Pearson Edexcel

Our focus on accessible exam papers

GCSE (9-1) Sciences

Nigel English

Our focus on accessible exam paper

Nigel English – Overarching Chair of Examiners

Our learners are at the heart of our assessments and the senior examiners are careful to develop questions that students can access and that will examine what students know and can apply.

Our papers go through a rigorous process of quality checks. At each stage of the development of a question paper, the review of the questions are undertaken to ensure careful consideration of the use of language, command words and contexts. Our quality review processes include the input from language modifiers who focus on the question design in terms of sentence structures, words and syllables, ensuring that the questions are appropriate for the learner. We also have Scrutineers who sit the papers and give feedback for any modifications.

In this report, we will look at the 2018 summer examination series and outline examples of a range of the type of questions asked, and some commentary from senior examiners. We will also look at how well students performed and how the question enabled students to access it. Specifically, we have analysed five key areas of the assessment:

Short open response questions (3 to 4 mark questions)

Prior to the examination series, there was concern from schools that some questions of this style might be overly demanding. Of course such questions must test the grade range available in the paper (1–5 for foundation paper and 4–9 for higher paper), so some will be testing the most able. Equally the command word used had to clearly indicate to students the type of answer they must write.

The following illustrate good examples of how examiners took these various factors into account.

Biology paper 1H Question 5c

(c) Most cases of scarlet fever occur in children.

Adults have usually developed immunity to a toxin that the *Streptococcus* bacteria produce during infection.

Explain how an adult develops immunity to the toxin.

(3)

Question Number	Answer	Additional guidance	Mark
5(c)	An answer linking three of the following: • exposure to the {toxin/antigen/ pathogen/bacteria} (1) • stimulates an **immune response** (1) • production of {(B)**lymphocytes** /antibodies} (1) • production of memory lymphocytes (1)	 accept immunised /vaccinated accept antitoxins	**(3)** AO 2 1

This question was about immunity, which is a topic that is often difficult for students (section 5.13 of the specification). In question 5, students were applying their knowledge (AO2) and it was set at high demand. The simple structure of the question allowed students access and they performed well. The rest of the question had led up to 5c, so students were prepared.

Mark	0	1	2	3
% of Candidates	6.4	13.0	26.4	54.2
Cumulative %	6.4	19.4	45.8	100.00

Biology paper 2H question 9b

(b) Explain how the release of adrenalin can result in the improved performance of an athlete.

(4)

Question number	Answer	Additional guidance	Mark
9(b)	An explanation linking four of the following: • adrenalin acts to increase heart rate / blood pressure (1) • so there is increased blood flow (1) • causes the release of glucose from glycogen (1) • so increased {oxygen/glucose} (1) • increased the rate of respiration (1) • to **release energy** (for the working muscles/body) (1)	accept more glucose released from liver/muscles accept ATP for energy	**(4)** AO 1 2

This question was about the hormone adrenalin. It was a question requiring students to apply some knowledge (AO2) and assessed specification point 9.2. It was set at high demand. The question was both clear and very direct, enabling students to answer it well. Discrimination was good across the higher grades.

Mark	0	1	2	3	4
% of Candidates	18.6	11.0	15.9	20.7	33.9
Cumulative %	18.6	29.6	45.5	66.2	100.00

(c) A substance is heated at a constant rate and its temperature is taken every minute. During the heating, the substance undergoes one change of state.

The results are shown on the graph in Figure 5.

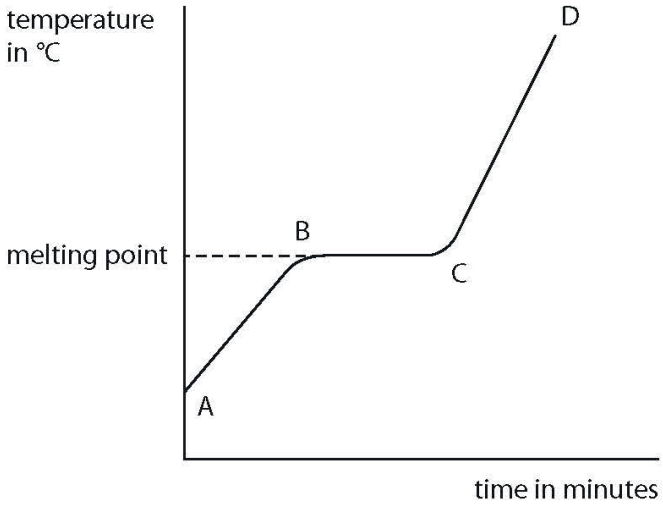


Figure 5

Explain the shape of the graph in terms of the changes in the movement and arrangement of the particles as the substance is heated.

