Pearson

Understanding Assessment and Improving Delivery in International GCSE Chemistry

Your Trainer Today is: CLIFF CURTIS BSc FRSC

Welcome to this Professional Development Training

Designed for teachers teaching the Pearson Edexcel International GCSE Chemistry Specifications.

- introduce the concept of assessment objectives: what are they and why they are used when writing examination papers
- analyse recent question papers and learn which types of questions match the different assessment objectives
- investigate different assessment objectives, considering how questions have been answered by looking at feedback from the previous exam series
- suggest some strategies to help students access questions targeting different assessment objectives
- review the support Pearson offers for teaching the qualification

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Welcome to Pearson

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Welcome to Pearson Edexcel

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Assessment Objectives

Why do we have assessment objectives?

- Help make exams fairer year on year
- Provide structure for question paper writers
- Make sure that exams are about skills, not just about knowledge
- Can provide students with some reassurance about the types of questions they will be asked

Assessment objectives

AO1	AO2	AO3
Knowledge and understanding in chemistry	Application of knowledge and understanding, analysis and evaluation in chemistry	Experimental skills, analysis and evaluation of data and methods in chemistry

Assessment objectives

AO1	AO2	AO3
Questions requiring students to recall and use information that you have taught them	Questions requiring students to apply what you have taught them, or to use skills, or to analyse and make judgements	Questions on practical work and associated practical skills, such as planning, drawing graphs, analysing data, evaluating methods

Assessment objectives

AO1	AO2	AO3
≈40% of total marks	≈ 40% of total marks	≈ 20% of total marks

- Paper 1 and Paper 2 both have the same balance of AO1 : AO2 : AO3
- Compared to our previous specification, the new specification has less AO1 and more AO2

Typical AO1 questions

- Can be simple recall

OR

- can be based on understanding, not just knowledge

Recall:

Name an element that is a liquid at room temperature.

Understanding:

Explain, in terms of electron configuration, why neon is unreactive.

Typical AO2 questions

- Can involve simple ideas being applied to unfamiliar scenarios

OR

- can involve more complex scenarios involving data analysis or evaluation

Typical AO2 questions

Application of simple ideas:

Give the number of protons and the number of neutrons in an atom of iodine–127

Draw the displayed formula of propanol.

4.30C understand how to draw structural and displayed formulae for methanol, ethanol, propanol (*propan-1-ol only*) and butanol (*butan-1-ol only*), and name each compound

Typical AO2 questions

Analysis of data:

The table gives some information about three substances, X, Y and Z.

Substance	Melting point	Conducts electricity when solid	Conducts electricity when molten	Type of bonding	Type of structure
X	low	no	no	covalent	simple molecular
Y	high	no	no		
Z	high	no	yes		

Complete the table by giving the missing information.

Typical AO2 questions

Calculations are AO2:

Propanol has this percentage composition by mass.

C = 60.0% H = 13.3% O = 26.7%

Show by calculation that the empirical formula of propanol is C_3H_8O.

The student finds that 15.00 cm^3 of sulfuric acid of concentration 0.180 mol/dm^3 neutralises 25.0 cm^3 of potassium hydroxide solution.

This is the equation for the reaction.

$$2KOH + H_2SO_4 \rightarrow K_2SO_4 + 2H_2O$$

Calculate the concentration of the potassium hydroxide solution.

Typical AO3 questions

- Questions based on practical experiences
- Not just Core Practicals, but any practical work!

Sodium chloride is a soluble salt.

(a) Name the acid and the alkali that can be used to make sodium chloride. (2)

(b) A teacher drops a bottle containing sodium chloride. The bottle breaks when it hits the floor. The teacher sweeps up the mixture of sodium chloride and glass.

Describe how the teacher can obtain a pure, dry sample of sodium chloride from the mixture. (4)

ACTIVITY 1

Assigning AOs

Assign an AO to each of the following

questions/part questions on the next few slides

ACTIVITY 1 – Assigning AOs

This question is about Group 2 elements and their compounds.

(a) A sample of magnesium contains three isotopes.

Mass number of isotope	24	25	26
Percentage abundance (%)	76.5	10.5	13.0

(i) State, in terms of subatomic particles, what is meant by the term **isotopes**.

(2)

(ii) Calculate the relative atomic mass (A_r) of magnesium.

Give your answer to one decimal place.

(3)

(b) Which of these compounds is an insoluble solid?

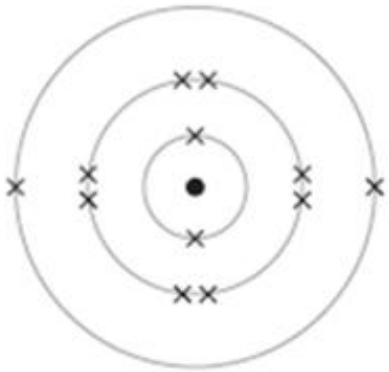
(1)

- ☐ **A** calcium nitrate
- ☐ **B** calcium sulfate
- ☐ **C** magnesium nitrate
- ☐ **D** magnesium sulfate

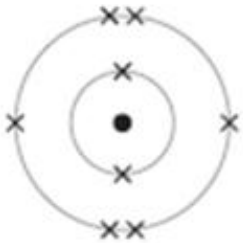
ACTIVITY 1 – Assigning AOs

(c) Magnesium oxide is an ionic compound.

The diagrams show the atoms of magnesium and oxygen.



Mg



O

Draw diagrams to show the structure of each ion in magnesium oxide.

Include the charge on each ion. (3)

(d) The table lists some substances and shows which substance conducts electricity.

Substance	Conducts electricity?
water	no
solid magnesium chloride	no
aqueous magnesium chloride	yes

Explain these observations.

Refer to structure and bonding in your answer. (5)

ACTIVITY 1 – Assigning AOs

This question is about the reactions of ethanol and ethanoic acid.

(a) (i) Ethanol reacts with potassium dichromate(VI) to form ethanoic acid.

Name the other reagent needed in this reaction. (1)

(ii) State the colour change that occurs when ethanol reacts with potassium dichromate(VI). (2)

(b) Ethanoic acid reacts with solid sodium carbonate.

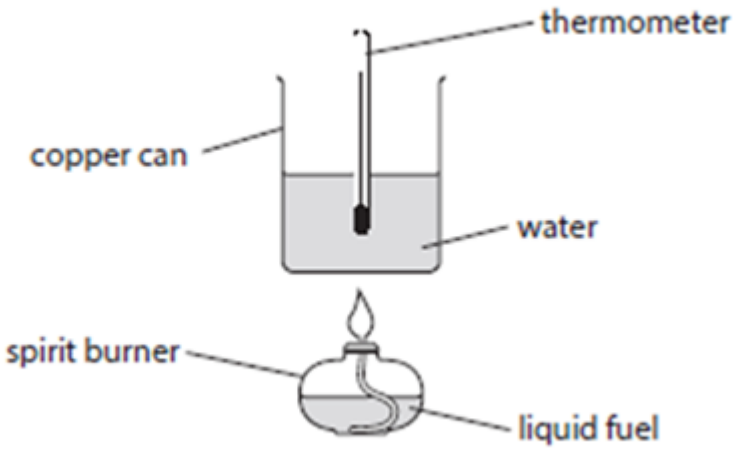
(i) Complete the chemical equation for this reaction. (2)

$2CH_3COOH + Na_2CO_3 \rightarrow$ ..... + ... + ...

(ii) State two observations seen in this reaction. (2)

ACTIVITY 1 – Assigning AOs

A student uses this apparatus to investigate the energy content of different fuels.



This is the student's method.

- pour some water into the copper can
- record the mass of the spirit burner and fuel
- measure the initial temperature of the water
- place the spirit burner under the copper can and light the burner
- stop heating the water when the temperature reaches 30°C
- record the new mass of the spirit burner and fuel

The student repeats the experiment with different fuels.

Explain two variables the student should control to make this a valid test. (4)

Command Words

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Command words

What they are and why they are important?

- Every question should have a command word.
- It is an instruction to candidates, telling them what we want them to write.
- It is critical that candidates know what each command word means so that they can answer the question effectively.
- Many candidates do not fully understand what each command word means – ‘describe’ and ‘explain’ are often confused with each other.
- All our qualifications in International GCSE sciences now use a common taxonomy for command words.
- These can be found in Appendix 5 at the back of the specification.
- Students can expect a range of command words across the demand range of the exam paper.

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Command Words

Command word	Definition
Identify/state/name	Recall or select one or more pieces of information.
Define	State the meaning of a term.
Calculate	Produce a numerical answer, showing relevant working.
Label	Add a label/labels to a given resource, graphic or image.
Draw/plot	Create a graphical representation of geographical information.
Compare	Find the similarities and differences of two elements given in a question. Each response must relate to both elements and must include a statement of their similarity/difference.
Describe	Give an account of the main characteristics of something or the steps in a process. Statements in the response should be developed but do not need to include a justification or reason.
Explain	Provide a reasoned explanation of how or why something occurs. An explanation requires a justification/exemplification of a point. Some questions will require the use of annotated diagrams to support the explanation.
Suggest	Apply understanding to provide a reasoned explanation of how or why something may occur. A suggested explanation requires a justification/exemplification of a point.
Examine	Break something down into individual components/processes and say how each one individually contributes to the question's theme/topic and how the components/processes work together and interrelate.
Assess	Use evidence to determine the relative significance of something. Give consideration to all factors and identify which are the most important.
Analyse	Investigate an issue by breaking it down into individual components and making logical, evidence-based connections about the causes and effects or interrelationships between the components.
Evaluate	Measure the value or success of something and ultimately provide a substantiated judgement/conclusion. Review information and then bring it together to form a conclusion, drawing on evidence such as strengths, weaknesses, alternatives and relevant data.
Discuss	Explore the strengths and weaknesses of different sides of an issue/question. Investigate the issue by reasoning or argument.

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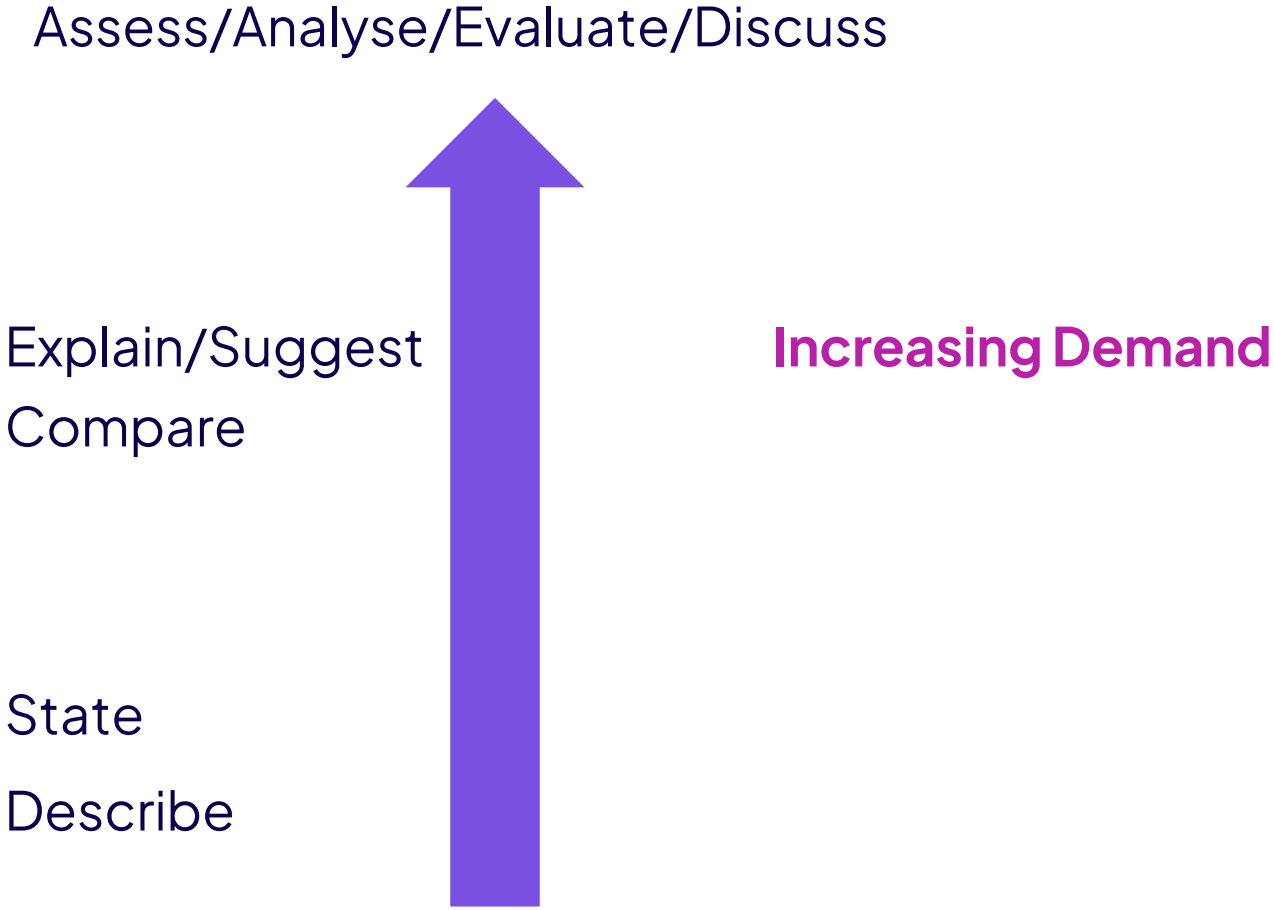
Cognitive demand of command words

Some command words have different cognitive demands:



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AO2 Questions and Mark Schemes

Why not look at AO1?

