Clitheroe Royal Grammar Sixth Form: Transition Pack

Welcome to the Chemistry Department

We look forward to meeting you and welcoming you to the Sixth Form.

This Transition Pack contains information to support your transition from GCSE to A Level study.

Please read all the pack ready to begin Year 12:

- Independent Learning in Chemistry
- Transition Guide for A Level Chemistry
- Chemistry Introductory Task

✓ **Read the Subject Information Sheet** which is available here:
CRGS Sixth Form Subject Sheet - Chemistry

✓ **Download the exam board specification** which is available here:
AQA A Level Chemistry

✓ **Read the section called 'Specification at a Glance'**, focusing on the A Level content.

✓ Some of these resources will become more useful when you have moved further through the course, such as the A Level specification, so store them where you can revisit them over the next 2 years.

✓ Don't worry if some of the work sounds challenging. A Level work is more difficult than GCSE work after all. Your teachers will be supporting you through this transition. Please talk to us if you are unsure about any aspect of the course.

We look forward to seeing you soon.

Miss Speirs - Head of Learning, Chemistry

Transition Guide - Moving from GCSE to A Level Chemistry

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You're studying A-Level Chemistry - Congratulations!

Studying chemistry after your GCSEs really develops your practical and mathematical skills. If you enjoy experimenting in the lab, you'll love it.

At first, you may find the jump in demand from GCSE a little daunting, but if you follow the tips and advice in this guide, you'll soon adapt.

We recommend you keep this somewhere safe, as you may like to refer to the information inside throughout your studies.

Why study A-Level Chemistry?

Chemistry students get to investigate a huge range of ideas: the big question you'll ask yourself is 'what is the world made of?' If you choose it as career, you have the potential to help solve all sorts of problems. You could work on a cure for cancer, or you might develop a new food: the possibilities are endless.

Even if you don't decide to work in chemistry, studying it still develops useful and transferable skills for other careers. You'll develop research, problem solving and analytical skills, alongside teamwork and communication. Universities and businesses regard all of these very highly.

Possible degree options

According to bestcourse4me.com, the top five degree courses taken by students who have A-level Chemistry are:

- Chemistry
- Biology
- Pre-clinical medicine
- Mathematics
- Pharmacology.

For more details, go to UCAS and read the subject guides and course entry requirements.

Which career appeals to you?

Studying Chemistry at A-level or degree opens up plenty of career opportunities, such as:

- analytical chemist
- chemical engineer
- clinical biochemist
- pharmacologist
- doctor
- research scientist (physical sciences)
- toxicologist
- environmental consultant
- higher education lecturer or secondary school teacher
- patent attorney
- science writer

Chemistry A Level - Specification at a glance

Topics covered in Y12

Physical Chemistry	Inorganic Chemistry	Organic Chemistry
Atomic structure	Periodicity	Introduction to organic chemistry
Amount of substance	Group 2, the alkaline earth metals	Alkanes
Bonding	Group 7 the halogens	Halogenoalkanes
Energetics		Alkenes
Kinetics		Alcohols
Chemical equilibria, Le Chatelier's principle and K_c		Organic analysis
Oxidation, reduction and redox reactions		

Topics covered in Y13

Physical Chemistry	Inorganic Chemistry	Organic Chemistry
Thermodynamics	Properties of Period 3 element and oxides	Optical chemistry
Rate equations	Transition metals	Aldehydes and ketones
Equilibrium constant K_p for homogeneous systems	Reactions of ions in aqueous solutions	Carboxylic acids and derivatives
Electrode potentials and electrochemical cells		Aromatic chemistry
Acids and bases		Amines
		Polymers
		Amino acids, proteins and DNA
		Organic synthesis
		NMR spectroscopy
		Chromatography

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The assessment for the A-level consists of three exams:

Paper 1	+	Paper 2	+	Paper 3
What's assessed • Relevant Physical chemistry topics (sections 3.1.1 to 3.1.4, 3.1.6 to 3.1.8 and 3.1.10 to 3.1.12) • Inorganic chemistry (section 3.2) • Relevant practical skills		What's assessed • Relevant Physical chemistry topics (sections • 3.1.2 to 3.1.6 and 3.1.9) • Organic chemistry (section 3.3) • Relevant practical skills		What's assessed • Any content • Any practical skills
How it's assessed • Written exam: 2 hours • 105 marks • 35% of A-level		How it's assessed • Written exam: 2 hours • 105 marks • 35% of A-level		How it's assessed • Written exam: 2 hours • 90 marks • 30% of A-level
Questions • 105 marks of short and long answer questions		Questions • 105 marks of short and long answer questions		Questions • 40 marks of questions on practical techniques and data analysis • 20 marks of questions testing across the specification • 30 marks of multiple choice questions