(4)

Question Number	Answer	Additional guidance	Mark
5(c)	An explanation linking from B to C: graph flat because • particles in solid use energy to {break out of lattice / break (intermolecular) bonds (between particles) / particles becoming randomly arranged / turn solid to liquid} (1) and any three from from A to B: graph rises because • particles in solid in a lattice / fixed (mean) positions (1) • vibrate more (rapidly) (as temperature increases) (1) from C to D: graph rises because • particles in liquid move past one another / randomly (1) • particles move more (rapidly) (as temperature increases) (1)	may be shown as a diagram / on graph may be shown as a diagram / on graph ignore references to gas / evaporation / boil	**(4)** AO 3 2a AO 3 2b

In this question students had to interpret a graph of temperature against time for a substance that was being heated. The graph was simple but the explanation was more difficult, so the question was set at a high demand and assessed AO3 and points 2.1/2.3 of the specification. The language used to introduce the question was both straightforward and brief. This enabled students to score relatively highly on a difficult topic.

Mark	0	1	2	3	4
% of Candidates	21.7	30.5	24.7	15.8	7.4
Cumulative %	21.7	52.2	76.9	92.7	100.00

Physics paper 1H question 5c

(c) When white light crosses the boundary between air and glass, it can split up into the colours of the spectrum.

Explain, in terms of speed, why the light behaves like this.

(3)

Question Number	Answer	Additional guidance	Mark
5(c)	an explanation linking: (the colours have) different wavelengths (1) different wavelengths / colours travel at different speeds (1) so refract by different amounts (1)	 allow the word frequencies for wavelengths for refract allow bend/change direction/follow different path	**(3)** AO 2 1

This question was about light refracting at a boundary. It assessed AO3 and specification point 5.13. It is a difficult concept, so was set as a high-demand question. The question was short and to the point, with no extra language included. There was some information in the stem to 'clue' the students in to the question and this may have helped students with the overall concept. The question worked well and resulted in good discrimination across the higher grades.

Mark	0	1	2	3
% of Candidates	30.1	20.9	30.4	18.5
Cumulative %	30.1	51.0	81.4	100.00

Extended open response questions

Until more recent times level of response mark schemes attached to questions were not commonly used in science papers. Mark schemes tended to be based on a more 'item by item' approach. Now all science papers need to include such questions and teachers need to be aware how such questions are marked.

In the mark scheme for each extended open response question there is a table indicating the generic levels attached to the question. There is also a list of indicative marking points. Pearson also develops additional guidance for each question, 'tailor-made' for the question. This enables both exam markers to mark answers consistently and also teachers to judge the performance of their students in mock exams effectively.

Chemistry paper 2F question 9cii

*(ii) A teacher demonstrated this experiment.

The results are shown in Figure 14.

	lithium	sodium	potassium
position of metal in water	floats	floats	floats
movement of metal	slow	fast	very fast
effervescence / bubbling	slow	fast	very fast

Figure 14

Describe, in detail, how the teacher would demonstrate this experiment safely, showing how the results give the order of reactivity of the metals.