- AO1 is all about knowledge – and basic understanding
- This is not one that teachers can influence much…
- … students either go away and learn what you teach them, or they do not!
- BUT… remember that students should still recognise AO1 questions and not spend time going beyond AO1

ACTIVITY 3

AO2 Questions

Use the mark schemes shown on screen to mark the student responses on following slides

We will go through each question one at a time

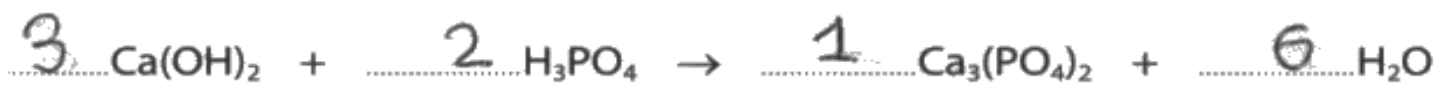
ACTIVITY 3 – AO2 Questions

Calcium hydroxide can react with phosphoric acid to form calcium phosphate.
Complete the equation for this reaction. (1)

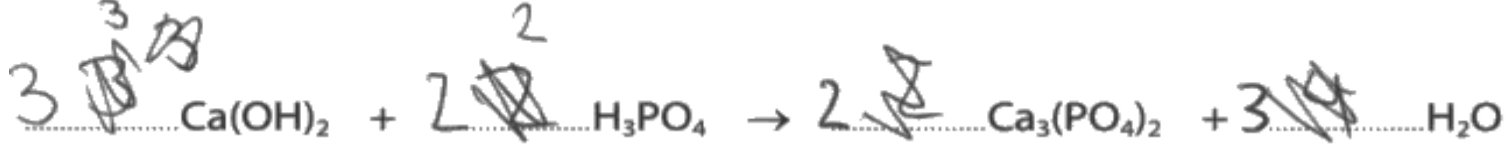
.....$Ca(OH)_2$ + ...H_3PO_4 → .....$Ca_3(PO_4)_2$ + ...H_2O

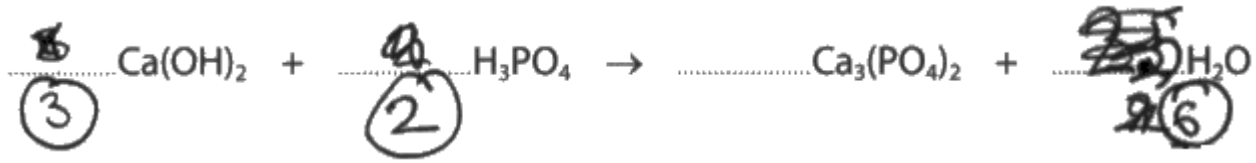
Answer	Notes
$3Ca(OH)_2 + 2H_3PO_4 \rightarrow (1)Ca_3(PO_4)_2 + 6H_2O$	ALLOW multiples and fractions

ACTIVITY 3 – AO2 Questions

Student 1 

Student 2 

Student 3 

Student 4 

Answer	Notes
$3Ca(OH)_2 + 2H_3PO_4 \rightarrow (1)Ca_3(PO_4)_2 + 6H_2O$	ALLOW multiples and fractions

Examiner's report

This was a challenging equation to balance and many candidates required several attempts to reach an answer.

Those candidates who were unsuccessful often did not attempt the question or showed some working but left the answer lines blank.

ACTIVITY 3 – AO2 Questions

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

Explain why this is a redox reaction. (2)

Answer	Notes
An explanation that links the following points M1 iron(III) oxide /Fe_2O_3 loses oxygen so is reduced M2 carbon monoxide gains oxygen so is oxidised OR M1 iron(III) oxide /Fe_2O_3 is reduced and carbon monoxide /CO is oxidised M2 iron(III) oxide /Fe_2O_3 loses oxygen and carbon monoxide /CO gains oxygen	ACCEPT Fe^{3+} gains electrons and is reduced

ACTIVITY 3 – AO2 Questions

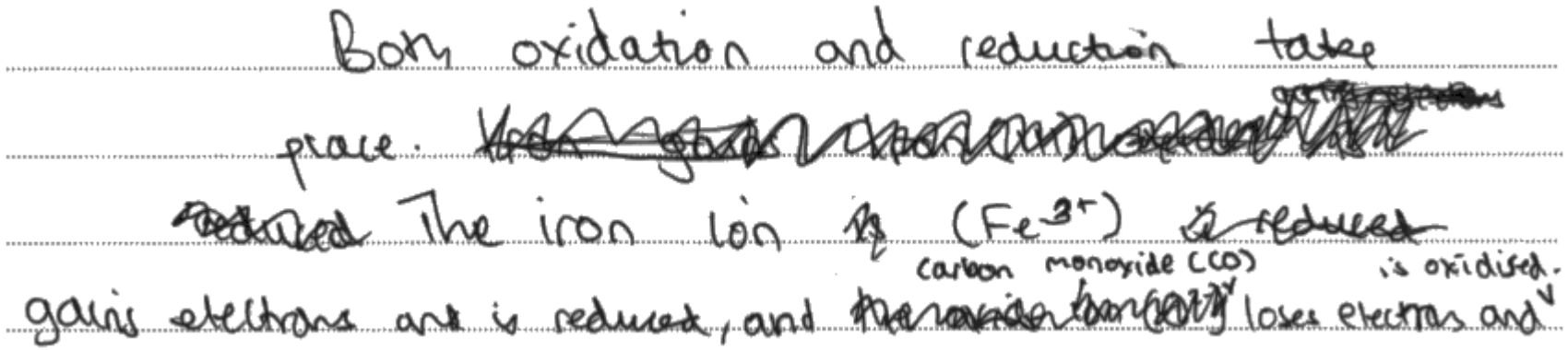
Student 1

as there is reduction and oxidation happening ~~in th~~ at the same time

Answer	Notes
An explanation that links the following points M1 iron(III) oxide /Fe_2O_3 loses oxygen so is reduced M2 carbon monoxide gains oxygen so is oxidised OR M1 iron(III) oxide /Fe_2O_3 is reduced and carbon monoxide /CO is oxidised M2 iron(III) oxide /Fe_2O_3 loses oxygen and carbon monoxide /CO gains oxygen	ACCEPT Fe^{3+} gains electrons and is reduced

ACTIVITY 3 – AO2 in exams

Student 2



Answer	Notes
An explanation that links the following points M1 iron(III) oxide /Fe_2O_3 loses oxygen so is reduced M2 carbon monoxide gains oxygen so is oxidised OR M1 iron(III) oxide /Fe_2O_3 is reduced and carbon monoxide /CO is oxidised M2 iron(III) oxide /Fe_2O_3 loses oxygen and carbon monoxide /CO gains oxygen	ACCEPT Fe^{3+} gains electrons and is reduced

ACTIVITY 3 – AO2 Questions

Student 3

It is a redox reaction as both reduction and oxidation occur. The Fe^{3+} ions are reduced (1) and the carbon monoxide is oxidised. (2) as they gain electrons (2) as it gains oxygen

Answer	Notes
An explanation that links the following points M1 iron(III) oxide /Fe_2O_3 loses oxygen so is reduced M2 carbon monoxide gains oxygen so is oxidised OR M1 iron(III) oxide /Fe_2O_3 is reduced and carbon monoxide /CO is oxidised M2 iron(III) oxide /Fe_2O_3 loses oxygen and carbon monoxide /CO gains oxygen	ACCEPT Fe^{3+} gains electrons and is reduced

ACTIVITY 3 – AO2 in exams

Student 4

- iron oxide is reduced as it gains electrons
- carbon monoxide is oxidised as it loses electrons
- oxidation and reduction are occuring at the same time

Answer	Notes
An explanation that links the following points M1 iron(III) oxide /Fe_2O_3 loses oxygen so is reduced M2 carbon monoxide gains oxygen so is oxidised OR M1 iron(III) oxide /Fe_2O_3 is reduced and carbon monoxide /CO is oxidised M2 iron(III) oxide /Fe_2O_3 loses oxygen and carbon monoxide /CO gains oxygen	ACCEPT Fe^{3+} gains electrons and is reduced

Examiner's report

There were several common issues with this question, including the incorrect assignment of oxidation and reduction, describing iron rather than iron(III) oxide as being reduced, and confusion when applying the loss/gain of electrons to carbon monoxide.

Some candidates simply stated the definition of redox without linking it to the equation provided.

As seen in previous years, candidates generally performed poorly on applied redox questions, and this series was no exception.

ACTIVITY 3 – AO2 Questions

A sample of magnesium contains three isotopes.

Mass number of isotope	24	25	26
Percentage abundance (%)	76.5	10.5	13.0

Calculate the relative atomic mass (A_r) of magnesium.
Give your answer to one decimal place.

(3)

Answer	Notes
M1 $\frac{76.5 \times 24 + 10.5 \times 25 + 13.0 \times 26}{100}$ M2 24.365 M3 24.4	correct answer without working scores 3 24 no working scores 0

ACTIVITY 3 – AO2 Questions

Student 1

$$\frac{(76.5 \times 24) + (25 \times 10.5) + (26 \times 13)}{100}$$

$= 24.4$

$A_r =$ 24.4

Answer	Notes
M1 $\frac{76.5 \times 24 + 10.5 \times 25 + 13.0 \times 26}{100}$	correct answer without working scores 3
M2 24.365	
M3 24.4	24 no working scores 0

ACTIVITY 3 – AO2 Questions

Student 2

$$\frac{(24 \times 76.5) + (25 \times 10.5) + (26 \times 13.0)}{100} = \frac{2436.5}{100}$$

$$= 24.365$$

$A_r =$ 24.365

Answer	Notes
M1 $\frac{76.5 \times 24 + 10.5 \times 25 + 13.0 \times 26}{100}$ M2 24.365 M3 24.4	correct answer without working scores 3 24 no working scores 0

ACTIVITY 3 – AO2 Questions

Student 3

$A_r =$ 24

Answer	Notes
M1 $\frac{76.5 \times 24 + 10.5 \times 25 + 13.0 \times 26}{100}$ M2 24.365 M3 24.4	correct answer without working scores 3 24 no working scores 0

ACTIVITY 3 – AO2 Questions

Student 4

$$\frac{(24 \times 76.5) + (25 \times 10.5) + (13.0 \times 26)}{100} = 21.365$$

$A_r =$ 21.4

Answer	Notes
M1 $\frac{76.5 \times 24 + 10.5 \times 25 + 13.0 \times 26}{100}$	correct answer without working scores 3
M2 24.365	
M3 24.4	24 no working scores 0

Examiner's report

Most candidates obtained all three marks for this calculation.

A few lost a mark for not reading the question and hence not giving the final answer to one decimal place.

ACTIVITY 3 – AO2 Questions

Explain why hexane (C_6H_{14}) has a higher boiling point than butane (C_4H_{10}). **(3)**

Answer	Notes
An explanation that links the following three points	
M1 hexane is a larger molecule/longer chain ORA	ALLOW contains more carbon (and hydrogen) atoms
M2 stronger intermolecular forces between the molecules ORA	no M2 or M3 if any mention of breaking covalent bonds
M3 so more energy to overcome the forces ORA	

ACTIVITY 3 – AO2 Questions

Student 1

(hexane) is a longer chain it ~~has more chains~~ of hydrocarbons so it requires more energy to break those chains. Butane has ~~less chains of~~ a shorter chain of hydrocarbons meaning less bonds to break therefore requiring less energy to break the bonds in order to boil compared to hexane.

Answer	Notes
An explanation that links the following three points	
M1 hexane is a larger molecule/longer chain ORA	ALLOW contains more carbon (and hydrogen) atoms
M2 stronger intermolecular forces between the molecules ORA	no M2 or M3 if any mention of breaking covalent bonds
M3 so more energy to overcome the forces ORA	

ACTIVITY 3 – AO2 Questions

Student 2

hexane has more covalent bonds as there are more atoms. These covalent bonds require more energy or energy as these covalent bonds are strong and there are more of them. hexane has more carbon atoms the butane hexane has more covalent bonds the butane

Answer	Notes
An explanation that links the following three points	
M1 hexane is a larger molecule/longer chain ORA	ALLOW contains more carbon (and hydrogen) atoms
M2 stronger intermolecular forces between the molecules ORA	no M2 or M3 if any mention of breaking covalent bonds
M3 so more energy to overcome the forces ORA	

ACTIVITY 3 – AO2 in exams

Student 3

Hexane has a higher boiling point than butane because it is larger so there is more area for weak intermolecular forces between the molecules therefore there are more intermolecular forces of attraction in hexane so the intermolecular forces of attraction will be stronger and will need more energy to break this means that hexane will have a higher boiling point than butane.

Answer	Notes
An explanation that links the following three points	
M1 hexane is a larger molecule/longer chain ORA	ALLOW contains more carbon (and hydrogen) atoms
M2 stronger intermolecular forces between the molecules ORA	no M2 or M3 if any mention of breaking covalent bonds
M3 so more energy to overcome the forces ORA	

ACTIVITY 3 – AO2 Questions

Student 4

it has a higher boiling point as it has a longer chain as it includes more carbons and hydrocarbons therefore if there is more then more heat will be needed to break down the alkanes into shorter more useful alkanes.