Places to go for help

The AQA Chemistry web page is a great place to start. A-level Chemistry webpages are aimed at teachers, but you may find them useful too. Information includes:

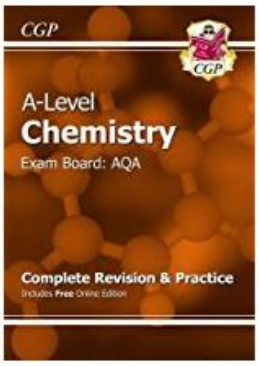
- The specification – this explains exactly what you need to learn for your exams.
- Practice exam papers.
- Lists of command words and subject specific vocabulary – so you understand the words to use in exams.
- Practical handbooks explain the practical work you need to know.
- Maths skills support.
- Web resources page with many links to other resources to support study.

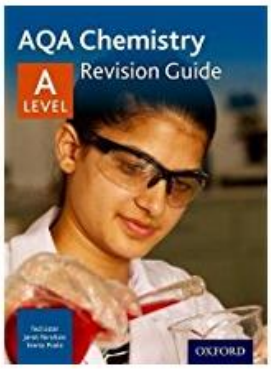
The Royal Society of Chemistry (RSC) - The RSC do everything from naming new elements and lobbying MPs, to improving funding for research sciences in the UK.
You'll find lots of handy resources on their website. As a student you are also entitled to join the RSC for free.

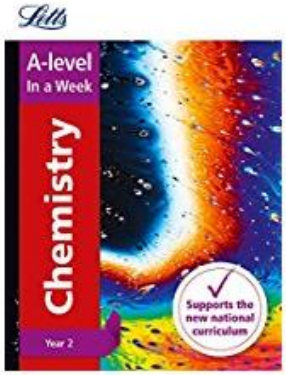
The student room - Join the A-level Chemistry forums and share thoughts and ideas with other students if you're stuck with your homework. Just be very careful not to share any details about your assessments, there are serious consequences if you're caught cheating. Visit thestudentroom.co.uk

Textbooks - Our approved textbooks are published by Collins, Hodder and Oxford University Press. Textbooks from other publishers will also be suitable, but you'll need to double-check that the content and formula symbols they use, match our specification.

Revision guides - These are great if you want a quick overview of the course when you're revising for Your exams. Remember to use other tools as well, as these aren't detailed enough on their own. Examples below others are available and you should look for one that suits your preferred style of revising:







YouTube - YouTube has thousands of Chemistry videos. Just be careful to look at who produced the video and why, because some videos distort the facts. Check the author, date and comments – these help indicate whether the clip is reliable. If in doubt, ask your teacher.

Magazines - Focus, New Scientist or Philip Allan updates can help you put the chemistry you're learning in context.

Other resources - Online resources such as Chemrevise – Has prepared revision notes for each topic. There are also online chemistry fact sheets that go over the material and have small examples to complete. Making use of websites for students such as DrBrowns to help review material taught in class. You could make use of Seneca an online learning platform. There are Kahoots quizzes you can also try.

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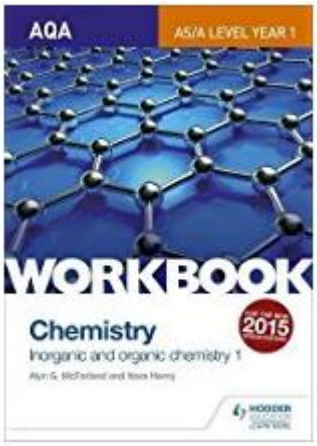
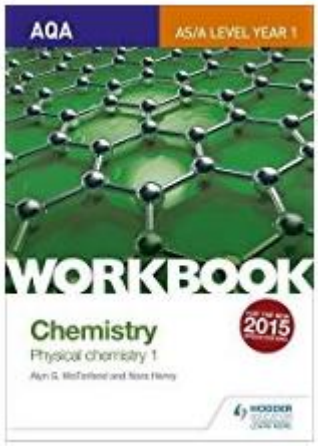
Revision work books (with questions to answer) such as shown below are also available from many bookshops. These could be helpful for independent study.





