Chemistry

General course information

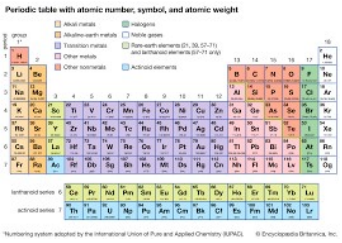
Year 12:

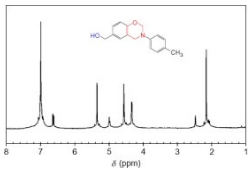
Teacher 1:

Atomic Structure (P)
Amount of Substance (P)
Energetics (P)
Chemical Equilibria (P)
Oxidation and Reduction (P)
Group 2 (I)
Group 7 (I)
Periodicity (I)

Teacher 2:

Bonding (P)
Kinetics (P)
Introduction to Organic Chemistry
Alkanes (O)
Halogenoalkanes (O)
Alkenes (O)
Alcohols (O)
Organic Analysis (O)





Year 13:

Teacher 1:

Thermodynamics (P)
Acids & Bases (P)
Electrode Potentials (P)
Transition Metals (I)
Reactions of Ions in Aqueous Solutions
Properties of Period 3 elements and their oxides (I)

Teacher 2:

Optical Isomerism (O)
Aldehydes & Ketones (O)
Carboxylic Acid & Derivatives (O)
Rate Equations (P)
Aromatic Chemistry (O)
Amines (O)
Polymers (O)
Amino Acids, Proteins & DNA (O)
Equilibrium Constant, K_p for homogenous systems (O)
NMR (O)
Chromatography (O)
Organic Synthesis (O)

How is it assessed?

3 Exam papers

Paper 1
Physical & Inorganic Chemistry
Relevant practical skills

- 2 hours
- 105 marks: short and long answer questions
- 2 X 35% of A-Level

Paper 2
Physical & Organic Chemistry
Relevant practical skills

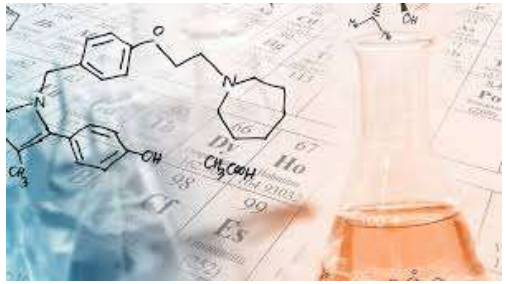
- 2 hours
- 90 marks
- 30% o f A-Level

Paper 3
Mixed Yr12 & Yr13 content
Theory and practical

- 40 marks: practical techniques & data analysis
- 20 marks: content
- 30 marks multiple choice

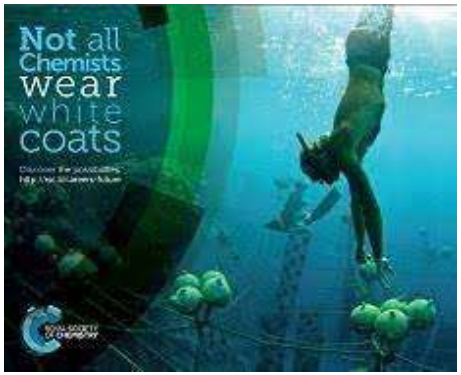
Practical certificate
12 required practicals that must be conducted, written up and passed

Entry requirements



- Minimum grade 66 in Combined or grade 6 for the Separate Sciences
- Minimum grade 6 in Maths
- Minimum grade 5 in English

- Supported subjects: Maths, Biology, Physics



- A real interest in the subject!

Transition booklet

Part One - Using Maths in Chemistry

Standard form and Significant figures

Converting Units

Measuring chemicals – the mole

Measuring chemicals - Solutions and concentration

2020-2021

Part Two - Skills for Practical Chemistry

Drawing tables

Task for submission

Yr11 – 12 Transition Activities

Subject: Chemistry

Part Three – Research Activities

Cornell notes and Referencing

Task for submission

Part four - Minimising Risk

Risk Assessment

Task for submission

BUSINESS & ENTERPRISE
The City of Leicester College

THE CITY OF LEICESTER COLLEGE

1.2 Amount of Substance

Topic	**Requirements**	**Practical Skills**
RAM (A_r) and (M_r)	- Define both - Calculate	
The Mole	- Avagadro constant - Conc. and units - Calculate mole from mass, conc., volume	- Use standard form - Appropriate sig.fig
Balanced equations	- Construct and balance full and ionic equations - Use balanced eqn to work out mass, conc. and vol - Titrations - Uncertainty of titre	- Ethanoic acid in vinegar - Calcium carbonate (indigestion tablets) - $MHCO_3$ - Succinic acid - Aspirin - Hydrated salt - Water of crystallisation
Atom economy and percentage yield	- Calculate - Economic, ethical and environmental advantages	- Yield for conversion of Mg to MgO - Group 2 carbonate to its oxide
Empirical and molecular formula	- Define - Understand the relationship - Calculate from data	- Find empirical formula of metal oxide
Ideal gas equation	- Know and rearrange equations - Units	- Find M_r of volatile fluid