Answer	Notes
An explanation that links the following three points	
M1 hexane is a larger molecule/longer chain ORA	ALLOW contains more carbon (and hydrogen) atoms
M2 stronger intermolecular forces between the molecules ORA	no M2 or M3 if any mention of breaking covalent bonds
M3 so more energy to overcome the forces ORA	

Examiner's report

Despite the overuse of intermolecular forces elsewhere in the paper, most candidates referenced the breaking of covalent bonds
when discussing the difference in the melting point of hexane and butane.

This resulted in loss of M2 and no access to M3 due to the larger amount of energy being related to the wrong attractive force.

Preparing students for AO2

Teaching approaches:

Is it better to present facts or to teach principles? Why?

Questioning styles:

Is it better to ask closed or open questions? Why?

Assessment activities:

Is it better to set formative or summative assessments? Why?

Exam preparation:

What else could you do to prepare your students to answer the AO2 exam questions?

AO2

Question styles

- Think about one of the topics that you teach which often has AO2 questions in exams.
- What sorts of questions do you ask in class when teaching this topic?
- How do these questions help students to prepare for AO2 questions?

AO2

Homework activities

- Why do you set homework?
- What sort of questions/problems do you set?
- What do you expect students to gain from the questions that you set?
- Will what they gain help them to answer AO2 questions?

AO3

What is AO3?

AO3 assesses the practical skills and understanding gained by students as they undertake practical work

AO3 questions may require RECALL of practical techniques and understanding or APPLICATION of these to new situations

AO3 may also involve the use of experimental data, and the evaluation of experimental methods or results

AO3 questions may require students to plan an experiment

AO3: Application of a Practical Technique

A student reacts dilute nitric acid with an excess of magnesium powder as a first step in the preparation of dry crystals of hydrated magnesium nitrate.

Describe how the student can obtain dry crystals of hydrated magnesium nitrate from the mixture at the end of the reaction. **(5)**

AO3: Analysis of results – Data

A student investigates the reactivities of four metals, aluminium, magnesium, copper and metal X.

The student adds pieces of magnesium ribbon to aqueous solutions of the sulfates of each metal.

After a few minutes the student removes the pieces of magnesium ribbon and records the appearance of each piece of magnesium.

Table 1 shows the student's results.

Solution	Appearance
aluminium sulfate	grey coating on magnesium
magnesium sulfate	no change
copper(II) sulfate	brown coating on magnesium
sulfate of metal X	grey coating on magnesium

Table 1

magnesium /Mg - most reactive
aluminium /Al
X
copper /Cu - least reactive

X - zinc / iron

The student repeats the experiment with pieces of metal X instead of pieces of magnesium.

Table 2 shows the student's results.

Solution	Appearance
aluminium sulfate	no change
magnesium sulfate	no change
copper(II) sulfate	brown coating on metal X
sulfate of metal X	no change

Table 2

Use the information from both tables to deduce the order of reactivity of aluminium, magnesium, copper and metal X. (2)

Give a possible identity for metal X. (1)

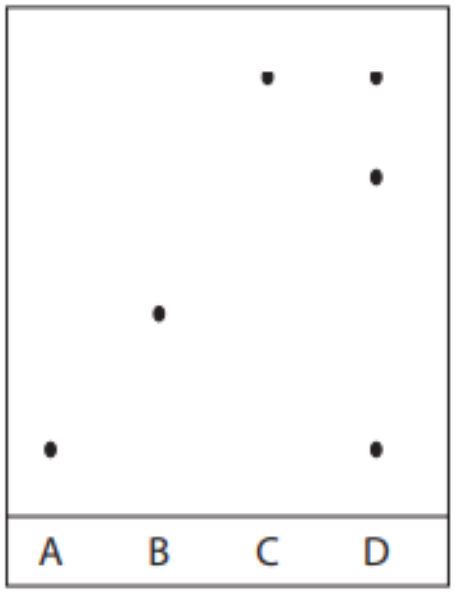
AO3: Analysis of results – Diagram

Food colourings are mixtures of food dyes.

A student uses paper chromatography to separate the food dyes contained in food colouring D.

The student places spots of three food dyes A, B and C and food colouring D on chromatography paper.

The diagram shows the appearance of the paper after the experiment.



Describe the composition of food colouring D. (2)

Any two from:

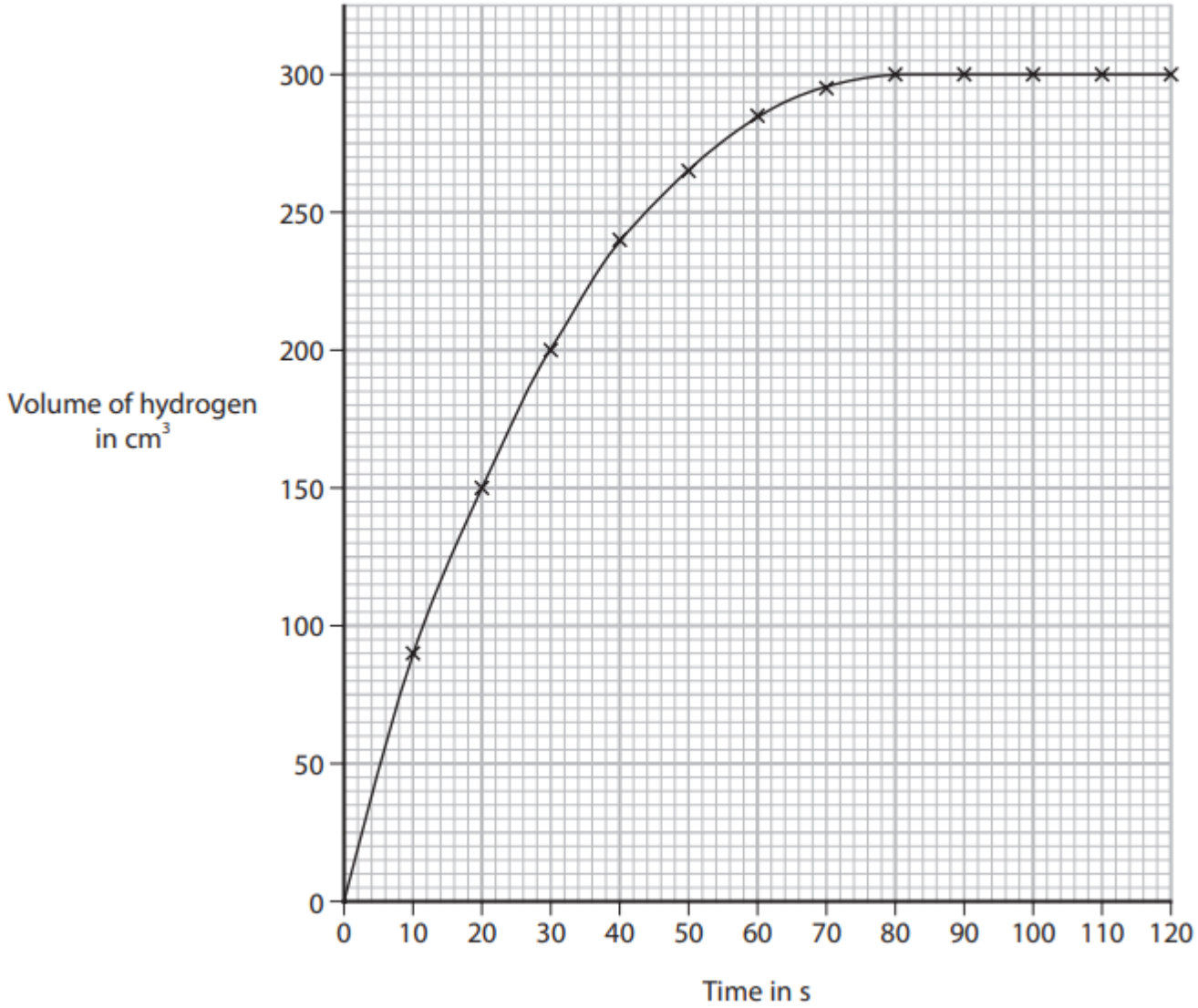
M1 D contains 3 food dyes

M2 food colouring D contains A and C

M3 food colouring D does not contain B / food colouring D contains another dye (which is not A, B or C)

AO3: Analysis of results – Graph

A student reacts dilute nitric acid with an excess of magnesium powder and records the volume of hydrogen gas collected.
The graph shows the student's results.



Use the graph to calculate the rate of reaction, in cm^3/s, at t = 40 s.

Show your working on the graph.

M1 tangent drawn (at 40 s)

M2 change in volume of hydrogen ÷ change in time

M3 correct answer between 2.75 and 3.75 (cm^3/s) inclusive

AO3 – Plan an experiment

A student is given an aqueous solution of chlorine and an aqueous solution of sodium iodide.

Explain how the student can use these solutions to compare the reactivity of chlorine with the reactivity of iodine. (4)

An explanation that links the following four points

M1 add chlorine (solution) to sodium iodide (solution)

M2 solution turns brown

M3 iodine/I_2 is displaced

M4 (so) chlorine is more reactive (than iodine) ORA

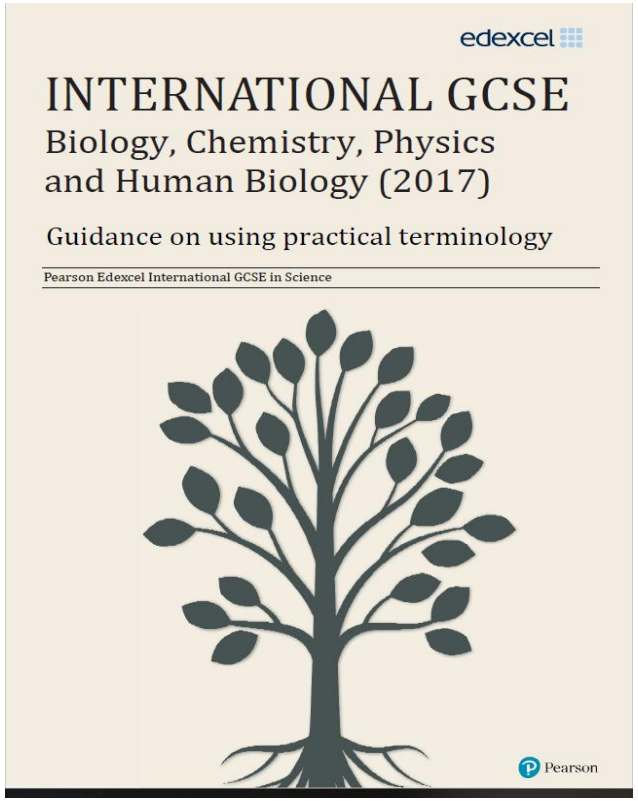
AO3 Terminology

validity

anomaly

precision

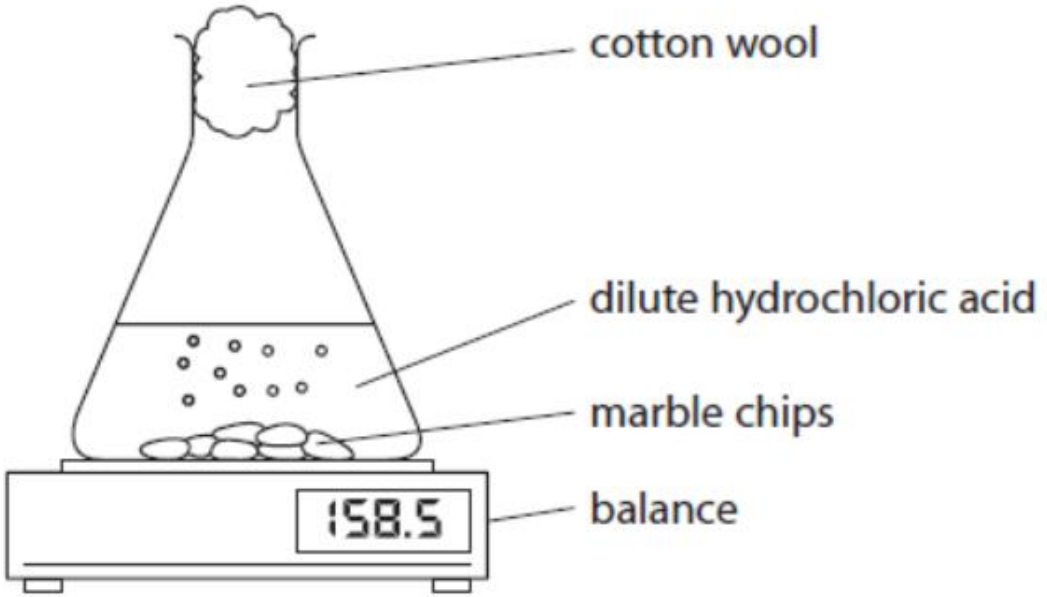
accuracy



reliability

ACCURACY

A student uses this apparatus to investigate the rate of reaction between marble chips and dilute hydrochloric acid.



(a) During the reaction, the reading on the balance decreases because mass is lost from the flask.