What does A Level Chemistry look like at CRGS Sixth Form?

In Year 12 you will have two teachers and be taught 4 hours a week in labs. This will consist of theory lessons and practical work.

Homework will be set each week by both teachers and as well as completing this you will be expected to complete your own independent work. Teachers may direct you to some reading material or give you suggestions for this.

There are 6 required experiments that you will also need to complete during the year. You will be expected to complete some practical work by yourself as well as also working in pairs.

In Year 13 there are 5 hours per week split between 2 teachers. Again there will be a mixture between theory and practical work. You will be expected to complete some practical work as individuals and some as pairs. Don't be surprised if the organic practical work takes more than two lessons to complete! There are also 8 required experiments that need to be completed in this time. Again you will be expected to carry out your own independent work outside of lessons beyond just the standard weekly set homework.

You will need to provide your own lab coat to use during practical work.

The department offers **weekly Help Sessions** that you are welcome to attend if you feel you would like to go over any of your work. You will be given details of these when term starts.

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Chemistry Introductory Task

Approximately 2-2½ hours of work

Please read through these instructions and complete all the tasks ready for when you begin Year 12. You will need all of these ideas, not just in the first few weeks of the course, but over the whole two years. It is designed to re-cap work you have been taught at GCSE and show you a little of the upcoming A Level work. Don't worry if you have forgotten parts of this. It will all be covered in your first few lessons. Don't stop if you reach an activity that you cannot complete - keep working through the whole document. There may be other questions that you can do.

Part 1 - Periodic Table

The periodic table of elements is shown here. The A-level course will build on what you've learned in your GCSE studies about the periodic table.

Activity 1 – Should take 5 minutes

(1)	(2)											(13)	(14)	(15)	(16)	(17)	(18)
							1.0 H hydrogen 1										4.0 He helium 2
6.9 Li lithium 3	9.0 Be beryllium 4											10.8 B boron 5	12.0 C carbon 6	14.0 N nitrogen 7	16.0 O oxygen 8	19.0 F fluorine 9	20.2 Ne neon 10
23.0 Na sodium 11	24.3 Mg magnesium 12	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	27.0 Al aluminium 13	28.1 Si silicon 14	31.0 P phosphorus 15	32.1 S sulfur 16	35.5 Cl chlorine 17	39.9 Ar argon 18
39.1 K potassium 19	40.1 Ca calcium 20	45.0 Sc scandium 21	47.9 Ti titanium 22	50.9 V vanadium 23	52.0 Cr chromium 24	54.9 Mn manganese 25	55.8 Fe iron 26	58.9 Co cobalt 27	58.7 Ni nickel 28	63.5 Cu copper 29	65.4 Zn zinc 30	69.7 Ga gallium 31	72.6 Ge germanium 32	74.9 As arsenic 33	79.0 Se selenium 34	79.9 Br bromine 35	83.8 Kr krypton 36
85.5 Rb rubidium 37	87.6 Sr strontium 38	88.9 Y yttrium 39	91.2 Zr zirconium 40	92.9 Nb niobium 41	96.0 Mo molybdenum 42	[98] Tc technetium 43	101.1 Ru ruthenium 44	102.9 Rh rhodium 45	106.4 Pd palladium 46	107.9 Ag silver 47	112.4 Cd cadmium 48	114.8 In indium 49	118.7 Sn tin 50	121.8 Sb antimony 51	127.6 Te tellurium 52	126.9 I iodine 53	131.3 Xe xenon 54
132.9 Cs caesium 55	137.3 Ba barium 56	138.9 La * lanthanum 57	178.5 Hf hafnium 72	180.9 Ta tantalum 73	183.8 W tungsten 74	186.2 Re rhenium 75	190.2 Os osmium 76	192.2 Ir iridium 77	195.1 Pt platinum 78	197.0 Au gold 79	200.6 Hg mercury 80	204.4 Tl thallium 81	207.2 Pb lead 82	209.0 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	[267] Rf rutherfordium 104	[268] Db dubnium 105	[271] Sg seaborgium 106	[272] Bh bohrium 107	[270] Hs hassium 108	[276] Mt meitnerium 109	[281] Ds darmstadtium 110	[280] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key: relative atomic mass / symbol / name / atomic (proton) number

