word describes the number of particles in 1 mole. <b><math>6.02 \times 10^{23}</math> of particles</b>	
5	What is the formula used to calculate number of moles using mass and relative formula mass	
6	Which key word describes the amount of product formed in a reaction, in g or moles?	
7	Which key word describes the amount of a reactant needed to produce the required amount of product?	
8	What is the relative formula mass of HCl?	
9	What is the % by mass of H in HCl? Give your answer to 3 significant figures	
10	Calculate the relative formula mass of $\text{NH}_3$	
11	Balance the equation: $\text{Cl}_2 + \text{H}_2 \rightarrow \text{HCl}$	
12	Calculate the number of moles in 2.5g of HCl Give your answer to 3 significant figures	
13	Calculate the mass of 0.75 moles of HCl Give your answer to 3 significant figures	

# Concentration

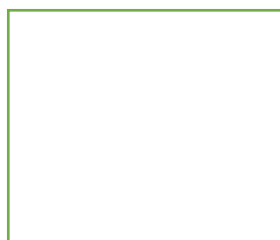
Fill in the key word next to the correct definition

	Describes a substance that can dissolve
	The name given to a mixture of a substance dissolved in a liquid
	The name of the solid used to make the solution
	The name for the liquid that is used to make the solution

Concentration is the amount of solute dissolved in  $1\text{dm}^3$  of solution.

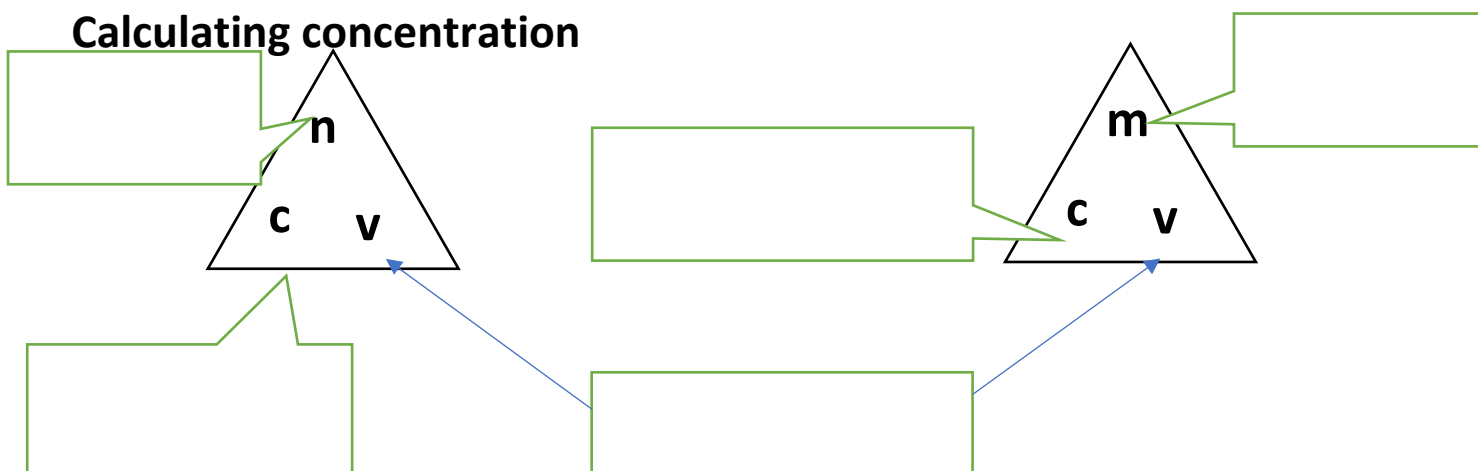


Low concentration



high concentration

## Calculating concentration



1	Calculate the concentration a solution made up of 5.0 g of sodium sulfate dissolved in $2.00\text{ dm}^3$ of water. Give your answer in $\text{g}/\text{dm}^3$	
2	Calculate the concentration a solution made up of 10.0 g of sodium chloride dissolved in $4.00\text{ dm}^3$ of water. Give your answer in $\text{g}/\text{dm}^3$ :	
3	Calculate the concentration a solution made up of 2.5.g of glucose dissolved in $0.5\text{ dm}^3$ of water. Give your answer in $\text{g}/\text{dm}^3$ :	
4	Calculate the mass of sodium sulfate needed to make $0.8\text{ dm}^3$ of a solution with a concentration of $6\text{g}/\text{dm}^3$ :	
5	Calculate the mass of sodium chloride needed to make $6\text{ dm}^3$ of a solution with a concentration of $20\text{g}/\text{dm}^3$ :	

