Chemistry Department

Foundations in Chemistry

PREPARATION FOR OCR A-LEVEL CHEMISTRY

Name: ______________________________

Summer work

A-level Chemistry Summer work

Please fill in this form and hand to your teacher in your first lesson.

Name:	Secondary School:	Exam board studied for GCSE Chemistry:

GCSE grades achieved:		
Chemistry	Maths	English

What chemistry topics did you enjoy the most at GCSE?	What topics did you enjoy the least at GCSE?

What career are you interested in pursuing?	
Things you are most looking forward to learning in the next two years of A-level Chemistry.	
Is there anything that worries you or any questions about A-level chemistry?	

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Name: ________________________________

Summer work

A-level Chemistry Reading list

Websites

chemguide.com
http://www.docbrown.info/page14/page14.htm
http://www.rsc.org/Education/SchoolStudents/index.asp
http://www.creative-chemistry.org.uk/alevel/
http://a-levelchemistry.co.uk/
http://www.s-cool.co.uk/a-level/chemistry
http://www.physicsandmathstutor.com/chemistry-revision/a-level-ocr-a/
www.ocr.org.uk – For past papers. Both the current (from 2015) and legacy Chemistry A papers. (Modules 1,2,3 = F321, Modules 1,2,4 = F322, Modules 1,2,6 = F324, Modules 1,2,5 = F325)

Books

Textbooks - all specs

Revision guides - all specs

Calculations in AS / A Level Chemistry 2000
by Jim Clark (Author)
ISBN-10: 0582411270
ISBN-13: 978-0582411272

Why chemical reactions happen (Wothers, Keeler, OUP)
ISBN-10: 0199249733
ISBN-13: 978-0199249732

What is Chemistry? 2013
by Peter Atkins (Author)
ISBN-10: 0199683980
ISBN-13: 978-0199683987

Magazines

New Scientist
FOCUS
Chemistry today
National Geographic

YouTube

There are many relevant videos in YouTube, there are new channels be created every day. Watch any but be aware of American terminology as it can sometimes differ!

MaChemGuy is recommended. He has many videos separated out into topics.

Apps

Khan Academy: Chemistry 1 - freeXimarc Studios Inc
Khan Academy: Chemistry 2 - freeXimarc Studios Inc
Chem Pro: chemistry tutor.
Quizlet
Kahoot
Follow us on Twitter @PHSGChemistry for help too

What you need to be able to do

By the time you have worked through all the notes and exercises in this study pack, you should be confident in:

- The use of correct words to describe chemical particles
- How to represent elements in symbol equations
- How to work out whether a substance is ionic or covalent
- Recall from memory, or work out from the periodic table, the formulae of common ions
- Writing the formulae of ionic compounds
- Recall from memory, or work out from the name, the formulae of common covalent molecules
- How to write balanced symbol equations for chemical reactions
- Recall from memory, the products of the reactions between an acid and a reactive metal, a metal oxide, a metal hydroxide and a metal carbonate respectively.
- The correct use of significant figures in calculations
- The use of standard form to represent numbers
- How to rearrange algebraic expressions
- How to record observations from chemical experiments

When you start in September you will be given the mark scheme for this document to then review and mark.

References

The notes included in this study pack should be sufficient to help you revise all these topics.

If you want further support, you may find the Chemistry and Maths sections of the BBC GCSE Bitesize website useful.