* 58 – 71 Lanthanides	140.1 Ce cerium 58	140.9 Pr praseodymium 59	144.2 Nd neodymium 60	[145] Pm promethium 61	150.4 Sm samarium 62	152.0 Eu europium 63	157.3 Gd gadolinium 64	158.9 Tb terbium 65	162.5 Dy dysprosium 66	164.9 Ho holmium 67	167.3 Er erbium 68	168.9 Tm thulium 69	173.1 Yb ytterbium 70	175.0 Lu lutetium 71
† 90 – 103 Actinides	232.0 Th thorium 90	231.0 Pa protactinium 91	238.0 U uranium 92	[237] Np neptunium 93	[244] Pu plutonium 94	[243] Am americium 95	[247] Cm curium 96	[247] Bk berkelium 97	[251] Cf californium 98	[252] Es einsteinium 99	[257] Fm fermium 100	[258] Md mendelevium 101	[259] No nobelium 102	[262] Lr lawrencium 103

On the table above:

1. Draw a line showing the metals and non-metals
2. Colour the transition metals blue
3. Colour the halogens yellow
4. Colour the alkali metals red
5. Colour the noble gases green
6. Draw a blue arrow showing the direction of periods
7. Draw a red arrow showing the direction of groups
8. Draw a blue ring around the symbols for all gases
9. Draw a red ring around the symbols for all liquids

Activity 2: Should take about 5 minutes

Use the periodic table to find the following:

1. The atomic number of: osmium, sodium, lead, chlorine
2. The relative atomic mass of: helium, barium, francium, oxygen
3. The number of protons in: mercury, iodine, calcium
4. The symbol for: gold, lead, copper, iron
5. The name of: Sr, Na, Ag, Hg
6. THINK can be written using a combination of the symbols for Thorium, Indium and Potassium (ThInK)

Which combinations of element symbols could be used to make the following words?
AMERICA, FUN, PIRATE, LIFESPAN, FRACTION, EROSION, DYNAMO

Part 2 - Relative atomic mass

You may have noticed that the relative atomic mass of the elements shown on the periodic table, on the previous page of this booklet, is slightly different to the ones you'll have seen at GCSE.
If there are several isotopes of an element, the relative atomic mass will take into account the proportion of atoms in a sample of each isotope.
For example, chlorine gas is made up of 75% of chlorine-35 and 25% of chlorine-37.
The relative atomic mass of chlorine is therefore the mean atomic mass of the atoms in a sample, and is calculated by:

$$A_r = \frac{(75\times35)+(25\times37)}{100} = 35.5$$

Activity 3: Should take about 10 minutes

1. What is the relative atomic mass of Bromine if the two isotopes, Br-79 and Br-80, exist in equal amounts?
2. Neon has three isotopes. Ne-20 accounts for 90.9%, Ne-21 accounts for 0.3% and the last 8.8% of a sample is N-21. What is the relative atomic mass of neon?
3. **Challenge** - Boron has two isotopes, B-10 and B-11. The relative atomic mass of boron is 10.8. What are the percentage abundances of the two isotopes?

Part 3 - Relative formula mass

From GCSE you will have calculated these values but note that we now quote them to 1 d.p.
Example 1. Carbon dioxide CO_2 has 1 carbon atom (RAM12.0) and two oxygen atoms (RAM 16.0). The relative formula mass is therefore:

RFM = (12.0 × 1) + (16.0 × 2) = 44.0

Example 2. Magnesium hydroxide $Mg(OH)_2$ has one magnesium ion (RAM 24.3) and two hydroxide ions, each with one oxygen (RAM 16.0) and one hydrogen (1.0).
The relative formula mass is therefore:

RFM = (24.3 × 1) + (2 × (16.0 + 1.0)) = 58.3

Activity 4: Should take about 10 minutes Calculate the relative formula mass of the following compounds remember the 1 d.p:

1. Magnesium oxide MgO
2. Sodium hydroxide NaOH
3. Copper sulfate $CuSO_4$
4. Ammonium chloride NH_4Cl
5. Ammonium sulfate $(NH_4)_2\ SO_4$

Part 4 – Common Ions – Keep these ions safe, you will be tested on these after the first few weeks.

You may have seen and used these ions at GCSE (they were on the back of your periodic table). At A Level you are expected to know them.