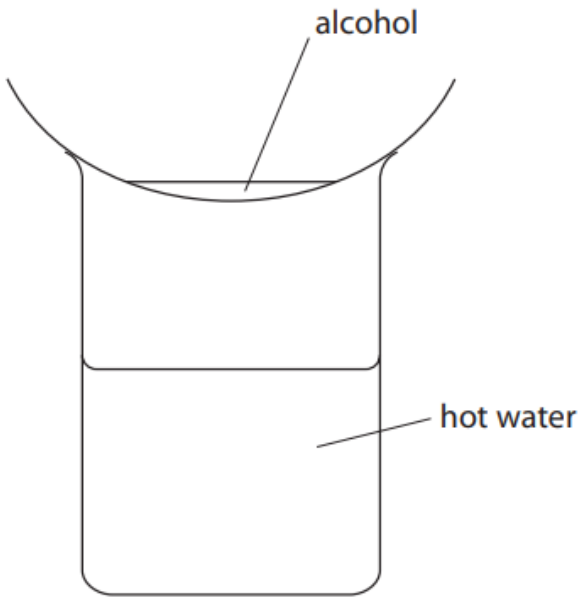
(i) Explain how using the cotton wool increases the accuracy of this investigation.

(2)

VALIDITY

Methanol, ethanol, propanol and butanol are alcohols. They are all liquids that evaporate easily when warmed.

A student uses this apparatus to compare the time taken for the four liquids to evaporate.



She uses this method.

- pour some methanol into an evaporating basin
- place the evaporating basin on top of a beaker containing hot water
- measure the time taken for the methanol to evaporate completely
- repeat the experiment with each of the other alcohols, using the same apparatus

(a) State two variables the student should control to make sure her results are valid.

AO3 – Plan an experiment

A student is given an aqueous solution of chlorine and an aqueous solution of sodium iodide.

Explain how the student can use these solutions to compare the reactivity of chlorine with the reactivity of iodine. (4)

An explanation that links the following four points

M1 add chlorine (solution) to sodium iodide (solution)

M2 solution turns brown

M3 iodine/I_2 is displaced

M4 (so) chlorine is more reactive (than iodine) ORA

AO3 Questions and Mark Schemes

ACTIVITY 4

AO3 Questions

Use the mark schemes shown on screen to mark the student responses on following slides

We will go through each question one at a time

ACTIVITY 4 – AO3 Questions

A small piece of lithium is added to a trough of water.

State two observations made when lithium reacts with water. (2)

Answer	Notes
Any 2 from	
M1 effervescence /fizzing /bubbles	IGNORE gas given off
M2 moves	moves on the surface scores M2 and M3
M3 floats	
M4 gets smaller / disappears	ALLOW dissolves
	IGNORE heat produced
	IGNORE colour change

ACTIVITY 4 – AO3 Questions

Student 1

1 It quickly melts to form a ball.

2 It floats on the surface of the water.

Answer	Notes
Any 2 from	
M1 effervescence /fizzing /bubbles	IGNORE gas given off
M2 moves	moves on the surface scores M2 and M3
M3 floats	
M4 gets smaller / disappears	ALLOW dissolves
	IGNORE heat produced
	IGNORE colour change

ACTIVITY 4 – AO3 Questions

Student 2

1 it Bubbles turns cloudy

2 it becomes warm

Answer	Notes
Any 2 from	
M1 effervescence /fizzing /bubbles	IGNORE gas given off
M2 moves	moves on the surface scores M2 and M3
M3 floats	
M4 gets smaller / disappears	ALLOW dissolves
	IGNORE heat produced
	IGNORE colour change

ACTIVITY 4 – AO3 Questions

Student 3

1 fizzing

2 gas is produced

Answer	Notes
Any 2 from	
M1 effervescence /fizzing /bubbles	IGNORE gas given off
M2 moves	moves on the surface scores M2 and M3
M3 floats	
M4 gets smaller / disappears	ALLOW dissolves
	IGNORE heat produced
	IGNORE colour change

ACTIVITY 4 – AO3 Questions

Student 4

1 There will be fizzing

2 The lithium will float on the water

Answer	Notes
Any 2 from	
M1 effervescence /fizzing /bubbles	IGNORE gas given off
M2 moves	moves on the surface scores M2 and M3
M3 floats	
M4 gets smaller / disappears	ALLOW dissolves IGNORE heat produced IGNORE colour change

Examiner's report

Question 2(a) is a familiar and well-established question.

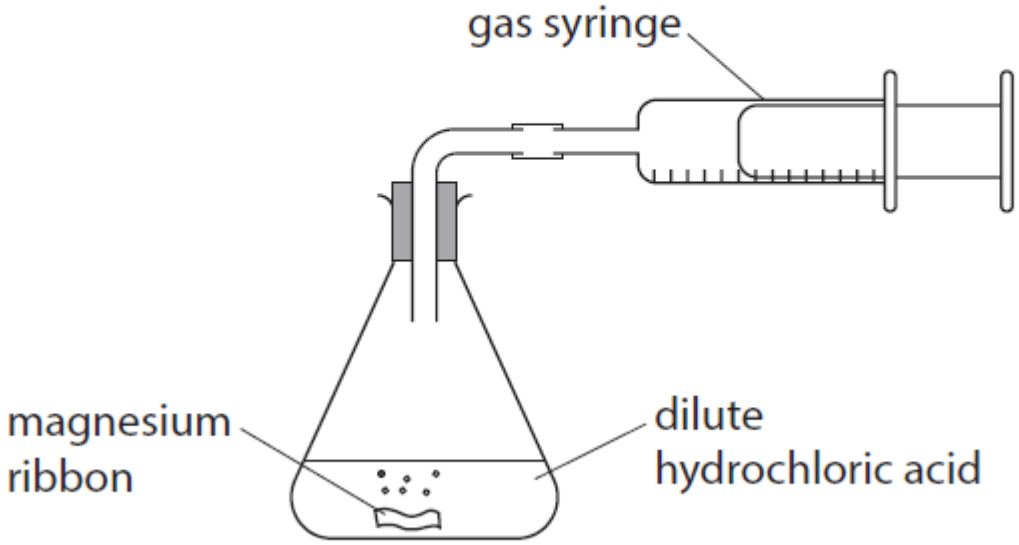
Most candidates picked up at least one mark, usually for stating that the substance got smaller or dissolved.

Some candidates gave answers linked to other Group 1 elements such as the appearance of a flame or the substance turning into a ball.

Candidates should be encouraged to provide the requested number of observations asked for in the question rather than potentially losing marks based on giving a list of answers with incorrect responses.

ACTIVITY 4 – AO3 Questions

Magnesium reacts with dilute hydrochloric acid to form magnesium chloride and hydrogen.
The hydrogen is collected in a gas syringe.



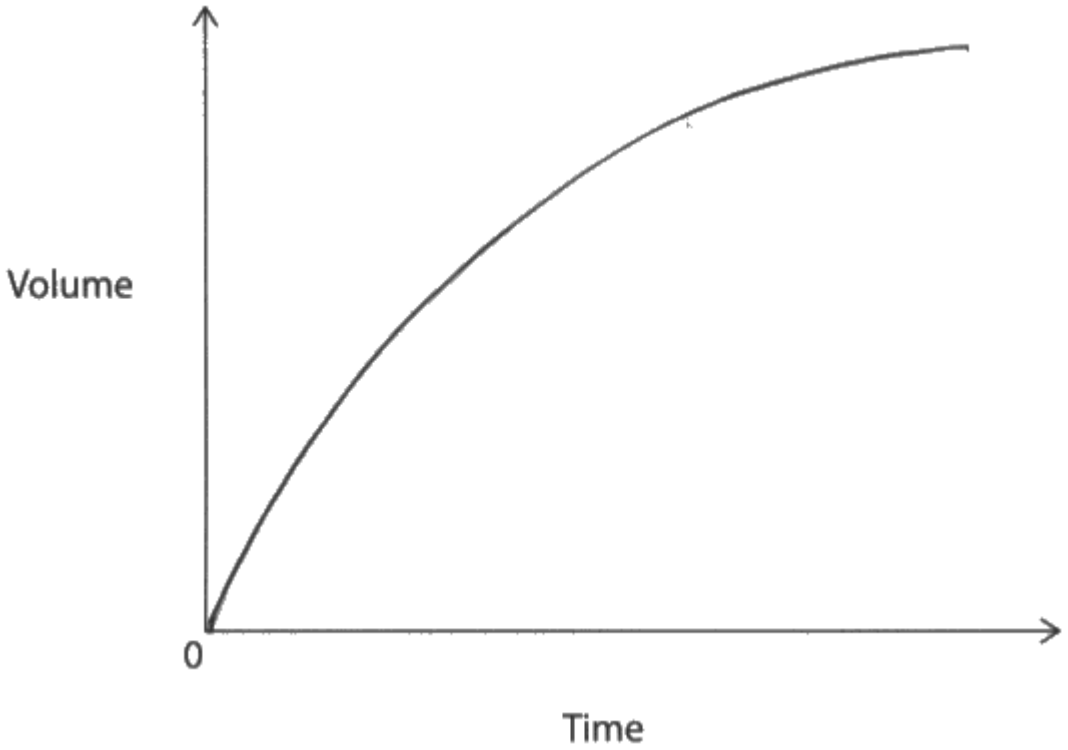
The reaction is exothermic and magnesium is in excess.

Draw a sketch graph to show how the volume of hydrogen changes with time until the reaction has finished. (2)

Answer	Notes
M1 smooth curve starting at the origin	
M2 levels off horizontally at constant volume	M2 depends on rising

ACTIVITY 4 – AO3 Questions

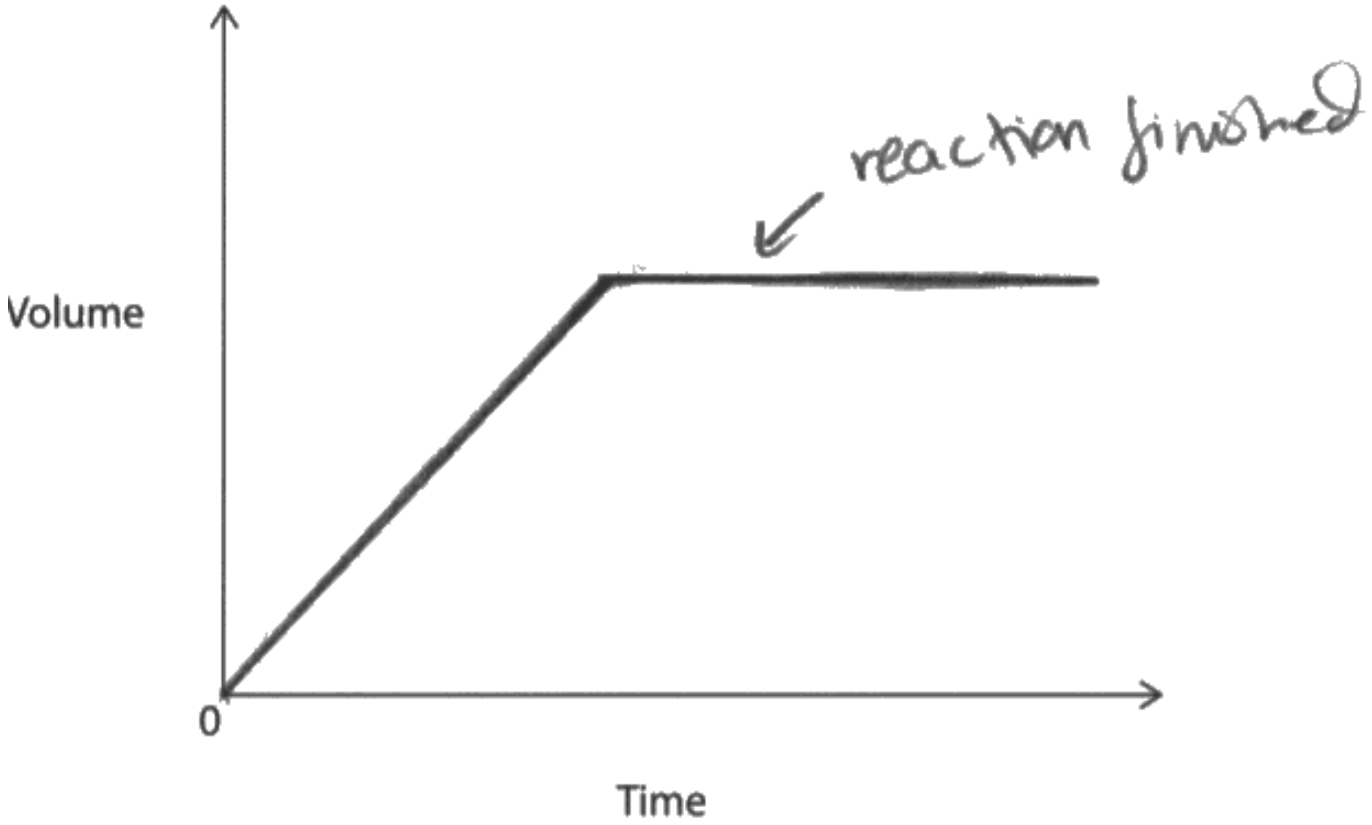
Student 1



Answer	Notes
M1 smooth curve starting at the origin	
M2 levels off horizontally at constant volume	M2 depends on rising