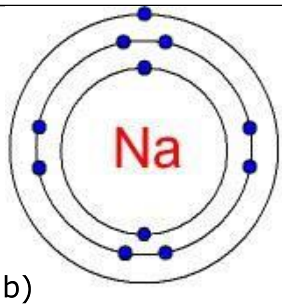
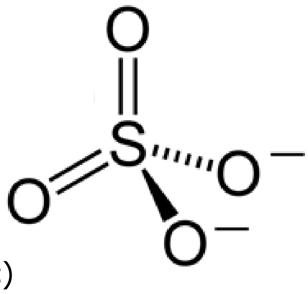
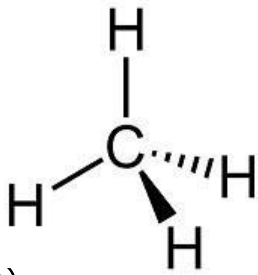
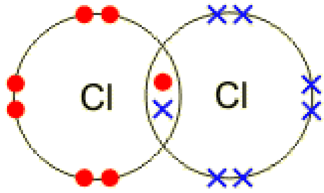
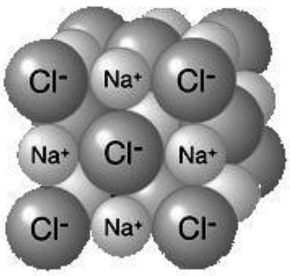
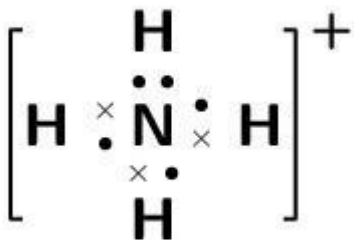
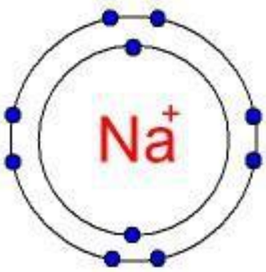
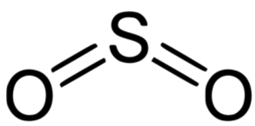
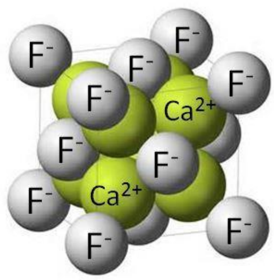
https://www.bbc.co.uk/bitesize/levels/z98jmp3

If you are very keen and want to look ahead at what we cover at A Level Chemistry, we recommend you visit the Chemguide website.

https://www.chemguide.co.uk/

Exercise 1: Types of particles

Classify these substances as **atom**, **element**, **molecule**, **compound** or **ion**. Some substances may have more than one classification.

$O=C=O$ (a)	 (b)	 (c)
Au (d)	 (e)	 (f)
 (g)	$N\equiv N$ (h)	 (i)
 (j)	 (k)	 (l)

Mark	/15

Exercise 2: Formulae for elements

Find these elements on the Periodic Table (final page).

Write down the group (vertical column in the Periodic Table) to which these elements belong and their formulae.

Q	Name of element	Group	Formula	Mark
(a)	Potassium			
(b)	Nitrogen			
(c)	Iodine			
(d)	Zinc	Transition metal		
(e)	Xenon			
(f)	Sulfur			
(g)	Fluorine			
(h)	Tin			
(i)	Tungsten	Transition metal		
(j)	Phosphorus			

Mark /10

Exercise 3: Terminology quiz

Test your understanding of chemical terms.

Read the following statements carefully.

Tick • if the statement is right with all the terms used correctly.

Cross • if *either* the statement is wrong *or* any terms are used incorrectly.

(a) Hydrogen is an element.

(b) NaOH is a molecule.

(c) All compounds are molecules.

(d) $CaCO_3$ is a compound.

(e) The formula of bromine is Br.

(f) CO_2 is a molecule.

(g) Ammonia, NH_3, is a molecule made up of N_2 and H_2 bonded together.

(h) All molecules are compounds.

(i) O_3 is a compound.

(j) O_2 is made up of oxygen elements bonded together with covalent bonds.

(k) Cl_2 is a molecule.

(l) The element helium is written in equations as He_2.

Mark	/12

Exercise 4a: Formulae for ions

Write the formulae for the following ions, with the aid of a periodic table.

(a)	**lithium** ion	....	(k)	**fluoride** ion	....
(b)	**magnesium** ion	....	(l)	**oxide** ion	....
(c)	**aluminium** ion	....	(m)	**nitride** ion	....
(d)	**sulfide** ion	....	(n)	**rubidium** ion	....
(e)	**hydride** ion	....	(o)	**manganese(II)** ion	....
(f)	**chromium(III)** ion	....	(p)	**hydrogen** ion	....
(g)	**barium** ion	....	(q)	**lead(II)** ion	....
(h)	**silver** ion	....	(r)	**zinc** ion	....
(i)	**strontium** ion	....	(s)	**iron(III)** ion	....
(j)	**bromide** ion	....	(t)	**phosphide** ion	....

Mark /20

Polyatomic ions

Polyatomic ions are groups of atoms covalently bonded together, that have gained or lost electrons, forming negative or positive ions respectively.

Eg the **carbonate ion, CO_3^{2-}**, has 1 carbon and 3 oxygen atoms held together y covalent bonds. It has an overall charge of 2- because it has gained 2 e^-s.

Learn by heart!

You must learn the names and formulae of these ions!!