(6)

Question Number	Indicative content	Mark
*9(c)(ii)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. **Aspect one: METHOD** • trough/large container of water • equal volumes of water for each experiment • remove metal from container with tongs • remove oil • cut small piece • add metal with tongs/tweezers etc. to water • teacher wears safety glasses • gloves • use of safety screen • class well back • class wear goggles ignore general safety ideas – hair tied back, lab coat etc. ignore equal sized pieces of metal **Aspect 2: ANALYSIS** • most vigorous effervescence of hydrogen with potassium and least with lithium • fastest movement with potassium and slowest with lithium • potassium is most reactive, then sodium, then lithium ignore copying of results from table e.g potassium bubbles very fast ignore writing up of results/ put in table etc	**(6)** AO 2 2 AO 3 1a AO 3 1b

Level	Descriptor
	No rewardable material.
Level 1	• Demonstrates elements of biological understanding, some of which is inaccurate. Understanding of scientific ideas lacks detail. • Presents an explanation with some structure and coherence.
Level 2	• Demonstrates biological understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas is not fully detailed and/or developed. • Presents an explanation that has a structure which is mostly clear, coherent and logical.
Level 3	• Demonstrates accurate and relevant biological understanding throughout. Understanding of the scientific ideas is detailed and fully developed. • Presents an explanation that has a well-developed structure which is clear, coherent and logical.

This question was about practical work and was marked as a level of response question. It was about the reactions of the alkali metals. A simple table was used to provide the necessary information, with a direct question to follow. This structure enabled the students to answer the question well. The question was set at low/medium demand and assessed AO3 and specification point 6.3.

Mark	0	1	2	3	4	5	6
% of Candidates	22.7	7.2	16.6	13.5	20.8	8.1	11.1
Cumulative %	22.7	29.9	46.5	60.0	80.8	88.9	100.00

Chemistry paper 1H question 7d

*(d) The reaction to produce sulfur trioxide reaches an equilibrium.

$$2SO_2(g) + O_2(g) \rightleftharpoons 2SO_3(g)$$

The forward reaction is exothermic.
The rate of attainment of equilibrium and the equilibrium yield of sulfur trioxide are affected by pressure and temperature.

A manufacturer considered two sets of conditions, A and B, for this reaction.
In each case sulfur dioxide is mixed with excess oxygen.
The manufacturer changed the temperature and the pressure and only used a catalyst in B.
The sets of conditions A and B are shown in Figure 7.

set of conditions	pressure in atm	temperature in °C	catalyst
A	2	680	no catalyst used
B	4	425	catalyst used

Figure 7

The manufacturer chooses set of conditions B rather than set of conditions A.

Explain, by considering the effect of changing the conditions on the rate of attainment of equilibrium and on the equilibrium yield of sulfur trioxide, why the manufacturer chooses the set of conditions B rather than the set of conditions A.

(6)

Question Number	Indicative content	Mark
7(d)	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • equilibrium reached faster because of higher temperature in set A / equilibrium reached slower because of lower temperature in set B • higher temperature means more frequent collisions because molecules have more energy / ORA for lower temperature in set B • decrease in temperature increases equilibrium yield but system takes longer to reach equilibrium • temperature chosen for optimum conditions • yield lower as forward reaction is exothermic • high temperature favours back reaction which is endothermic • equilibrium reached faster because of higher pressure in set B / equilibrium reached slower because of lower pressure in set A • higher pressure causes molecules to be closer together so more frequent collisions / ORA for lower pressure in set A • yield higher because products occupy smaller volume than reactants for set B • catalyst in set B causes equilibrium to be reached faster • catalyst increases rate of both forward and back reactions • equilibrium position not affected so catalyst does not affect yield • catalyst reduces the need for the higher temperature	**(6)** AO 2 1 AO 3 1a AO 3 1b