ACTIVITY 4 – AO3 Questions

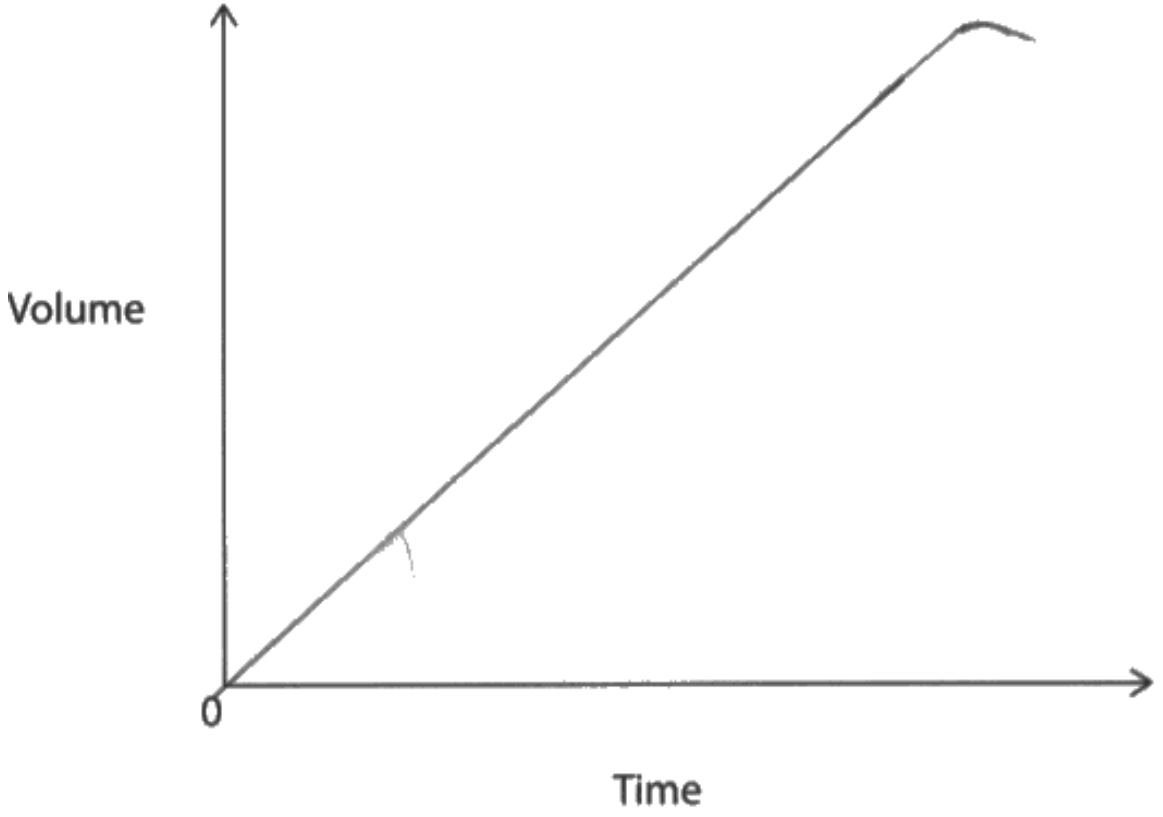
Student 2



Answer	Notes
M1 smooth curve starting at the origin M2 levels off horizontally at constant volume	 M2 depends on rising

ACTIVITY 4 – AO3 Questions

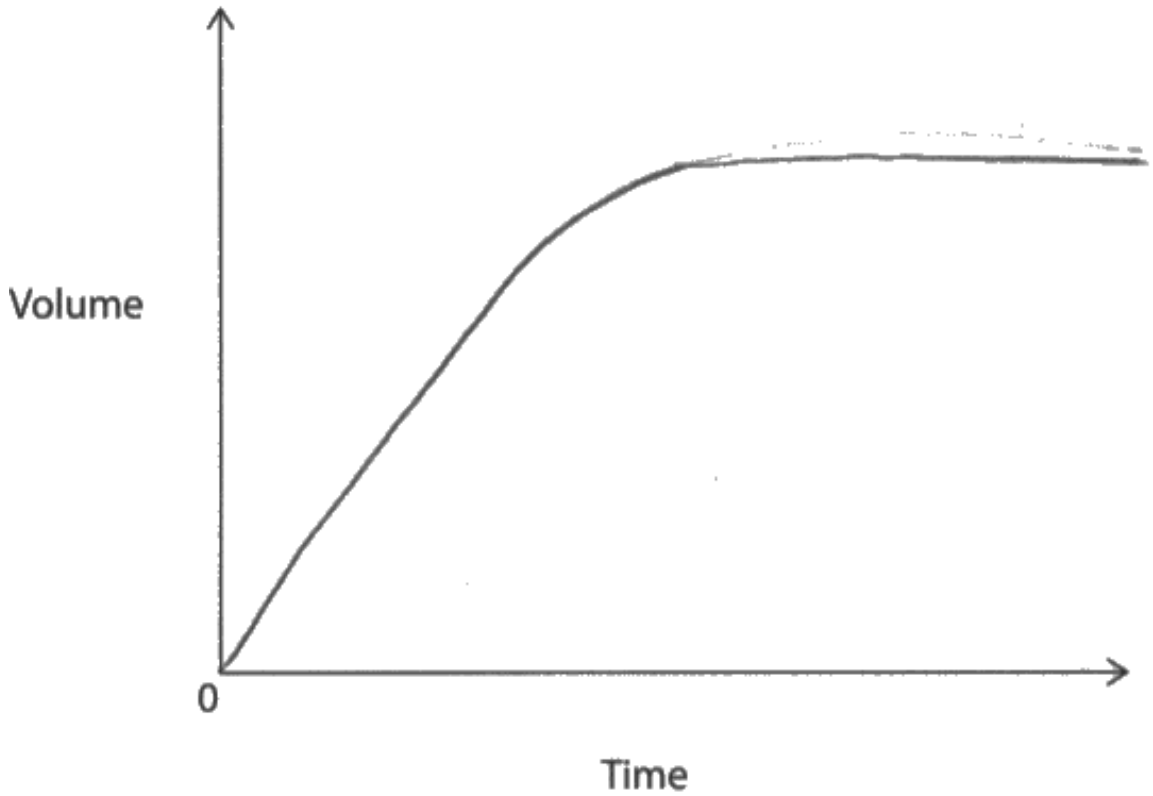
Student 3



Answer	Notes
M1 smooth curve starting at the origin M2 levels off horizontally at constant volume	 M2 depends on rising

ACTIVITY 4 – AO3 Questions

Student 4



Answer	Notes
M1 smooth curve starting at the origin	
M2 levels off horizontally at constant volume	M2 depends on rising

Examiner's report

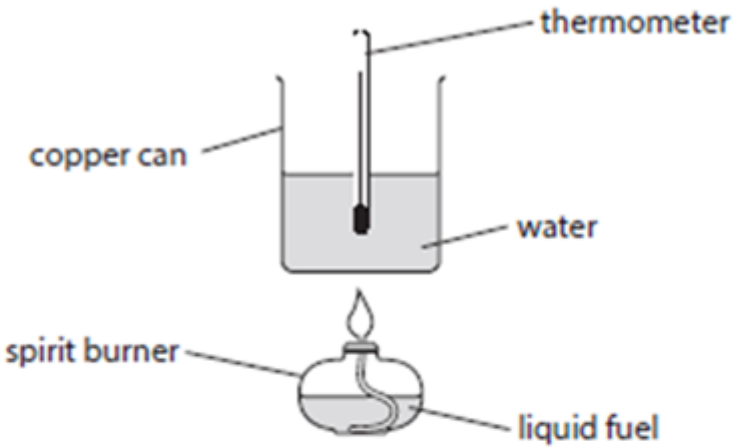
In order to obtain two marks, the curve must start at the origin, smooth and be followed by a horizontal line.

Some lost the mark for a straight line from the origin or others did not do a horizontal line.

Most gained at least one mark.

ACTIVITY 4 – AO3 Questions

A student uses this apparatus to investigate the energy content of different fuels.



This is the student's method.

- pour some water into the copper can
- record the mass of the spirit burner and fuel
- measure the initial temperature of the water
- place the spirit burner under the copper can and light the burner
- stop heating the water when the temperature reaches 30°C
- record the new mass of the spirit burner and fuel

The student repeats the experiment with different fuels.

Explain two variables the student should control to make this a valid test. (4)

Answer	Notes
An explanation that links any two pairs	
Pair 1	
M1 same volume of water	ALLOW same mass of water
M2 so the same amount of fuel/heat is required	IGNORE references to time
Pair 2	
M1 stir the water	
M2 so the temperature is uniform throughout the water	
Pair 3	
M1 to make sure the spirit burner is the same distance to the copper can	ALLOW the wick is the same height
M2 so the same amount of heat loss occurs	ALLOW any other acceptable answer

ACTIVITY 4 – AO3 Questions

Student 1

1 amount of water in the copper can, more water would take more time to heat up, making it an unfair experiment

2 distance ~~of the cup from the~~ of the copper cup from the spirit burner, if it is further away less heat energy would be reach the cup as more would have been dispersed

Answer	Notes
An explanation that links any two pairs **Pair 1** M1 same volume of water	ALLOW same mass of water
M2 so the same amount of fuel/heat is required	IGNORE references to time
Pair 2 M1 stir the water	
M2 so the temperature is uniform throughout the water	
Pair 3 M1 to make sure the spirit burner is the same distance to the copper can	ALLOW the wick is the same height
M2 so the same amount of heat loss occurs	ALLOW any other acceptable answer

ACTIVITY 4 – AO3 Questions

Student 2

1 Use the same volume of water to ensure it is a fair test

2 Keep the position of the spirit burner the same so it is a fair test

Answer	Notes
An explanation that links any two pairs	
Pair 1	
M1 same volume of water	ALLOW same mass of water
M2 so the same amount of fuel/heat is required	IGNORE references to time
Pair 2	
M1 stir the water	
M2 so the temperature is uniform throughout the water	
Pair 3	
M1 to make sure the spirit burner is the same distance to the copper can	ALLOW the wick is the same height
M2 so the same amount of heat loss occurs	ALLOW any other acceptable answer

ACTIVITY 4 – AO3 Questions

Student 3

1 Measure volume of water added into the copper can do this with a measuring cylinder

2 Control the tempreture using thermometer ~~stir~~

Answer	Notes
An explanation that links any two pairs **Pair 1**	
M1 same volume of water	ALLOW same mass of water
M2 so the same amount of fuel/heat is required	IGNORE references to time
Pair 2	
M1 stir the water	
M2 so the temperature is uniform throughout the water	
Pair 3	
M1 to make sure the spirit burner is the same distance to the copper can	ALLOW the wick is the same height
M2 so the same amount of heat loss occurs	ALLOW any other acceptable answer

ACTIVITY 4 – AO3 Questions

Student 4

1 To use the same volume of liquid fuel for each experiment. ~~so th~~

2 To use the same amount of water for each experiment as a higher volume or mass would take longer to heat up.

Answer	Notes
An explanation that links any two pairs	
Pair 1	
M1 same volume of water	ALLOW same mass of water
M2 so the same amount of fuel/heat is required	IGNORE references to time
Pair 2	
M1 stir the water	
M2 so the temperature is uniform throughout the water	
Pair 3	
M1 to make sure the spirit burner is the same distance to the copper can	ALLOW the wick is the same height
M2 so the same amount of heat loss occurs	ALLOW any other acceptable answer

Examiner's report

The most common mark was M1, but there was a wide spread of marks achieved by candidates.

The quality of responses was not as strong as in other parts of the paper, with less precise language and a lack of familiarity with determining control variables in a practical context proving to be a challenge.

Many candidates explained their control variables by linking them to time, or they misunderstood the purpose of the experiment and suggested controlling the mass of the fuel instead.

While most candidates recognised that the volume or mass of water should remain the same, this was often justified in terms of the time the experiment would take, rather than the energy required to cause a temperature change.

Although some candidates identified the distance from the flame to the can as a variable, they rarely explained how this would affect heat loss.

Candidates often failed to clearly express their reasoning and sometimes contradicted themselves.

Only a comparatively small number of candidates achieved full marks with an explanation that was both clear and well-structured.

Teaching AO3

Doing practical work

- The specifications for International GCSE Chemistry contain a number of practical activities that form part of the subject content
- Exam questions expect students to be familiar with methods for each of these practicals
- Questions also expect students to apply their knowledge of practical methodology to unfamiliar scenarios

Teaching AO3

Doing practical work

Some points for you to think about:

- Why should students do practical work?
- Are students getting knowledge or skills from practical activities?
- When do you do practical activities: before or after teaching the theory of a topic?

Preparing students for AO3

Teaching approaches: fact .v. investigative

Why does copper turn black when heated in air using a Bunsen burner?

Fact: Copper reacts with oxygen to form copper(II) oxide

Investigative: What may have caused the black substance to appear?

Answer – the Bunsen flame or the air

How can we find out which?

Answer – heat the copper in a vacuum (not practical)

OR

– heat the copper in a test tube so it is not in contact with the Bunsen flame

Preparing students for AO3

Teaching approaches: fact .v. investigative

Investigative: The copper stills turns black so it must be something in the air

How can we find out which gas in the air is responsible?