Positive ions (cations)		Negative ions (anions)	
Name	**Symbol**	**Name**	**Symbol**
Hydrogen	H^+	Chloride	Cl^-
Sodium	Na^+	Bromide	Br^-
Lithium	Li^+	Oxide	O^{2-}
Silver	Ag^+	Hydrogencarbonate	HCO^{3-}
Magnesium	Mg^{2+}	Nitrate	NO^{3-}
Calcium	Ca^{2+}	Sulfate	SO_4^{2-}
Zinc	Zn^{2+}	Carbonate	CO_3^{2-}
Lead	Pb^{2+}	Phosphate	PO_4^{3-}
Aluminium	Al^{3+}		
Iron(II)	Fe^{2+}		
Iron(III)	Fe^{3+}		
Ammonium	NH_4^+		

Activity 5: Should take about 10 minutes

(1)	(2)											(13)	(14)	(15)	(16)	(17)	(18)
							1.0 H hydrogen 1										4.0 He helium 2
6.9 Li lithium 3	9.0 Be beryllium 4											10.8 B boron 5	12.0 C carbon 6	14.0 N nitrogen 7	16.0 O oxygen 8	19.0 F fluorine 9	20.2 Ne neon 10
23.0 Na sodium 11	24.3 Mg magnesium 12	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	27.0 Al aluminium 13	28.1 Si silicon 14	31.0 P phosphorus 15	32.1 S sulfur 16	35.5 Cl chlorine 17	39.9 Ar argon 18
39.1 K potassium 19	40.1 Ca calcium 20	45.0 Sc scandium 21	47.9 Ti titanium 22	50.9 V vanadium 23	52.0 Cr chromium 24	54.9 Mn manganese 25	55.8 Fe iron 26	58.9 Co cobalt 27	58.7 Ni nickel 28	63.5 Cu copper 29	65.4 Zn zinc 30	69.7 Ga gallium 31	72.6 Ge germanium 32	74.9 As arsenic 33	79.0 Se selenium 34	79.9 Br bromine 35	83.8 Kr krypton 36
85.5 Rb rubidium 37	87.6 Sr strontium 38	88.9 Y yttrium 39	91.2 Zr zirconium 40	92.9 Nb niobium 41	96.0 Mo molybdenum 42	[98] Tc technetium 43	101.1 Ru ruthenium 44	102.9 Rh rhodium 45	106.4 Pd palladium 46	107.9 Ag silver 47	112.4 Cd cadmium 48	114.8 In indium 49	118.7 Sn tin 50	121.8 Sb antimony 51	127.6 Te tellurium 52	126.9 I iodine 53	131.3 Xe xenon 54
132.9 Cs caesium 55	137.3 Ba barium 56	138.9 La * lanthanum 57	178.5 Hf hafnium 72	180.9 Ta tantalum 73	183.8 W tungsten 74	186.2 Re rhenium 75	190.2 Os osmium 76	192.2 Ir iridium 77	195.1 Pt platinum 78	197.0 Au gold 79	200.6 Hg mercury 80	204.4 Tl thallium 81	207.2 Pb lead 82	209.0 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	[267] Rf rutherfordium 104	[268] Db dubnium 105	[271] Sg seaborgium 106	[272] Bh bohrium 107	[270] Hs hassium 108	[276] Mt meitnerium 109	[281] Ds darmstadtium 110	[280] Rg roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

Key: relative atomic mass / symbol / name / atomic (proton) number

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232.0 Th thorium 90	231.0 Pa protactinium 91	238.0 U uranium 92	[237] Np neptunium 93	[244] Pu plutonium 94	[243] Am americium 95	[247] Cm curium 96	[247] Bk berkelium 97	[251] Cf californium 98	[252] Es einsteinium 99	[257] Fm fermium 100	[258] Md mendelevium 101	[259] No nobelium 102	[262] Lr lawrencium 103

* **58 – 71** Lanthanides

† **90 – 103** Actinides

On the periodic table, colour the elements that form one atom ions (eg Ag^+ or O^{2-}) according to the following key:

Charge	Colour	Charge	Colour
+1	red	-1	blue
+2	yellow	-2	brown
+3	green		

Use your chart to predict the charge of ions of: potassium, beryllium, sulphur and iodine.