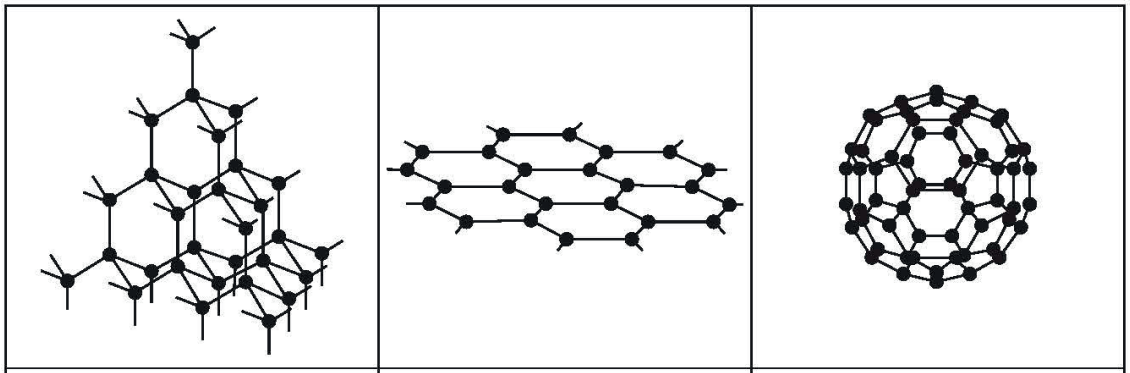
Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Interpretation and evaluation of the information attempted but will be limited with a focus on mainly just one variable. Demonstrates limited synthesis of understanding. (AO3) • The explanation attempts to link and apply knowledge and understanding of scientific ideas, flawed or simplistic connections made between elements in the context of the question. (AO2)
Level 2	3–4	• Interpretation and evaluation of the information on both variables, synthesising mostly relevant understanding. (AO3) • The explanation is mostly supported through linkage and application of knowledge and understanding of scientific ideas, some logical connections made between elements in the context of the question. (AO2)
Level 3	5–6	• Interpretation and evaluation of the information, demonstrating throughout the skills of synthesising relevant understanding. (AO3) • The explanation is supported throughout by linkage and application of knowledge and understanding of scientific ideas, logical connections made between elements in the context of the question. (AO2)

This question was about equilibrium and was set at medium to high demand. It assessed specification point 5.20, and AO2 and AO3. Equilibrium is a topic that is not well understood by students. In this case, the language was kept to a minimum and the table of information, used as the basis of the question, was reduced as much as possible. This enabled students to score well on the question. The levels-based mark scheme developed for this question allowed examination markers to mark consistently and should be a useful tool in schools. The question discriminated very well across the higher grades.

Mark	0	1	2	3	4	5	6
% of Candidates	7.6	11.0	15.9	12.6	21.6	12.5	18.8
Cumulative %	7.6	18.6	34.5	47.1	68.7	81.2	100.00

Chemistry paper 1H question 8c

*(c) Figure 8 shows the arrangement of carbon atoms in diamond, graphene and a fullerene (C_{60}).



diamond	graphene	a fullerene, C_{60}

Figure 8

Consider these three substances.

Explain, in terms of their structures and bonding, their relative melting points, strengths and abilities to conduct electricity.

(6)

Number		
8(c)*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlines in the generic mark scheme. The indicative content below is not prescriptive and candidates are not required to include all the material which is indicated as relevant. Additional content included in the response must be scientific and relevant. • in all structures the carbon atoms bonded by single covalent bonds • shared pair of electrons • strong bonds • in diamond each carbon atom joined to four others • diamond has a giant covalent {structure/lattice} • graphene has a giant covalent {structure/lattice} • fullerene has a molecular structure • in graphene and fullerene each carbon atom joined to three others • in diamond and graphene many bonds need to be broken to melt • need lots of energy • therefore very high melting / sublimation points • in fullerene weak forces between molecules • less energy needed to separate molecules • fullerene has the lowest melting / sublimation point • because diamond and graphene have lots of strong covalent bonds so both are very strong materials • because weak forces between fullerene molecules so its strength is very low • in diamond there are no free electrons • so diamond does not conduct • in graphene and fullerene each carbon atom has one free electron • hence delocalised electrons • graphene conducts electricity • fullerene only conducts electricity across the surface of the molecule • no/little movement of electrons between molecules • so fullerene is poor conductor of electricity (/ semi conductor)	**(6)** AO 1 1

Level	Mark	Descriptor
	0	No rewardable material.
Level 1	1–2	• Demonstrates elements of chemical understanding, some of which is inaccurate. Understanding of scientific ideas, enquiry, techniques and procedures lacks detail. (AO1) • Presents an explanation with some structure and coherence. (AO1)
Level 2	3–4	• Demonstrates chemical understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas, enquiry, techniques and procedures is not fully detailed and fully devolved. (AO1) • Presents an explanation that has a structure which is mostly clear, coherent and logical. (AO1)
Level 3	5–6	• Demonstrates accurate and relevant chemical understanding throughout. Understanding of the scientific ideas, enquiry, techniques and procedures is detailed and fully devolved. (AO1) • Presents an explanation that has a well-developed structure which is clear, coherent and logical. (AO1)

This question was about considering three carbon-based structures: diamond, graphene and fullerene. The information presented in the question was kept to a minimum but diagrams were included to help support and guide the students' answers. Students achieved well on this recall (AO1) question assessing specification point 1.37. It was set at medium/high demand. The question discriminated well across the ability range it was set for.