1+	1-	2-	3-
ammonium NH_4^+	**hydroxide** OH^-	**carbonate** CO_3^{2-}	**phosphate** PO_4^{3-}
	nitrate NO_3^-	**sulfate** SO_4^{2-}	
	hydrogencarbonate HCO_3^-		

Note: polyatomic ions that contain oxygen as well as another element have names that end **–ate** to denote the presence of the oxygen.

Writing the formulae of ionic compounds

(1) Work out the **formulae** and **charges** of the separate ions.

(2) Work out how many of each ion is needed to get an **overall charge of zero**.

(3) Put **brackets** around any **polyatomic** ion present more than once in the formula. Simple ions do not need brackets.

(4) Note the charges of the separate ions are not shown in the formula of the compound.

Example 1 What is the formula of **sodium nitrate**?

Ions: Na^+ and NO_3^-

Balance charges: One of each is needed for an overall charge of zero.

Formula: $NaNO_3$

Example 2 What is the formula of **aluminium sulfate**?

Ions: Al^{3+} and SO_4^{2-}

Balance charges: 2 x 3+ and 3 x 2- will give an overall charge of zero.

Formula: $Al_2(SO_4)_3$

Exercise 4b: Ionic compounds

1. Write the formulae for the following compounds.

(a) lithium fluoride

(b) iron(II) bromide

(c) strontium nitrate

(d) zinc hydroxide

(e) silver iodide

(f) aluminium nitride

(g) calcium phosphate

(h) lead(II) oxide

(i) ammonium sulfate

(j) caesium oxide

(k) magnesium hydrogen carbonate

(l) barium sulfide

(m) vanadium(V) oxide

(n) tin(IV) chloride

(o) potassium carbonate

(p) sodium hydride

2. Name these compounds.

(a) NH_4OH

(b) $CaBr_2$

(c) $CoSO_4$

(d) $CoCl_3$

Mark	/20

Exercise 5: Covalent compounds

Write the formulae for the following compounds.

(a) carbon monoxide ....

(b) nitrogen dioxide ....

(c) nitrogen triiodide ....

(d) sulfur dichloride ....

(e) ammonia ....

(f) silicon tetrachloride ....

(g) phosphorus trichloride ....

(h) dinitrogen tetroxide ....

(i) ethanoic acid ....

(j) carbon disulfide ....

(k) methane ....

(l) dinitrogen monoxide ....

Mark	/12

Exercise 6a: Balancing equations

Balance these equations. Some of them are quite tricky, but there are *no* mistakes in the questions!

(a) $Na_2O + H_2O \rightarrow NaOH$

(b) $KClO_3 \rightarrow KCl + O_2$

(c) $H_2O_2 \rightarrow H_2O + O_2$

(d) $Fe + H_2O \rightarrow Fe_3O_4 + H_2$

(e) $C_2H_5OH + O_2 \rightarrow CO_2 + H_2O$

(f) $(NH_4)_2Cr_2O_7 \rightarrow N_2 + Cr_2O_3 + H_2O$

(g) $Sn + HNO_3 \rightarrow SnO_2 + NO_2 + H_2O$

(h) $PCl_5 + H_2O \rightarrow H_3PO_4 + HCl$

(i) $CuSO_4 + KI \rightarrow CuI + K_2SO_4 + I_2$

(j) $PbO_2 + HCl \rightarrow PbCl_2 + Cl_2 + H_2O$

Mark	/10

Exercise 6b: Writing equations

Write balanced symbol equations for these reactions.

(a) Methane + oxygen → carbon dioxide + water

(b) Sodium carbonate + calcium chloride → sodium chloride + calcium carbonate

(c) Silver nitrate + copper → copper(II) nitrate + silver

(d) Potassium iodide + bromine → potassium bromide + iodine

(e) Ammonia + oxygen → nitrogen + water

(f) Lithium nitrate → lithium oxide + nitrogen dioxide + oxygen

(g) Iron metal + chlorine → iron(III) chloride

(h) Zinc sulfide + oxygen → zinc oxide + sulfur dioxide

Mark	/16

Exercise 7a: Acid reactions

1. Fill in the blanks using the words given below – you may use each word once, more than once or not at all.

carbonate	chloride	chlorine	hydrogen
hydroxide	nitrate	nitride	oxygen
salt	sulfate	sulfuric	water

acid + metal .... → .... + water + carbon dioxide

.... acid + metal oxide → metal sulfate + ...

nitric acid + metal .... → metal .... + water

metal + hydrochloric acid → metal .... + ...