## Converting $\text{cm}^3$ to $\text{dm}^3$

$$1\text{dm}^3 = 1000\text{cm}^3$$

So to convert a volume in  $\text{cm}^3$  to  $\text{dm}^3$  you need to divide by 1000

Volume ( $\text{cm}^3$ )	Volume ( $\text{dm}^3$ )
100	
20	
	0.5
300	
	3.4

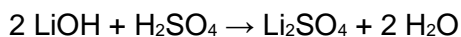
Remember that concentrations are always measured in  $\text{g}/\text{dm}^3$  so if you are given the volume in  $\text{cm}^3$  you must convert to  $\text{dm}^3$  by dividing by 1000 before substituting into the equation.

Show all your working

1	Calculate the concentration a solution made up of 0.5 g of sodium sulfate dissolved in $20\text{ cm}^3$ of water. Give your answer in $\text{g}/\text{dm}^3$	
2	Calculate the concentration a solution made up of 10 g of sodium chloride dissolved in $400\text{ cm}^3$ of water. Give your answer in $\text{g}/\text{dm}^3$ :	
3	Calculate the concentration of a solution made of 60g of sugar in $300\text{ cm}^3$ of water	
4	Calculate the mass of copper sulphate needed to make $50\text{ cm}^3$ of $3.4\text{g}/\text{dm}^3$ solution	
5	Calculate the mass of sodium chloride needed to make $60\text{ cm}^3$ of a solution with a concentration of $20\text{g}/\text{dm}^3$ :	

**Q1.** Lithium hydroxide reacts with sulfuric acid to produce lithium sulfate.

The equation for the reaction is:



(a) Calculate the relative formula mass ( $M_r$ ) of sulfuric acid ( $\text{H}_2\text{SO}_4$ ).

Relative atomic masses ( $A_r$ ): H = 1 O = 16 S = 32

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Relative formula mass ( $M_r$ ) = \_\_\_\_\_ (2)

(b) Calculate the percentage by mass of oxygen in lithium sulfate ( $\text{Li}_2\text{SO}_4$ ).

Relative atomic mass ( $A_r$ ): O = 16

Relative formula mass ( $M_r$ ):  $\text{Li}_2\text{SO}_4 = 110$

Give your answer to 2 significant figures.

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Percentage by mass of oxygen (2 significant figures) = \_\_\_\_\_ % (4)

(c) A solution of lithium sulfate contains 0.30 g of lithium sulfate in 25 cm<sup>3</sup>.

Calculate the concentration of lithium sulfate in g/dm<sup>3</sup>.

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Concentration = \_\_\_\_\_ g/dm<sup>3</sup>

(3)(Total 10 marks)

**Q2.** Some students investigated the change in temperature as sodium hydroxide solution is added to dilute sulfuric acid.

The sodium hydroxide solution in this investigation contains 80 grams per  $\text{dm}^3$

The students use  $40 \text{ cm}^3$  of sodium hydroxide solution.

Calculate the mass of sodium hydroxide in  $40 \text{ cm}^3$

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Mass = \_\_\_\_\_ g

**(3)**

**Q3.** A student investigates the mass of copper produced during electrolysis of copper chloride solution.

The table below shows the student's results.

	Total mass of copper produced in mg			
Time in mins	Experiment 1	Experiment 2	Experiment 3	Mean
1	0.60	0.58	0.62	0.60
2	1.17	1.22	1.21	1.20
4	2.40	2.41	2.39	2.40
5	3.02	X	3.01	3.06

(a) Determine the **mean** mass of copper produced after 3 minutes.

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Mass = \_\_\_\_\_ mg (1)

(b) Calculate the mass **X** of copper produced in **Experiment 2** after 5 minutes.

Use the table above.

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Mass **X** = \_\_\_\_\_ mg (2)

- (c) The copper chloride solution used in the investigation contained 300 grams per  $\text{dm}^3$  of solid  $\text{CuCl}_2$  dissolved in 1  $\text{dm}^3$  of water.

The students used 50  $\text{cm}^3$  of copper chloride solution in each experiment.

Calculate the mass of solid copper chloride used in each experiment.