Mark	0	1	2	3	4	5	6
% of Candidates	3.0	4.1	12.5	16.7	27.3	16.8	19.6
Cumulative %	3.0	7.1	19.6	36.3	63.6	80.4	100.00

Questions that include an element of maths

Teachers have noted more maths within the examination papers. This was, of course, an Ofqual requirement. Pearson examiners included maths only where it was within a science context.

In physics, it is of note that equations are often (though not always) given to the lower ability students to use, in order that their maths skills can be assessed appropriately. For middle ability students, information is sometimes given to 'clue them in' to the equation that they require; for example, we will give them acceleration, force and mass and ask them to write down an appropriate equation from this before asking them to carry out the calculation. At high demand no help is given.

Transformations of equations may be required at all ability levels.

Biology paper 1F/H question 8di/2ci

(d) BMI and waist:hip ratio can be used to find out if a person is obese.

Figure 9 shows some data for two males.

male	BMI	waist:hip ratio
A	27.3	0.85
B	?	0.81

Figure 9

BMI is calculated using the equation:

$$\text{BMI} = \frac{\text{mass in kilograms}}{(\text{height in metres})^2}$$

(i) Male B has a mass of 72 kg and a height of 1.81 m.

Calculate the BMI of male B.

Question Number	Answer	Additional guidance	Mark
8(d)(ii)	• the BMI shows male A is overweight but his waist:hip ratio {shows he is not abdominally obese / is below 0.9/is healthy} (1) • male A's weight distribution is not around the {vital organs/abdomen} (1)	accept male A's weight is distributed evenly over the body accept more weight on the hips than the waist accept mass for weight	**(2)** AO 3 2a AO 3 2b

The question was a calculation of BMI, with the equation given and set within the overall context of the question 8/2. It was set at medium demand and assessed specification point 5.24. The assessment objective was AO3. The equation and the table (which included the relevant data) were both clearly presented, which enabled students to access the question well. The equation was not straightforward and the answer included significant figures. The students performed well.

Mark	0	1	2	3
% of Candidates (F tier)	31.1	4.5	48.0	16.4
Cumulative % (F tier)	31.1	35.6	83.6	100.00
% of Candidates (H tier)	2.7	3.4	34.7	59.3
Cumulative % (H tier)	2.7	6.1	40.8	100.00

Chemistry paper 1F/1H question 9aii/3aii

(ii) The formula of the iron oxide is Fe_2O_3.

Calculate the maximum mass of iron that can be obtained from 240 tonnes of iron oxide, Fe_2O_3.

(relative atomic masses: O = 16, Fe = 56)

(3)

Question Number	Answer		Mark
9(a)(ii)	final answer of 168 (tonnes) with or without working (3) OR relative formula mass Fe_2O_3 = 2x56 + 3x16 (= 160) (1) 160 tonnes Fe_2O_3 produces {2x56 / 112} tonnes Fe (1) 240 tonnes Fe_2O_3 produces $\frac{2x56}{160}$ x 240 (1) = 168 (tonnes) OR relative formula mass Fe_2O_3 = 2x56 + 3x16 (= 160) (1) $\frac{240}{160}$ (1) = 1.5 1.5 x 112 (1) = 168 (tonnes) OR relative formula mass Fe_2O_3 = 2x56 + 3x16 (= 160) (1) $\frac{112}{160}$ (1) = 0.7 0.7 x 240 (1) = 168 (tonnes)	allow ECF throughout M_r [Fe_2O_3]= 160 seen without working (1) allow 320 tonnes : 224 tonnes (1) final answer 84 (tonnes) with or without working (2) Note : final answer 1.5 scores 2 overall	**(3)** AO 2 1

The question involved mathematical work using the formula for iron oxide. It is a straightforward calculation and was set with the minimum of information required. The calculation is medium demand and assessed AO2 and specification point 1.48. The question discriminated very well across the ability range it was set for.