2. Each of the following equations contains at least one error or omission. Circle the mistakes and rewrite the equations correctly.

(a) The reaction between aluminium hydroxide and hydrochloric acid

$$AlOH_3 + 3HCl \rightarrow Al_3Cl + 3H2O$$

(b) The reaction between potassium and sulfuric acid

$$K_2 + H_2SO_4 \rightarrow K_2SO_4 + 2H$$

(c) The reaction between sodium carbonate and nitric acid

$$naCo_3 + H_2NO_3 \rightarrow naNO^3 + H_2O$$

(d) The reaction between ammonium hydroxide and sulfuric acid

$$Nh_3OH + H_2SO_4 \rightarrow Nh_3SO_4 + H_2$$

Mark	/26

Exercise 7b: Acid equations

1. Complete the following word equations and re-write them as balanced symbol equations.

(a) ammonium hydroxide + sulfuric acid →

(b) aluminium oxide + hydrochloric acid →

(c) magnesium + nitric acid →

(d) potassium carbonate + phosphoric acid →

(e) sodium hydroxide + ethanoic acid →

2. Ammonia is a **base**, which is a substance that accepts H^+ ions from an acid to form a salt. Predict the **single** product in this reaction and write the balanced symbol equation for this reaction.

ammonia + hydrochloric acid →

Mark	/18

Mathematical skills

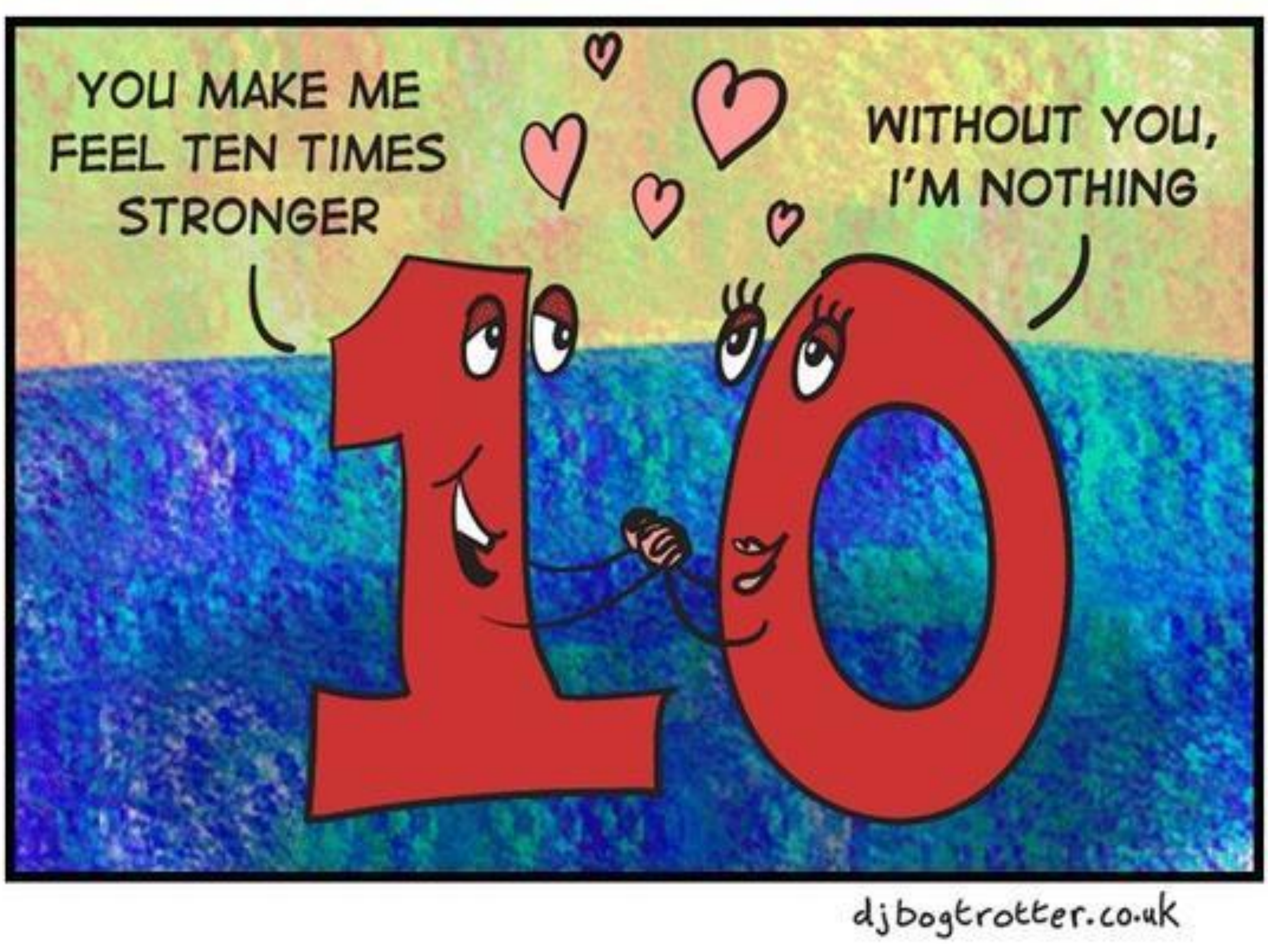
During your Chemistry course at Plymouth High School for Girls you will be required to do some calculations. There is not a lot of mathematical content in A Level Chemistry, but you mustn't be afraid of Maths either.