Do Now…

Determine the relative molecular mass of the following:

- $NaOH$
- $CaCO_3$
- $Mg(OH)_2$

An atom has half as many protons as an atom of ^{28}Si and also has six fewer neutrons than an atom of ^{28}Si. Give the symbol, including the mass number and the atomic number, of this atom.

Magnesium nitride reacts with water to form magnesium hydroxide and ammonia.

(i) Balance the equation, given below, for the reaction between magnesium nitride and water.

$$Mg_3N_2 + H_2O \rightarrow Mg(OH)_2 + NH_3$$

(ii) Calculate the number of moles, and hence the number of molecules, of NH_3 in 0.263 g of ammonia gas.
(The Avogadro constant $L = 6.02 \times 10^{23}$ mol^{-1})

Determine the relative molecular mass of the following:

- NaOH
- $CaCO_3$
- $Mg(OH)_2$

NaOH: 23.0 + 16.0 + 1.0 = 40

$CaCO_3$: 40.1 + 12.0 + (16.0 X 3) = 100.1

$Mg(OH)_2$: 24.3 + ((16.0 + 1.0) X 2) = 58.3

An atom has half as many protons as an atom of ^{28}Si and also has six fewer neutrons than an atom of ^{28}Si. Give the symbol, including the mass number and the atomic number, of this atom.

$^{15}_{7}N$

Mass number = 15 AND atomic number = 7 **(1)**

Magnesium nitride reacts with water to form magnesium hydroxide and ammonia.

(i) Balance the equation, given below, for the reaction between magnesium nitride and water.

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(ii) Calculate the number of moles, and hence the number of molecules, of NH_3 in 0.263 g of ammonia gas.
(The Avogadro constant $L = 6.02 \times 10^{23}$ mol^{-1})

(i) $Mg_3N_2 + \mathbf{6}H_2O \rightarrow \mathbf{3}Mg(OH)_2 + \mathbf{2}NH_3$ **(1)**

(ii) Moles NH_3 = $\frac{0.263}{17}$ (=0.0155 mol) **(1)**

Number of molecules of $NH_3 = 0.0155 \times 6.02 \times 10^{23}$ **(1)**

[mark conseq] = 9.31×10^{21} **(1)**
[range 9.2×10^{21} to 9.4×10^{21}]

*Conseq (**min** 2 sig fig)*

How do we know how much ‘stuff’ we have…or how much we need…or where it’s all gone?!

Explain the difference between empirical and molecular formulae
Carry out calculations:
to find empirical formula from data
to find molecular formula from the empirical formula & RMM

24 August 2022

Key Words: RAM, RAM, empirical formula, moles

Things we should know…

RELATIVE ATOMIC MASS

- *Weighted mean mass of one atom of an element compared with one twelfth of the mass of an atom of carbon -12.*

- Symbol A_r or RAM

Explain the difference between empirical and molecular formulae
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Things we should know…

RELATIVE MOLECULAR MASS

- *Weighted mean mass of a molecule or a compound, or element, compared with one twelfth of the mass of an atom of carbon-12*
- Find the RMM by adding up RAM of atoms present
- Symbol M_r and RMM
- Try these: NaOH, Na_2O

- Brackets: everything inside the bracket is multiplied ie $(NO_3)_3$ means 3 nitrogens and 9 oxygens
- A dot indicates water of crystallisation and can be considered as a plus sign e.g $MgSO_4.5H_2O$ means add the RMM of $MgSO_4$ + 5xH_2O

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Empirical Formula

- The **empirical formula** of a compound is the formula which shows the simplest whole-number ratio in which the atoms in that compound exist.

- It can be calculated if the composition by mass of the compound is known.

- The **molecular formula** of a substance is the formula which shows the number of each type of atom in the one molecule of that substance.

- It applies only to molecular substances, and can be deduced if the empirical formula and molar mass of the compound are known.