Mark	0	1	2	3
% of Candidates (F tier)	42.7	35.6	15.1	6.6
Cumulative % (F tier)	42.7	78.3	93.4	100.00
% of Candidates (H tier)	10.8	18.9	30.5	39.7
Cumulative % (H tier)	10.8	29.7	60.2	100.00

Chemistry paper 2H question 10a

10 (a) Hydrogen reacts with oxygen to form steam.

$$2H_2(g) + O_2(g) \rightarrow 2H_2O(g)$$

Bond energies are shown in Figure 14.

bond	bond energy in kJ mol^{-1}
H—H	435
O═O	500
O—H	460

Figure 14

Calculate the energy change for the reaction of 2 mol of hydrogen gas, H_2, with 1 mol of oxygen gas, O_2, to give 2 mol of steam, H_2O.

(4)

Question Number	Answer	Additional guidance	Mark
10(a)	award full marks for correct numerical answer without working energy needed to break bonds = (2 x 435) + (1 x 500) = 1370 (kJ mol^{-1}) (1) energy released when bonds are formed = 4 × 460 = 1840 (1) energy change = 1370 – 1840 = (-) 470 (kJ mol^{-1}) (1) negative sign or 'energy released' (1)	 allow 1840 - 1370 = 470 (1) ignore sign allow exothermic (reaction) final answer 450 award 2 marks -450 award 2 marks final answer +450 award 3 marks	**(4)** AO 2 1

This question was about bond energies and assessed AO2. It was set at high demand and assessed specification point 7.14. The information presented was the minimum that would allow the students to answer. As well as the balanced equation, the number of moles for each substance was also 'spelled out' for the students. The question discriminated well across the higher grades.

Mark	0	1	2	3	4
% of Candidates	15.2	13.5	29.8	19.8	21.6
Cumulative %	15.2	28.7	58.5	78.3	100.00

Physics paper 2F question 4d

(d) (i) Complete the equation that relates efficiency, useful energy transferred by a device and total energy supplied to the device.

(1)

efficiency = _____

(ii) In one second an engine has a total energy input of 7500 J.

In one second 3200 J is transferred to the surroundings as wasted energy.

Calculate the useful energy transferred by the engine.

(1)

useful energy transferred = ... J

(iii) Calculate the efficiency of this engine.

(2)

Question Number:	Answer	Mark
4(d)(i)	efficiency = **useful** (energy transferred by the device) (x100) total (energy supplied to the device)	**(1)** AO 1 1

Question Number:	Answer	Additional guidance	Mark
4(d)(ii)	determine useful energy (1) 7500 -3200 = 4300		**(1)** AO 2 1

Question Number:	Answer	Additional guidance	Mark
4(d)(iii)	substitution (1) efficiency = 4300 / 7500 evaluation (1) 0.57	 allow ECF from (i) and/ or (ii) for 1 mark maximum accept 57(.33)(%), 0.6, 60(%) award full marks for the correct answer without working	**(2)** AO 2 1

This calculation was set at low/medium demand. The assessment objective was AO2 and the specification point 8.15. As such, some information was presented to the students to enable them to construct the correct equation (part di). The students were then able to use their equation to attempt the rest of the question successfully and the question discriminated well.

Mark	0	1	2	3	4
% of Candidates	20.5	24.0	17.7	4.0	33.7
Cumulative %	20.5	44.5	62.2	66.2	100.00

Physics paper 1F question 7b

(b) Calculate the power of a lens of focal length 17 cm.

Use the equation

$$\text{power (in dioptres)} = \frac{1}{\text{focal length (in metres)}}$$

Give the answer to 2 significant figures.

(3)

power = ... dioptres

Question Number	Answer	Additional guidance	Mark
7(b)	substitution (1) $\frac{1}{}$ 17 or 0.17 evaluation (1) 5.882... evaluation to 2sf (1) 5.9 (any answer to 2 sf for this mark, but not if wrong rounding is seen)	lose this mark if there is **any other power of 10 error** but then apply ecf (e.g. 1/1.7) so 0.588 then = 1 mark for that ecf independent mark award full marks for the correct answer without working	**(3)** AO 2 1

This question asked students to calculate the power of a lens using a given equation. It was set at low/medium demand, assessing AO2. It assessed specification point 5.4. While not an easy calculation for students at this level, the question was phrased and set out clearly. Students were also asked to give their answers to two significant figures. As a result, the calculation discriminated well across the target ability range.