You need to be comfortable with:

- significant figures
- standard form
- rearranging algebraic formula

which are concepts that you have encountered in GCSE Maths.
The following sections contain notes and exercises to refresh your memory, but you may find the BBC GCSE Bitesize website a useful additional resource if you want further revision.

If you are still not happy with any of these topics after working through this mathematical skills section, please speak to your teacher when you start. Don't be afraid to ask for help: the sooner we can help you catch up, the more easily you will settle into your new course.



(8) Significant figures

When we do calculations in Chemistry, most of the numbers we use came from experimental measurements. These data are subject to measurement errors, so the answers to our calculations are not 100% accurate. Because we know the answers are not *exactly* as calculated, it is not meaningful to write down the long calculator tail to many digits. Instead, we give the answer to the magnitude (rough size) of which we are confident – we say the answer is quoted to a certain number of significant figures.

Which numbers are significant?

Non-zero numbers are significant. The first significant figure is the first non-zero number reading from left to right.

Zeros *between* other, non-zero, numbers are classed as significant.

Zeros at the end may or may not be significant! Zeros following non-zero numbers beyond a decimal point are definitely significant; but if the number is quoted as a whole number, you cannot easily tell whether the zeros on the end are significant.

All the numbers below are quoted to 3 sig figs:

123	0.0000234	30.4	4.05
5.67	0.678	7.00	80.0

These numbers that follow may be considered as 3 sig figs, but without further information, you cannot be sure:

100	230	40500	600000

In these cases, standard form should be used to avoid doubt:

1.00×10^2	2.30×10^2	4.05×10^4	6.00×10^5

To how many significant figures should an answer be quoted?

A calculated value is only as good as the worst piece of data used to find it. Your final answer should not have more sig figs than the lowest number of sig figs found in the numbers used.

In multi-step calculations you should not round until you reach the final answer.

Do not forget to round your number appropriately!

Look at these examples:

(1) Convert **102345** to 3 sig figs.

You look to the 4th significant digit which is 3. As this is less than 5, it is small enough to ignore.

The answer is **102000** (to 3sf).

(2) Convert **0.00132475** to 4 sig figs.

You look to the 5th significant digit which is 7. As this is 5 or greater, it is too big to ignore. You round up the previous digit by 1.

The answer is **0.001325** (to 4sf).

Exercise 8: Significant figures

1. Explain why 3.99521 to 3 sig figs is 4.00.

2. To how many significant figures are the following quoted?

(a) 2048

(b) 9.00043

(c) 0.0008

(d) 0.00395

(e) 0.05030

(f) 650000

3. Re-write the following to the number of significant figures required.

(a) 5462 (to 2sf)

(b) 20543 (to 2sf)

(c) 1.5952 (to 3sf)

(d) 0.039214 (to 3sf)

(e) 0.0056972 (to 3sf)

(f) 470356 (to 3sf)

4. Calculate the following to **an appropriate number** of significant figures.

(a) 3.854 + 2.06

(b) 6.52 - 2.7

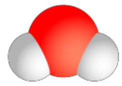
(c) 1.48 x 6.2

(d) 19.5 ÷ 0.284

Mark	/16

(9) Standard form

(or scientific notation)



Chemists encounter numbers that can encompass an enormous range. For example, there are 1 700 000 000 000 000 000 000 water molecules in a drop of water, but a water molecule is approximately 0.000 000 000 15 m long (both values to 2 sig figs).