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Molecular Formula - Empirical Formula Comparision

Molecular formula

- TOTAL number of atoms of each element present in a molecule of the compound

Empirical Formula

- Simplest ratio of the atoms of each element in a compound

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Working Out Empirical Formula

compound	*empirical*	*molecular*
Water		
Methane		
Butane		
Benzene		C_6H_6
Hexane		

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Working Out Empirical Formula

compound	*empirical*	*molecular*
Water	H_2O	H_2O
Methane	CH_4	CH_4
Butane	C_2H_5	C_4H_{10}
Benzene	CH	C_6H_6
Hexane	C_3H_7	C_6H_{14}

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Calculating Empirical Formula

You can use information about reacting masses to calculate the formula of a compound. Here is an example:

3.2g of sulfur reacts with 3.2g oxygen to produce 6.4g of an oxide of sulfur.

What is the formula of the oxide?

Use the fact that the A_r of sulfur is 32 and the A_r of oxygen is 16

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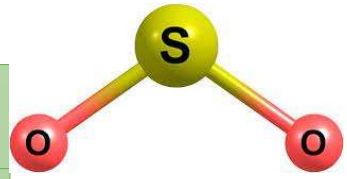
3.2g of sulfur reacts with 3.2g oxygen to produce 6.4g of a sulphur oxide.



Step	Action	S	O
1	find masses	3.2	3.2
2	look up given A_r values	32	16
3	divide masses by A_r	0.1	0.2
4	find the ratio	1	2

The calculation tells us that for every 1 sulfur atom we need 2 oxygen atoms therefore the formula is: SO_2

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Empirical formulae question

- If 9g Aluminium reacts with 35.5g Chlorine what is the empirical formula of the compound formed?

step	action	Al	Cl
1	find masses		
2	look up A_r values		
3	divide masses by A_r		
4	find the ratio		

Explain the difference between empirical and molecular formulae
Carry out calculations:
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Empirical formulae question

- If 9g Aluminium reacts with 35.5g Chlorine what is the empirical formula of the compound formed?

step	action	Al	Cl
1	find masses	9.00	35.50
2	look up A_r values	27.00	35.50
3	divide masses by A_r	0.33	1.00
4	find the ratio	1	3

Explain the difference between empirical and molecular formulae
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24 August 2022

Key Words: RAM, RAM, empirical formula, moles

Example

- Caffeine has an elemental analysis of 49.48% carbon, 5.190% hydrogen, 16.47% oxygen, and 28.85% nitrogen. It has a molar mass of 194.19 g/mol.

- What is the molecular formula of caffeine?

Explain the difference between empirical and molecular formulae
Carry out calculations:
- to find empirical formula from data
- to find molecular formula from the empirical formula & RMM

Key Words:

Caffeine has an elemental analysis of 49.48% carbon, 5.190% hydrogen, 16.47% oxygen, and 28.85% nitrogen. It has a molar mass of 194.19 g/mol.

What is the molecular formula of caffeine?

Examples-

Caffeine has an elemental analysis of 49.48% carbon, 5.190% hydrogen, 16.47% oxygen, and 28.85% nitrogen. It has a molar mass of 194.19 g/mo
What is the molecular formula of caffeine?

(Hint-Save the molar mass 194.19g/mol until the end)

49.48% C, 5.190%H, 16.47% O and 28.85% N

Step 1 Mass is 100% so % becomes grams

49.48g C, 5.190gH, 16.47g O and 28.85g N

Step 2 determine the moles of each element

49.48g C x (12.0 g C / mole) = 4.123moles C
5.190g H x (1.0 g H / mole) = 5.190 moles H
16.47g O x (16.0 g O / mole) =1.029moles O
28.85g N x (14.0 g N / mole) = 2.061 moles N

Step 3 determine the mole ratio by dividing each elements number of moles by the smallest

Dividing by the smallest (1.029) we get

C: 4.123 / 1.029 = 4.007
H: 5.190 / 1.029 = 5.044
O: 1.029 / 1.029 =1.000
N: 2.061 / 1.029 = 2.002

Step 4 Double, triple .. to get an integer is they are not all whole numbers

The values are all really close to whole numbers.

Empirical Formula= $C_4H_5ON_2$

Example- Molecular Formulas (Steps 5-7)

It has a molar mass of 194.19 g/mol.

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Calculations involving empirical & molecular formulae

Combustion analysis

0.500g of substance X was burnt on oxygen to give 0.733g of CO_2 and 0.300g water.

- E.g. Work out mass of C in 0.733g of CO_2 = 0.733 x 12/44
- Then…

Show you know…

Calculation	*C*	*H*	*O*
Mass or %			
Molar mass			
No.moles			
ratio			
Whole number ratio			
Empirical Formula			

VERY IMPORTANT If the whole number ratio comes out as .5 eg 4.5 1.5 then you must multiply everything by 2 you can not round up or down.

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Any questions? Please email.

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