Answer – heat copper in each gas separately (not practical)

– heat copper in a sample of air and find out the percentage of gas used up

– ≈20% used up, so copper has combined with oxygen

Preparing students for AO3

- **Good, I'm glad it's gone wrong!**
- Add 1 cm depth of 1 mol/dm^3 hydrochloric acid to each of three boiling tubes
- Leave one tube at room temperature
- Place the second in a water bath at ≈ 40°C
- Place the third in a water bath at ≈ 60°C
- You are going to add a 1 cm strip of clean magnesium ribbon to each tube and measure how long it takes for the magnesium ribbon to completely disappear
- Predict the order of disappearance and then do the experiment

Preparing students for AO3

Prediction – magnesium disappears first at 60°C and last at room temperature

Outcome – magnesium usually disappears first at room temperature and last at 60°C

Explanation – gas given off so violently at 60°C that the magnesium continuously lifts off the acid and falls back down
– at room temperature the magnesium sinks

EXAM TECHNIQUE

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The Exam Paper

Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name, centre number and candidate number.
- Answer **all** questions.
- Answer the questions in the spaces provided
  – *there may be more space than you need.*
- Show all the steps in any calculations and state the units.
- Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.

Information

- The total mark for this paper is 110.
- The marks for **each** question are shown in brackets
  – *use this as a guide as to how much time to spend on each question.*

Advice

- Read each question carefully before you start to answer it.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.

Exam Technique

Preparation

- Effective exam techniques need to be practised by students using past papers or part-papers; perhaps ‘home-made’ papers using Exam Wizard tailored to suit the exercise or focused on the particular technique being practised
- Give students such a paper to practice how to access it
- Give students mark schemes so they can learn what is expected
- Having a ‘go to’ strategy, a starting point, builds confidence and reduces the stress of ‘what do I do first’

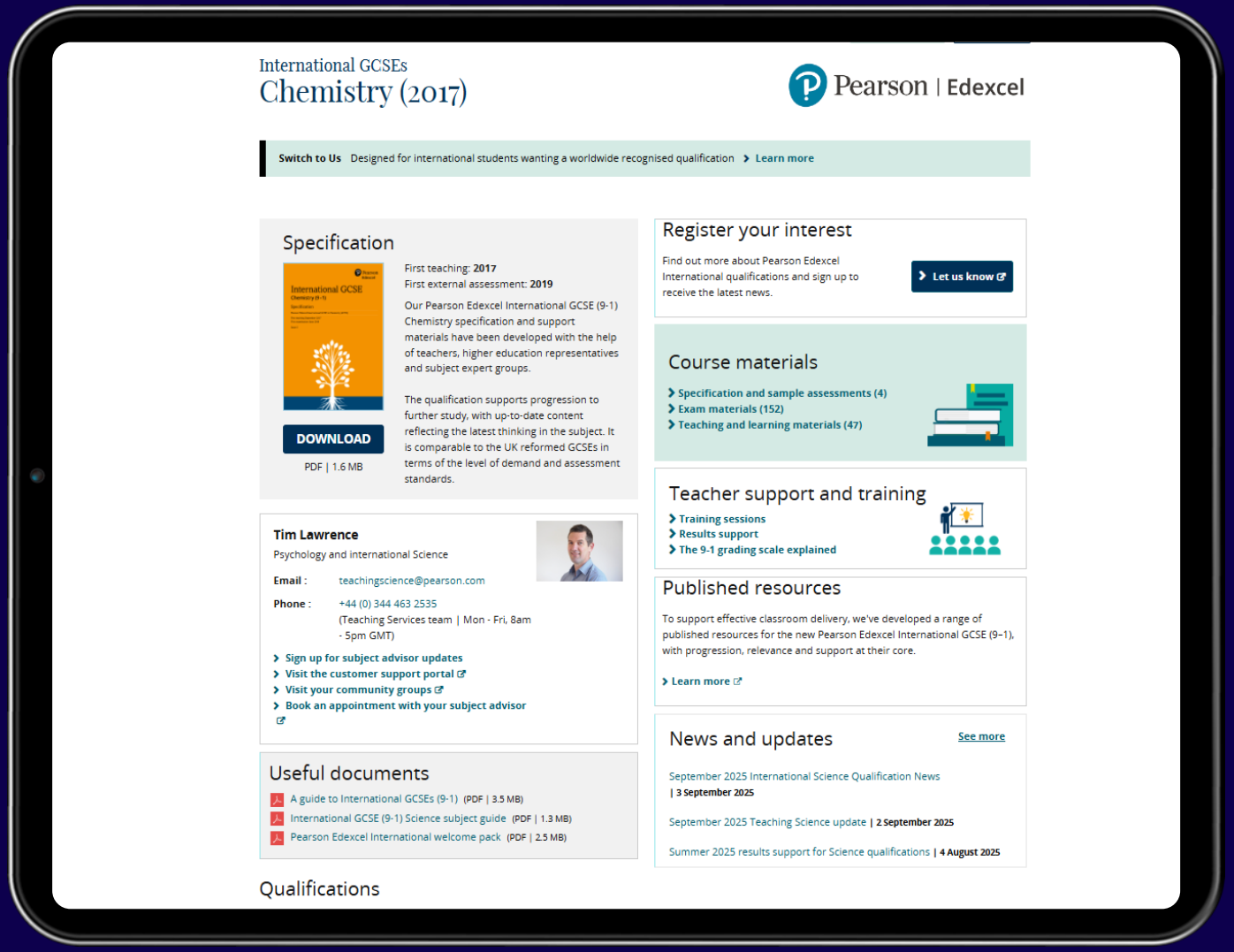
Exam strategy – one way to tackle a paper

- Look through the whole paper first, underlining (or, better, highlighting) the command words in each question
- Decide which question to do first – start with the question(s) you feel most confident with, which is not necessarily question 1
- Read question carefully – **do not repeat stem in your answer**
- Do not give up on a whole question if you find one section of the question difficult – move on to the next part
- The same strategy holds for whole questions you find difficult – move on
- Come back to missed questions and parts of questions when you have picked off all the 'low-hanging fruit'

Walking-talking mocks

- Students sit in the same exam room where they will do their exam, preferably in the same seats (it can be done in the classroom, but not always as effective in building confidence in exam conditions)
- Students are given an exam paper which is as close to being like the real thing as possible (i.e. exam writing booklet if relevant)
- Students are literally walked through every question on the paper – the person leading the session talks them through the smallest steps, such as underlining key words, how to plan, things to remember, etc.
- You might focus on a particular area – such as mathematical questions, or questions based on devising a practical investigation
- Students then write their responses in timed conditions

Support for you at every Stage



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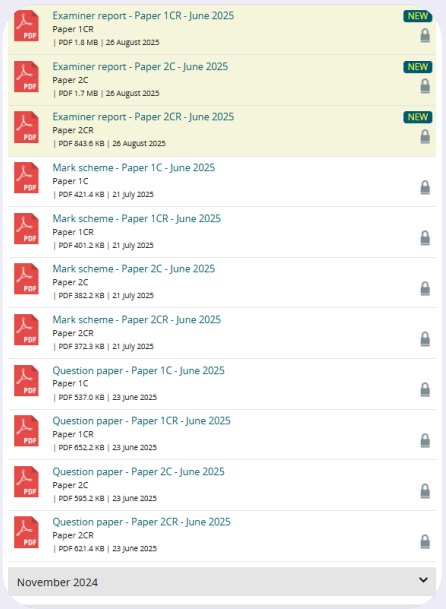
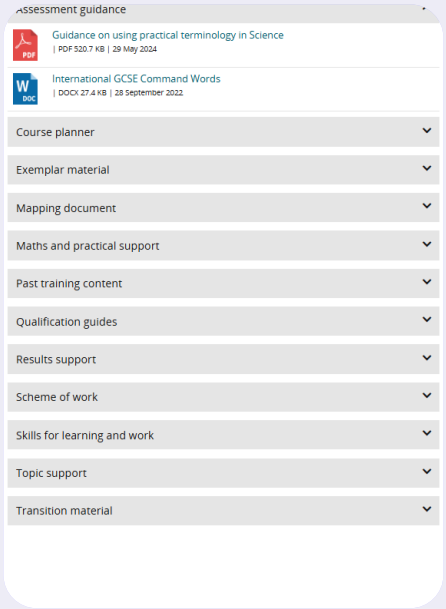
Teaching and Learning Materials

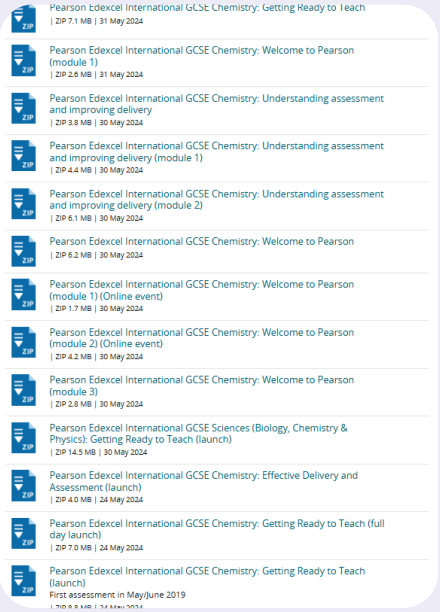
Specification



Past Papers



Teaching and Learning Materials



Past Training Content

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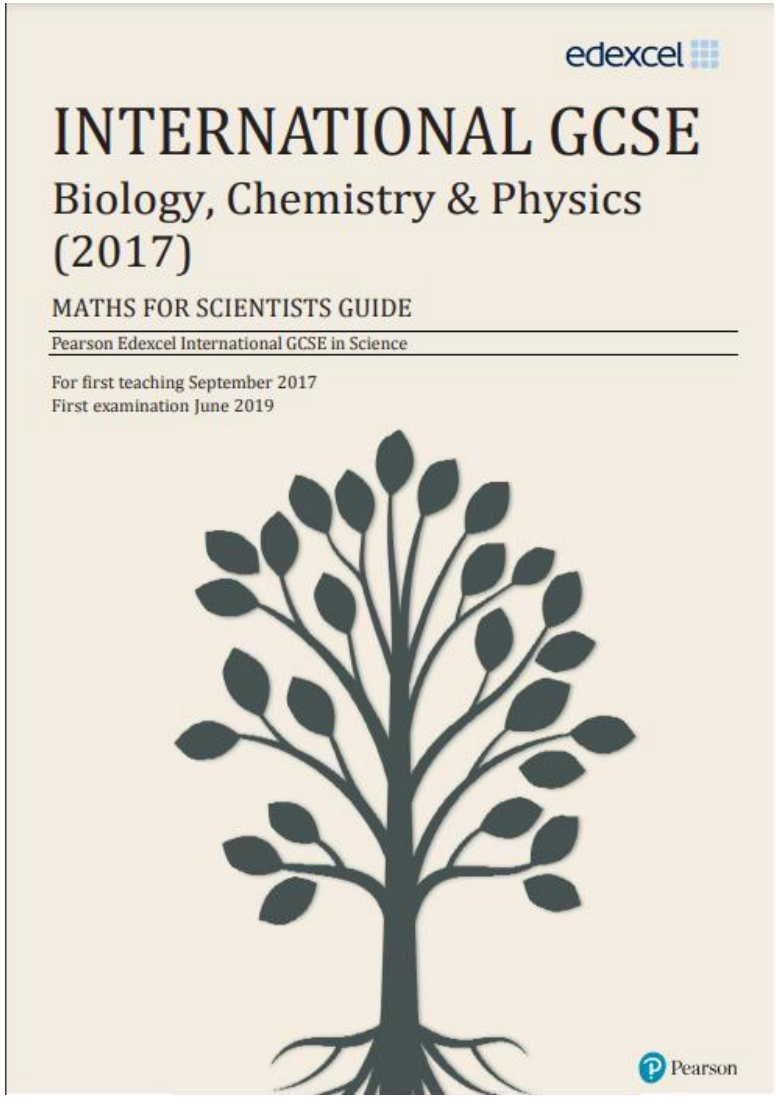
Guides

Maths for Scientists Guide

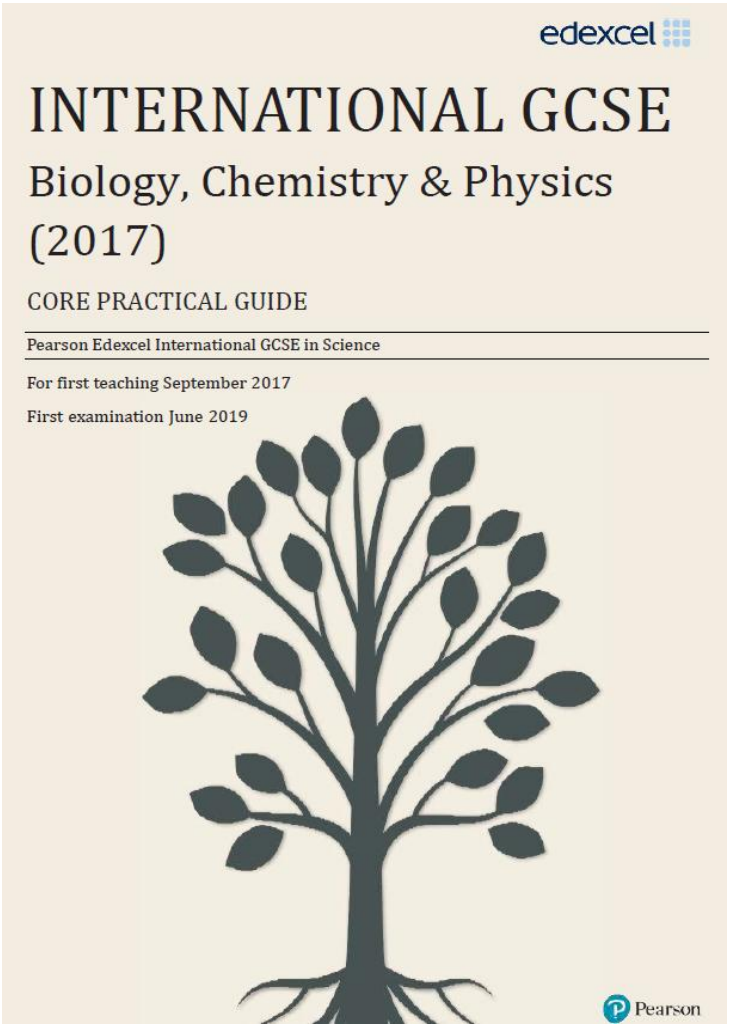
This guide to maths for scientists outlines the content that students will have covered in their maths lessons throughout KS3 and KS4