Part 5 - Ionic compounds

Ionic compounds must have an overall neutral charge. The ratio of cations (positive ions) to anions (negative ions) must mean that there are as many positives as negatives.
Examples:

NaCl	
Na^+	Cl^-
+1	-1

MgO	
Mg^{2+}	O^{2-}
+2	−2

$MgCl_2$	
Mg^{2+}	Cl^-
	Cl^-
+2	−2

Activity 6: Should take about 15 minutes
Work out what the formulas for the following ionic compounds should be:

1. Magnesium bromide
2. Lead oxide
3. Zinc chloride
4. Aluminium bromide
5. Iron (II) sulfate
6. Iron (III) sulfate

Part 6 – Balancing equations

Activity 7: Should take about 15 minutes
Write balanced **symbol** equations for the following reactions. You'll need to use the information on the previous pages to work out the formulas of some of the compounds.

1. $Al + O_2 \rightarrow Al_2O_3$
2. $FeS + O_2 \rightarrow Fe_2O_3 + SO_2$
3. Methane + oxygen → carbon dioxide + water
4. Calcium carbonate + hydrochloric acid → calcium chloride + water + carbon dioxide
5. $Al_2(SO_4)_3 + Ca(OH)_2 \rightarrow Al(OH)_3 + CaSO_4$

Part 7 – Moles and empirical formula

Moles

A mole is the amount of a substance that contains 6.02×10^{23} particles.

The mass of 1 mole of any substance is the relative formula mass (M_r) in grams.

Examples:
One mole of carbon contains 6.02×10^{23} particles and has a mass of 12.0 g

Two moles of copper contains 12.04×10^{23} particles, and has a mass of 127 g 1 mole of water contains 6.02×10^{23} particles and has a mass of 18 g

The amount in moles of a substance can be found by using the formula:

$$\text{Amount in moles of a substance} = \frac{\text{mass of substance}}{\text{relative formula mass}}$$

Activity 8 – Moles and Avogadro's' – Complete the table should take 10 minutes

Substance	Mass of substance	Amount/moles	Number of particles
Helium			18.12×10^{23}
Chlorine	14.2		
Methane		4	
Sulfuric acid	4.905		

Empirical formula

If you measure the mass of each reactant used in a reaction, you can work out the ratio of atoms of each reactant in the product. This is known as the **empirical formula**. This may give you the actual chemical formula, as the actual formula may be a multiple of this. For example, hydrogen peroxide is H_2O_2 but would have the empirical formula HO.

Use the following to find an empirical formula:

1. Write down reacting masses
2. Find the amount in moles of each element
3. Find the ratio of moles of each element

Example: A compound contains 2.232 g of ion, 1.284 g of sulfur and 1.920 g of oxygen. What is the empirical formula?

Element	Iron	Sulfur	Oxygen
mass/relative atomic mass	2.232/55.8	1.284/32.1	1.920/16.0
Amount in moles	0.040	0.040	0.120
Divide by smallest value	0.040/0.040	0.040/0.040	0.120/0.040
Ratio	1	1	3

So, the empirical formula is $FeSO_3$.

If the question gives the percentage of each element instead of the mass, replace mass with the percentage of an element present and follow the same process.

Activity 9 - Work out the following empirical formulas: Should take about 15 minutes

1. The smell of a pineapple is caused by ethyl butanoate. A sample is known to contain only 0.180 g of carbon, 0.030 g of hydrogen and 0.080 g of oxygen. What is the empirical formula of ethyl butanoate?

2. Another 300 g sample is known to contain only carbon, hydrogen and oxygen. The percentage of carbon is found to be exactly the same as the percentage of oxygen. The percentage of hydrogen is known to be 5.99%. What is the empirical formula of the compound?

Part 8 – Important language for practical work

There are many words used in practical work. You will have come across most of these words in your GCSE studies. It is important you are using the right definition for each word.

Activity 10 – Should take about 10 minutes Join the boxes to link the word to its definition.

Accurate	A statement suggesting what may happen in the future.
Data	An experiment that gives the same results when a different person carries it out, or a different technique or set of equipment is used.
Precise	A measurement that is close to the true value.
Prediction	An experiment that gives the same results when the same experimenter uses the same method and equipment.
Range	Physical, chemical or biological quantities or characteristics.
Repeatable	A variable that is kept constant during an experiment.
Reproducible	A variable that is measured as the outcome of an experiment.
Resolution	This is the smallest change in the quantity being measured (input) of a measuring instrument that gives a perceptible change in the reading.
Uncertainty	The interval within the true value can be expected to lie.
Variable	The spread of data, showing the maximum and minimum values of the data.
Control variable	Measurements where repeated measurements show very little spread.
Dependent variable	Information, in any form, that has been collected.