To make these numbers easier to write and to get a better sense of their size, scientists use *standard form* or *scientific notation* to represent them.

A number in standard form has the shape **A x 10$^{\mathbf{n}}$**

where A = a number between 1 and $9.\dot{9}$

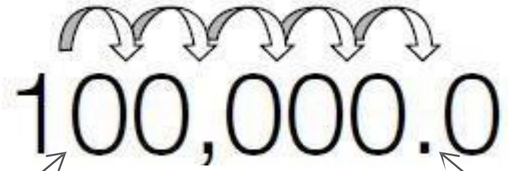
n = ± a whole number

(tells us how many places to move the decimal point.

To convert from standard form back to longhand form:

+ moves the decimal point to the right; – to the left)

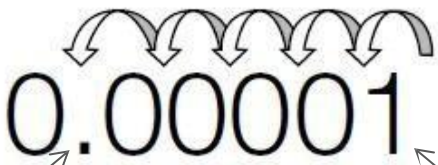
For big numbers, eg 100 000 = 1.0 x 10^5, n is a positive number.



The decimal point lies here in standard form.

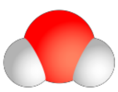
It moves 5 places to the right in the longhand form.

For small numbers, eg 0.00001 = 1.0 x 10^{-5}, n is a negative number.



The decimal point moves 5 places to the left to arrive here in the longhand form.

The decimal point lies here in standard form.



so we can say there are 1.7 x 10^{21} water molecules in a drop of water and

the length of a water molecule is 1.5 x 10^{-10} m.

Exercise 9: Standard form

1. Write the following numbers in standard form to 3 significant figures.

(a) 123456

(b) 45062

(c) 0.058345

(d) 0.000259631

2. Write the following numbers in longhand ("normal numbers").

(a) 1.36×10^4

(b) 5.75×10^{-3}

(c) 6.02×10^{23}

(d) 1.60×10^{-19}

Mark	/8

Exercise 10: Rearranging algebraic equations

The following equations are all ones that you will eventually encounter at A Level Chemistry. You don't have to worry that you have not seen them before! However, rearrange each equation for the given subject.

(a) Find $mass$ if $moles = \frac{mass}{molar\ mass}$

(b) Find $volume$ if $number\ of\ moles = concentration \times volume$

(c) Find $molar\ volume$ if $moles = \frac{volume}{molar\ volume}$

(d) Find ΔT if $Q = mc\Delta T$

(e) Find $[H^+]$ if $K_a = \frac{[H^+][A^-]}{[HA]}$

(f) Find $[HI]$ if $K_c = \frac{[HI]^2}{[H_2][I_2]}$

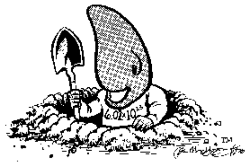
(g) Find ΔH if $\Delta G = \Delta H - T\Delta S$

(h) Find ΔS if $\Delta G = \Delta H - T\Delta S$

Extension: Find out when these equations are used.

Mark	/8

(11) Maths quiz



We dig Chemistry

This quiz makes use of the relationships between amount of substance (moles) with mass, concentration and volumes of chemicals. A few of you may have already encountered this at GCSE, but you are not disadvantaged if you have not done this before! All students should be able to solve this quiz as all the formulae you need are provided below. You just need to apply the skills practised in the last 3 exercises.

You will need to use the 3 formulae below to complete this exercise. You may have to rearrange them as appropriate.

① Relationship between mass and moles

$$amount\ (in\ mol) = \frac{mass\ (in\ g)}{molar\ mass\ (in\ g\ mol^{-1})}$$

② Relationship between gas volumes and moles

$$amount\ of\ gas\ (in\ mol) = \frac{volume\ (in\ cm^3)}{molar\ volume\ (in\ cm^3 mol^{-1})}$$

③ Relationship between moles and concentration of a solution

$$amount\ of\ solute\ (in\ mol) = concentration\ (in\ mol\ dm^{-3}) \times volume\ (in\ dm^3)$$

If you are keen to get ahead, learn these formulae before September! However, you will be given the opportunity to learn this from scratch when you start your A Level course.

Exercise 11: Maths quiz

You will need the formulae given on the previous page to answer these questions.