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Mass = \_\_\_\_\_ g (3)

- Q4.** A solution of hydrochloric acid contains 3.2 g of hydrogen chloride in 50  $\text{cm}^3$

Calculate the concentration of hydrogen chloride in g per  $\text{dm}^3$

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Concentration = \_\_\_\_\_ g per  $\text{dm}^3$  (3)

**Q5.**

- (a) When heated 0.72 g of magnesium reacts with iron oxide to produce 2.32 g of products. Calculate the mass of iron oxide that reacts with 0.72 g of magnesium.

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Mass of iron oxide = \_\_\_\_\_ g (1)

- (b) 1  $\text{dm}^3$  of magnesium chloride solution contains 180 g of magnesium chloride. Calculate the mass of magnesium chloride in 30  $\text{cm}^3$  of magnesium chloride solution.

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Mass of magnesium chloride = \_\_\_\_\_ g (3)

**Q6.** Titanium is extracted from titanium chloride by reacting titanium chloride with sodium.

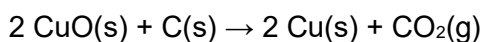
(a) Balance the equation for the reaction.



(1)

Copper is extracted from copper oxide by reacting copper oxide with carbon.

The equation for the reaction is:



In an experiment 15.9 g of copper oxide and 1.2 g of carbon reacted.

12.7 g of copper was produced in the reaction.

(b) Calculate the mass of carbon dioxide produced in this experiment.

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Mass of carbon dioxide = \_\_\_\_\_ g

(1)

(c) Explain why the mass of the contents in the crucible changed during the experiment.

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(2)

**Q7.** The total mass of dissolved solids in a 100 cm<sup>3</sup> sample of sea water is 3.50 g.

The percentage of sodium chloride in the dissolved solids is 77.8%.

Calculate the mass of sodium chloride dissolved in the 100 cm<sup>3</sup> sample of sea water.

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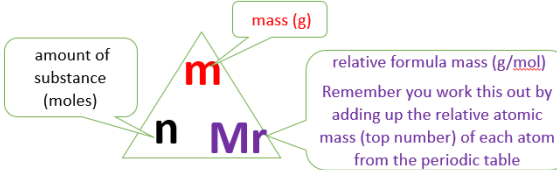
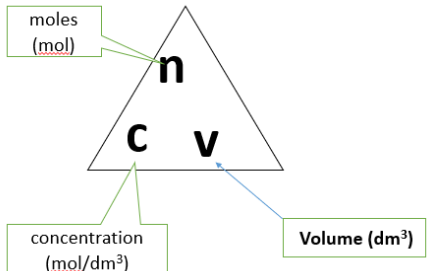
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Mass of sodium chloride = \_\_\_\_\_ g

(2)



# C4 - Chemical Calculations Knowledge Organiser

1	What are isotopes?	Atoms with the same number of protons and a different number of neutrons
2	What is mass number?	Sum of protons and neutrons in the nucleus of an atom
3	What is a mole?	<b>A measure of the number of particles. 1 mole contains <math>6.02 \times 10^{23}</math> of particles</b>
4	What is Avogadro's number?	The number of particles in 1 mole. <b>1 mole contains <math>6.02 \times 10^{23}</math> of particles</b>
5	What is the formula used to calculate number of moles using mass and relative formula mass	 <p><math>n = m / m_r</math></p>
6	How many g are in 1 kg?	1kg = 1000g
7	How many mg are in 1 g?	1g = 1000 mg
8	What is conservation of mass?	<b>Mass of reactants = mass products.</b>
9	Why must chemical equations be balanced?	Due to conservation of mass. The number of atoms of each element must be the same at the start and end of the reaction as atoms cannot be created or destroyed, only rearranged in a chemical reaction.
10	What is a limiting reactant?	<b>A reactant in a reaction which is completely used up when the other reactant is in excess.</b>
11	What does it mean if a reactant is in excess?	The reactant in excess will not be used up during the reaction and does not affect the amount of product formed.
12	What is the yield of a chemical reaction?	The yield is the amount of product formed in a reaction, in g or moles
13	What is a solvent?	The solvent is the liquid used to dissolve another substance to make a solution.
14	What is a solute?	The solute is the solid that is dissolved to make a solution
15	What is a solution?	A solution is a mixture of a substance dissolved in a liquid
16	What does concentration mean?	Concentration is the amount of solute dissolved in 1 dm <sup>3</sup> of solution.
17	How many cm <sup>3</sup> are in 1dm <sup>3</sup> ?	1dm <sup>3</sup> = 1000cm <sup>3</sup>
18	What is the formula used to calculate concentration using number of moles and volume	 <p><math>c = n / v</math></p>