Guides

Core Practical Guide

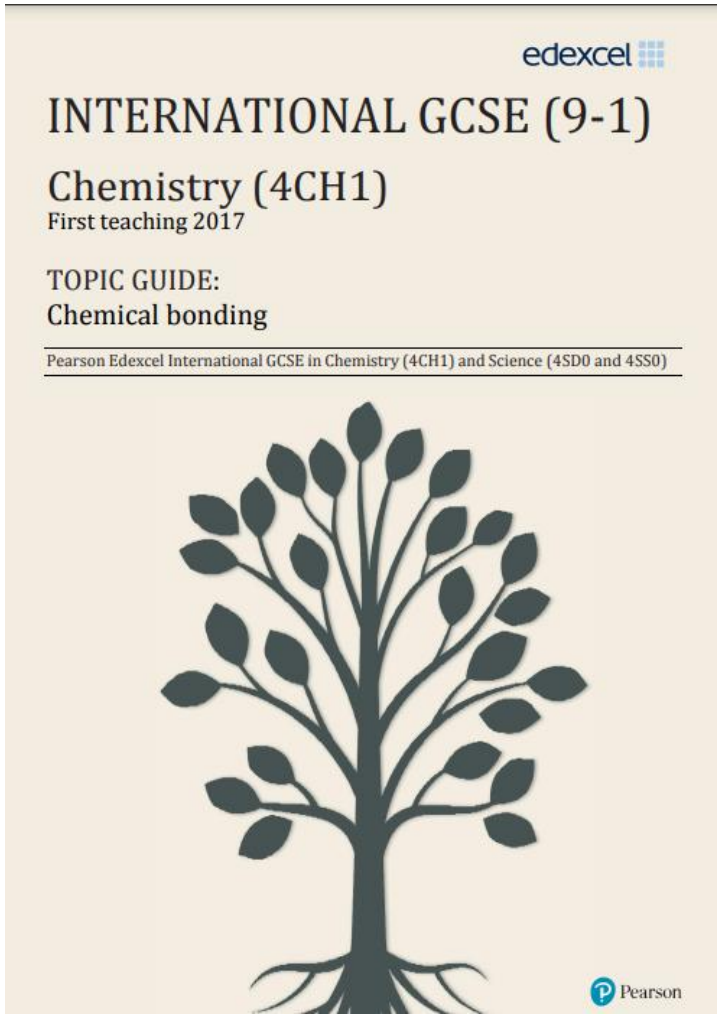
- An introduction to each practical activity
- Description of the practical, with some useful hints and tips
- Questions to use with students to test their understanding as they do the experiment in the lab
- A past paper question, where relevant, to use as a homework activity



Guides

Topic Guide: Chemical Bonding

- Chemical bonding (and related ideas about chemical stability/reactivity) is acknowledged as being a ‘tricky to teach’ topic, and with good reason

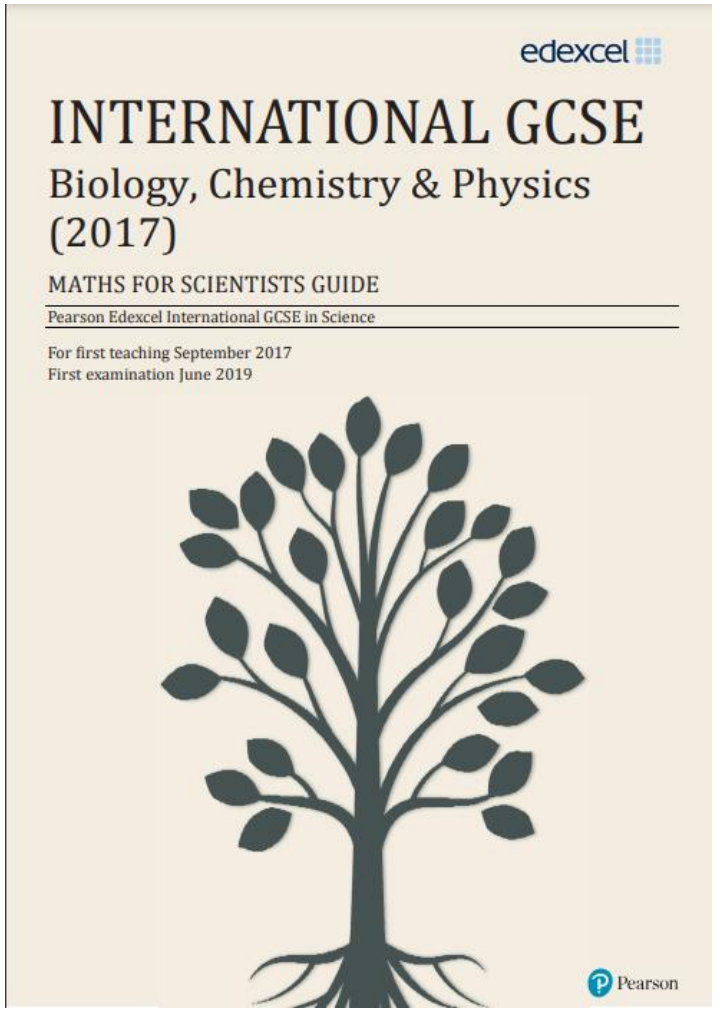


Guides

Topic Guide: Chemical Equilibrium

- In 1984 R.T. Allsop and N.H. George wrote an article, published in Education in Chemistry, entitled 'Le Châtelier – A Redundant Principle?' in which they argued that the use of the principle was counterproductive to the understanding of chemical equilibrium

- Although Le Châtelier's Principle is not required for teaching the International GCSE Chemistry specification, a number of students refer to it in answers



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- Provides detailed analysis of your learners performance.
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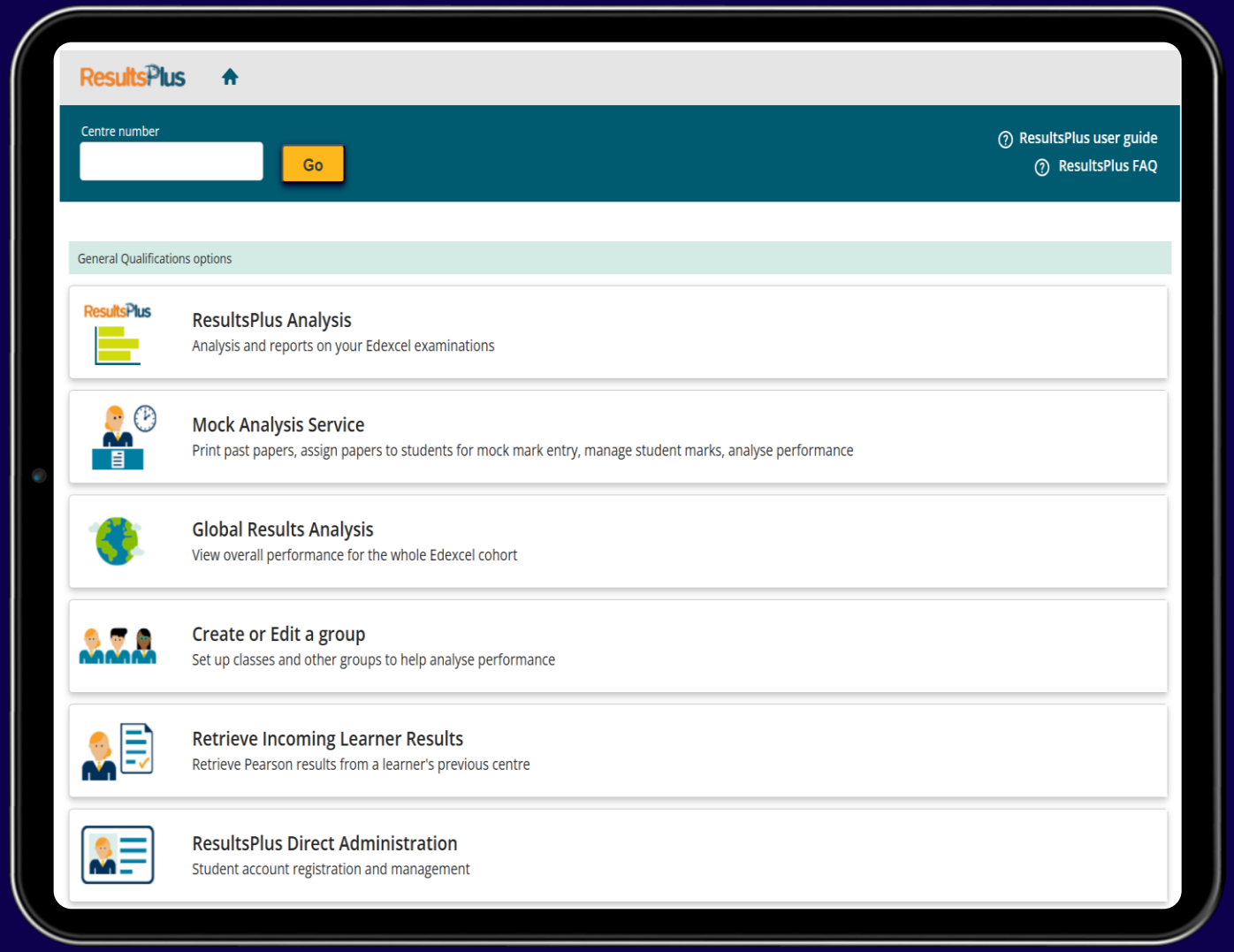

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Exam Wizard

- Saves time by creating your own mock paper exams, topic tests, homework or revision activities.
- Uses our Pearson back catalogue of exam questions to practice and develop these skills with your learners'.
- Gain access to past papers and test questions to create tailored learners plans, which target individuals weaknesses.
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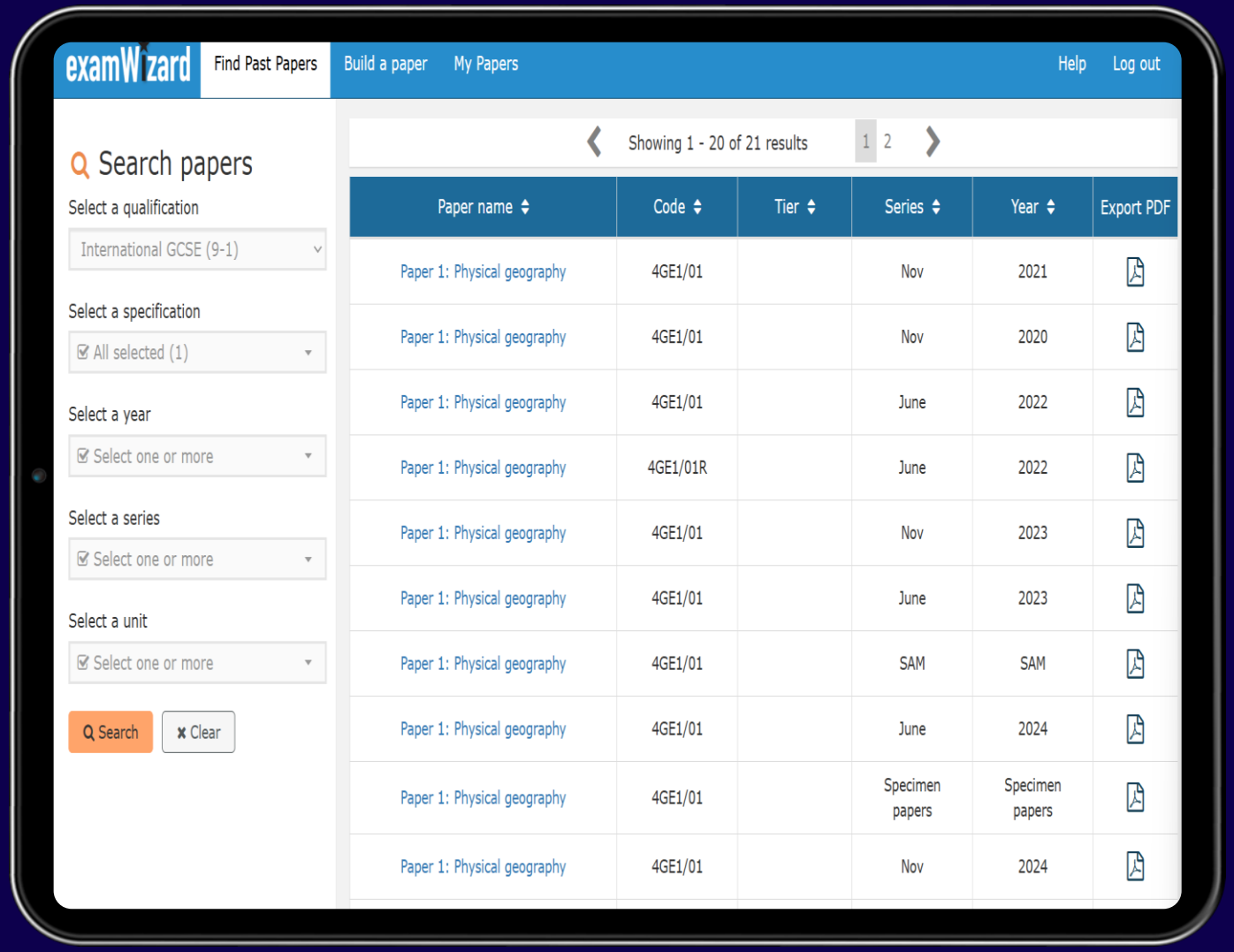