Set out your workings for each answer clearly, so that any errors can be identified more easily.

A. Find the amount, in mol, of NaCl in 10.0g of NaCl, given its molar mass is 58.5 g mol^{-1}. Give your answer to 3sf.

…………..………………………. mol

B. Find the volume, in cm^3, of 4.246 x 10^{-4} mol of a gas, given the molar volume is 24000 cm^3 mol^{-1}. Give your answer to 4sf.

…………..………………………. cm^3

C. A 0.330 dm^3 can of Coke contains 0.102 mol sucrose. What is the concentration, in mol dm^{-3}, of sucrose in this can of Coke?

a. Give your answer to 3sf.

..…..………………………. mol dm^{-3}

D. 76,000 cm^3 CO_2 was collected in an experiment at room temperature and pressure (RTP). The molar volume of any gas is 24000 cm^3 mol^{-1} at RTP. What is the amount, in mol, of CO_2 collected in this experiment? Give your answer in standard form to 5sf.

…………..………………………. mol

E. A chemist needs 1.25×10^{-3} mol of $KMnO_4$ in an experiment. He has a solution of $KMnO_4$ of 2.25×10^{-2} mol dm^{-3} concentration.

i. Calculate the volume, in dm^3, of this solution he needs to 3sf.

…………..………………………. dm^3

ii. The molar volume of gases changes according to temperature. Find the molar volume, in cm^3 mol^{-1}, of a gas at 0°C if 0.125 mol of this gas occupied a volume of 2800 cm^3. Give your answer to 3sf.

…………..………………………. cm^3 mol^{-1}

F. 0.2000g (5.414×10^{-4} mol) of an illegal drug caused death by overdose. Deduce the molar mass, in g mol^{-1}, of this drug. Give your answer to 4sf.

…………..………………………. g mol^{-1}

G. Sulfur dioxide emitted from industry produces sulfuric acid when it reacts with rain water. A lake of volume 4.0×10^{14} dm^3 was found to have a sulfuric acid concentration of 5.2×10^{-5} mol dm^{-3}. Calculate the amount, in mol, of H_2SO_4 present in this lake. Give your answer in standard form to 2sf.

…………..………………………. mol

H. In 2000, 1.94×10^8 mol of aspirin was consumed worldwide. The molar mass of aspirin is 180 g mol^{-1}. Calculate the mass, in **tonnes**, of aspirin consumed in 2000. (1 tonne = 1×10^6 g)

Give your answer to 2sf.

………………………………………. tonnes

I. The average concentration of NaCl in the oceans is 0.60 mol dm^{-3}. The volume of water in the oceans is approximately 1.3×10^9 **km^3**. Find, to 2sf, the amount, in mol, of NaCl found in the world's oceans. (1 km^3 = 1×10^{12} dm^3)

………………………………………. mol

Mark	/20

Challenge!

Now combine the numerical values from your answers to the questions A – J in according to the following expression. Quote your final answer to 3 significant figures.

$$\frac{(A+C)}{B} \times G \times \left(\frac{E}{D} + \frac{H}{F \times I}\right) \times J$$

What is the chemical significance of this number?

Summary exercise
(12) Correct the errors

A teacher asked several groups of students to prepare samples of salts and to write up their experiments. Some of the students also carried out chemical calculations.

The relationship between amount of substance, **n**, in mol; mass of substance, **m**, in g; and molar mass (mass of one mole of substance, **M**) in g mol^{-1} is:

$$\text{amount (in mol)} = \frac{\text{mass (in g)}}{\text{molar mass (in g mol}^{-1}\text{)}}$$

Here are the students' accounts. Identify the errors and correct them. There may be mistakes in the chemistry, the chemical formulae, the use of words, the calculations, or the representation of the numbers. You may assume that all balance readings are correct, as are statements in *italics*.

(a) Making copper(II) sulfide (*Hint: You should find 7 errors.*)

We decided to make copper(II) sulfide by reacting *copper(II) oxide with sulfuric acid*. The equation for the reaction is:

$$CuO + 2HSO4 \rightarrow Cu(SO_4)_2 + H_2O$$

We weighed out 0.6g (2sf) copper(II) oxide (*an excess*) and added enough sulfuric acid to react with most of the copper(II) oxide. We filtered off the unreacted copper(II) oxide and obtained a clear solution of copper(II) sulfide. We left the solution in an evaporating dish for a week and obtained *blue* molecules of copper(II) sulfide. The mass of our copper(II) sulfide was 1.55g (3sf) or 1.5g (2sf).