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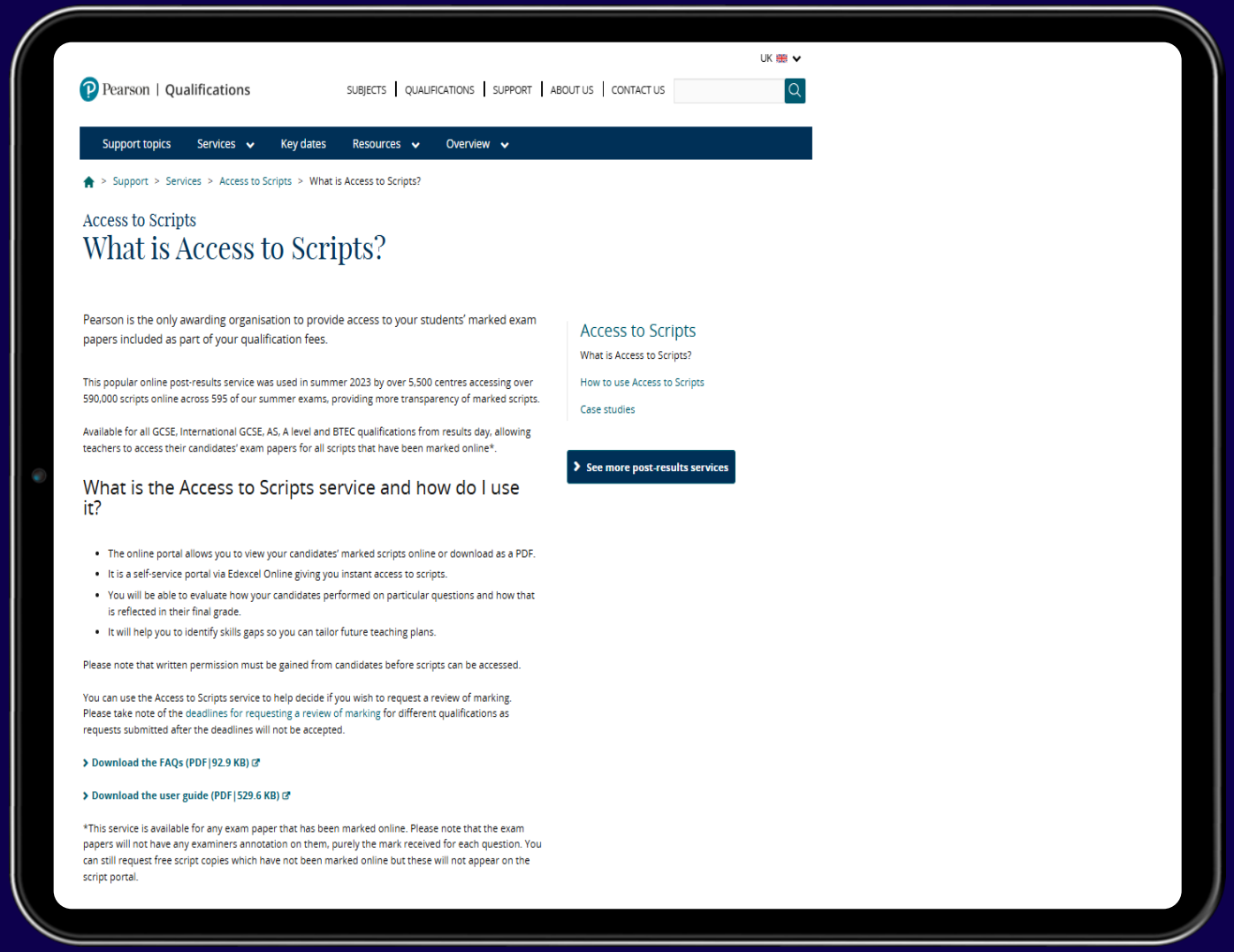

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Pearson published resources

Student Book

Edexcel International GCSE (9-1): Chemistry Student Book

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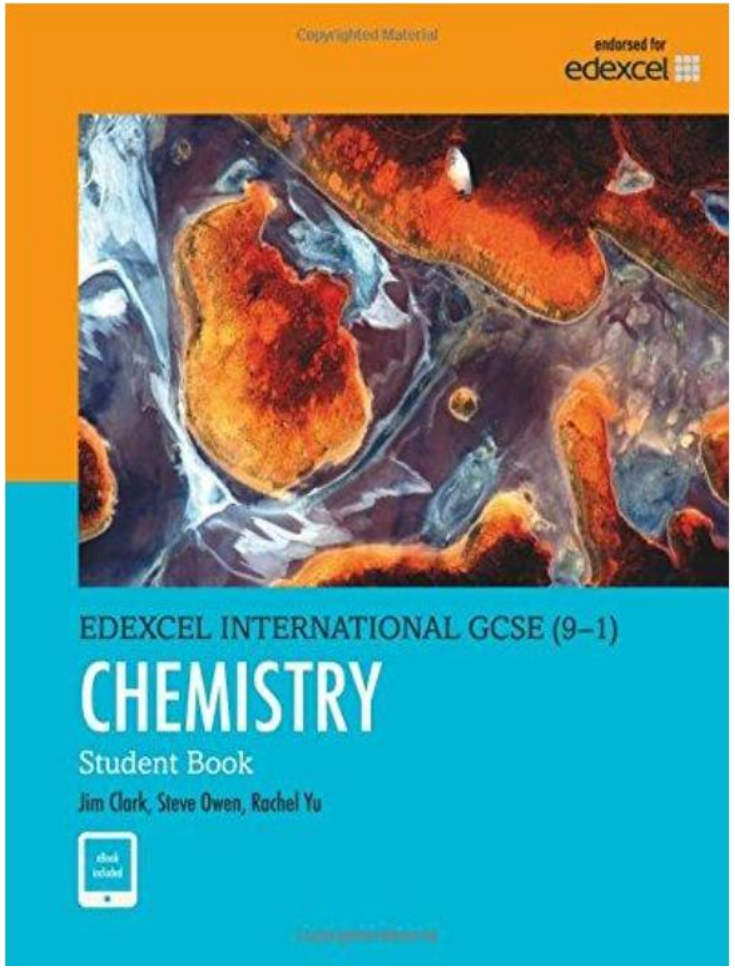

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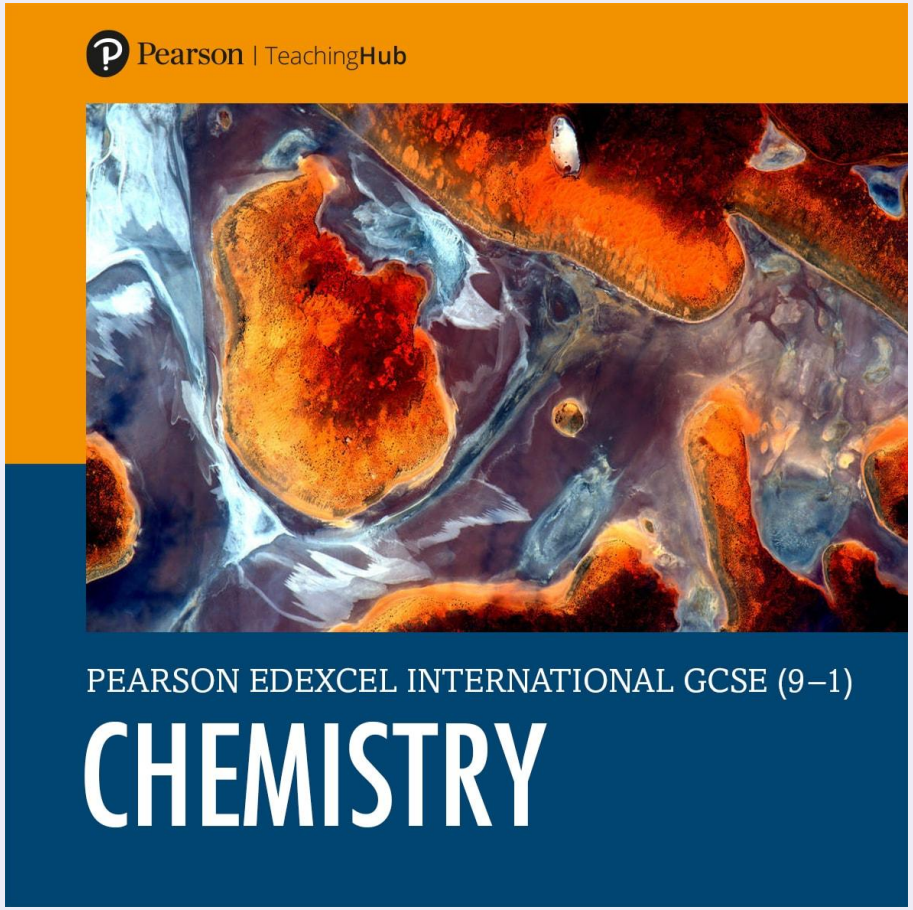

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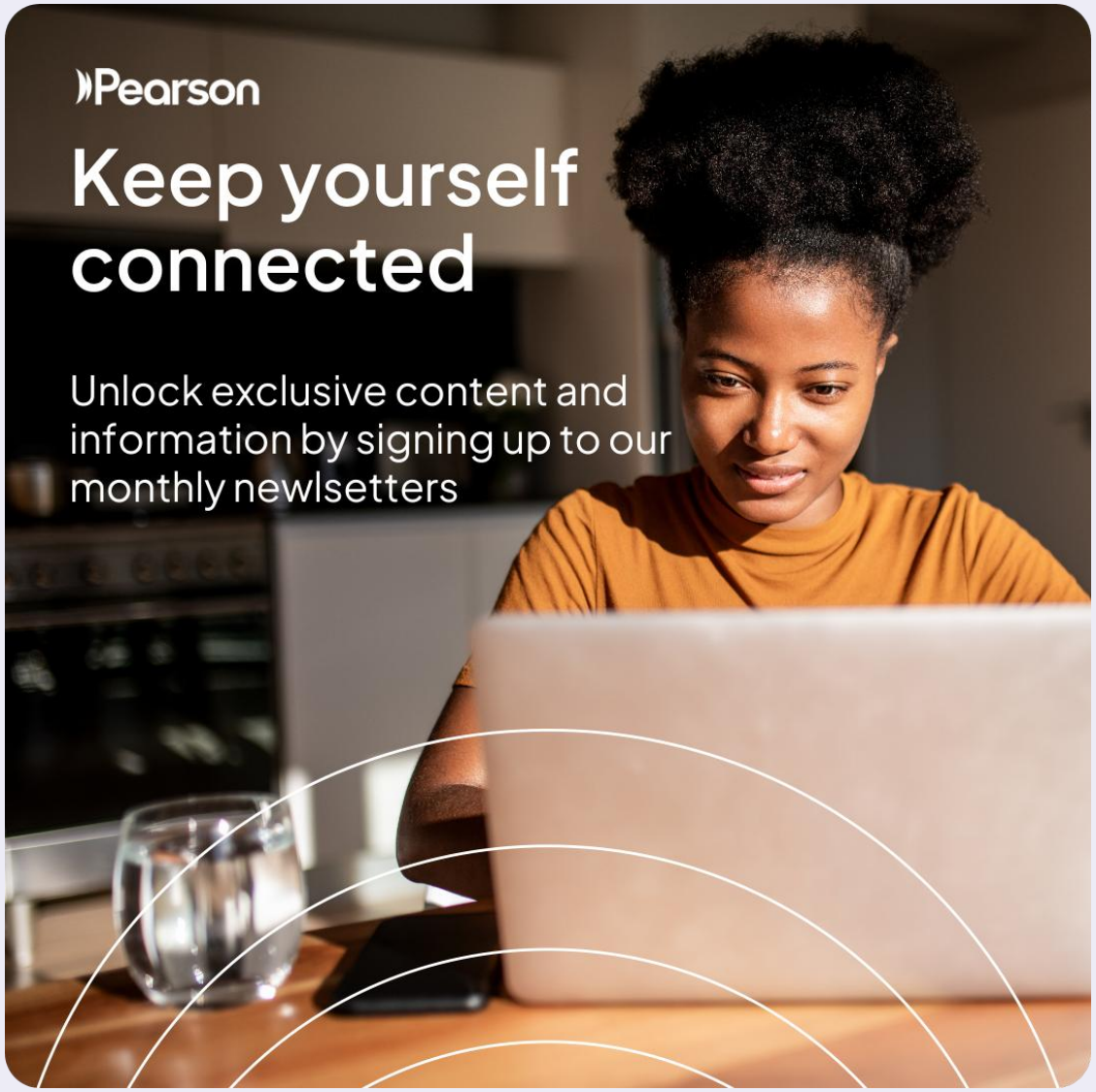

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Questions

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Thank you