(b) Making potassium nitrate (*Hint: You should find 7 errors.*)

We reacted *potassium carbonate with nitric acid* to make potassium nitrate. The equation for the reaction is:

$$KCO_3 + H_2NO_3 \rightarrow KNO_3 + H_2CO_3$$

In this reaction potassium elements replaced the hydrogen atoms in the acid to make the potassium nitrate salt. We obtained 0.65g of potassium nitrate molecules (*molar mass 101.1g mol^{-1}*). This amount of potassium nitrate is 6.43 x10^{-3} mol = 0.0643 mol (3sf).

(c) Making magnesium chloride

Magnesium chloride is an ionic compound made up of magnesium ions and chlorine ions. We made magnesium chloride by reacting *magnesium ribbon with hydrochloric acid*.

$$Mg_2 + 4HCl \rightarrow 2MgCL_2 + 4H$$

We added pieces of magnesium compound to hydrochloric acid in a test-tube until all the acid was used up. We knew the acid had all reacted because there was no more fizzing and some magnesium molecules were left. We found that we had used 0.08g (2sf) of magnesium metal (*molar mass 24.3g mol^{-1}*) which is 1.94 mol of magnesium. *Our teacher said we should expect the same amount of magnesium chloride (molar mass 95.3g mol^{-1}) as the amount of magnesium used.* We were disappointed that we only obtained 0.31g (2sf) of magnesium chloride.

Practical work

(A) Making observations

Chemistry is a practical science. As part of your A Level course, you will need to demonstrate ability in carrying out experiments, recording results, processing data and evaluating the practical procedures.

How much detail should we give in observations?

The purpose of recording observations is to allow other scientists to know what to expect and to be able to reproduce and verify your results.

You need to record:

- the appearance (including colour and state) of your **starting materials**;
- the appearance (including colour and state) of your **final product**;
- plus any interesting observations during the reaction, such as effervescence (bubbling), intermediate colours, smell of any gas evolved, temperature change of the mixture.

Examples

(a) Dissolving sugar in water

A white crystalline solid was added to a colourless liquid to form a colourless solution.

(b) Limescale forming in a kettle after boiling tap water

A white precipitate formed when a colourless solution was heated.

(c) Making tea with loose tea leaves

A hot colourless liquid was added to a black solid to form a brown solution. The black solid remained.

(d) Making a blackcurrant vitamin C drink with a fizzy tablet

A pink solid was added to a colourless liquid. Effervescence occurred and a purple solution formed.

Solution or liquid?

A **liquid** is a melted solid.

A **solution** is a mixture where a substance (the solute – may be solid, liquid or gas) has been dissolved into a liquid (the solvent).

If you know something has been dissolved into water, describe it as a *solution.*

Solutions are always **clear** (see-through), so it is redundant to describe them as "clear solutions". If a solution has no colour, ie looks like water, you must describe it as **colourless**.

Solid or precipitate?

A **solid** is a state of matter.

A **precipitate** is a solid that *forms* from a solution. It was not present at the start of the reaction.

A precipitate may be correctly described as a solid, but it is incorrect to call a solid that was present at the start and end of a reaction a precipitate.

You can tell if a precipitate has formed if a solution stops being clear (transparent) even if there are no obvious lumps of solid. Eg carbon dioxide turns limewater cloudy because it causes a *white precipitate* of calcium carbonate to form.

Observations exercise

Watch the video: https://youtu.be/F-gspJFPzxo

Record your observations of the different reactions in the table below.

Expt	Observations	Mark
A		
B		
C		
D		
E		

Mark /20

Glossary

Use the information from this pack to write down the meaning of the following terms and LEARN THEM!!!

Atom	
Element	
Molecule	
Compound	
Ion	
Ionic bonding	
Covalent bond	
Acid	
Salt	
Base	
Alkali	
Effervescence	
Precipitate	

The Periodic Table of Elements

Key

relative atomic mass **atomic symbol** name atomic (proton) number

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	[285] **Cn** copernicium 112	[286] **Nh** nihonium 113	[289] **Fl** flerovium 114	[289] **Mc** moscovium 115	[293] **Lv** livermorium 116	[294] **Ts** tennessine 117	[294] **Og** oganesson 118

* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.

Relative atomic masses for **Cu** and **Cl** have not been rounded to the nearest whole number.