Mark	0	1	2	3
% of Candidates	13.4	25.5	34.4	26.7
Cumulative %	13.4	38.9	73.3	100.00

Questions that are practically based (compulsory or otherwise)

Compulsory practicals were included in the specifications as an Ofqual requirement. Questions based on these practicals help to replace the old 'coursework' element of examinations. Pearson's examination papers include questions asking for various aspects from the compulsory practicals. However, questions are also asked where students have to develop their own investigation either based on their knowledge or information provided. Clearly those who have enjoyed practical experiences during their course are at an advantage in all of these questions. Questions are also asked where students have to suggest improvements to a given procedure. This tends to be a higher order skill.

Biology paper 2H question 2bi

(b) Red blood cells are carried in veins and arteries.

Figure 4 shows the equipment used to measure the elasticity of an artery.

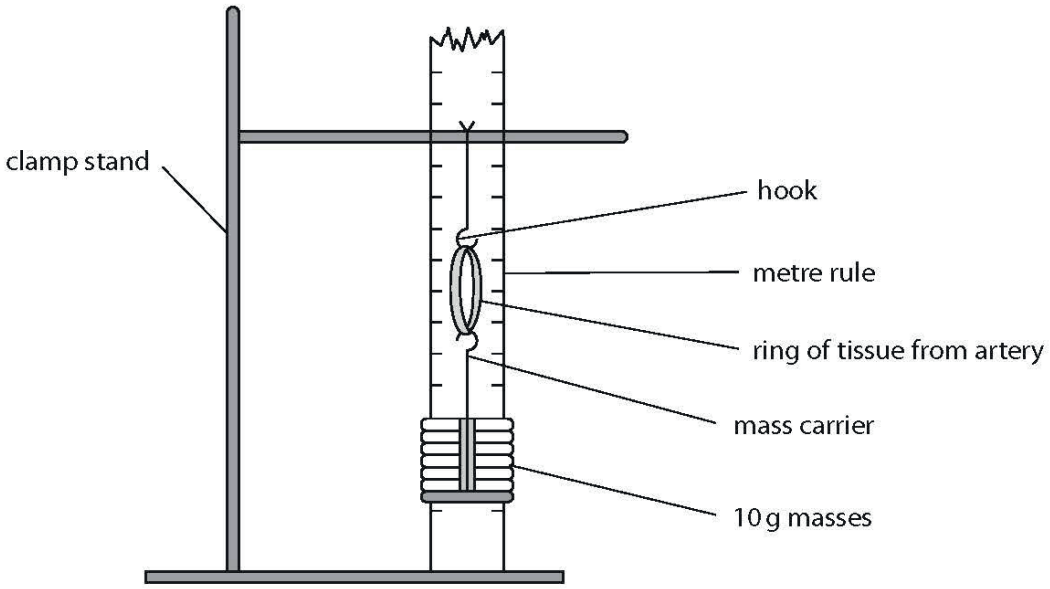


Figure 4

(i) Describe a method you could use to see how much the ring of tissue from an artery could stretch before it no longer returned to its original size.

(3)

Question number	Answer	Additional guidance	Mark
2(b)(i)	An answer that combines **three** of the following points to provide a method: • measure the length of the tissue (1) • add masses / mass (1) • remove the mass and measure length of the tissue (1) • repeat until the tissue no longer returns to its original length (1)	accept remove the mass and see if the tissue returns to its original size	**(3)** AO 3 3a

The question provided information, through the use of a clearly presented diagram, on an investigation. Students were then asked to provide a method. The question was assessed at medium demand against specification point 8.7. The assessment objective was AO3. The diagram provided a clear stimulus from which students could devise their plan. The question discriminated well across the grades it was targeted at, with most students able to make a satisfactory attempt. However, the question illustrated a key point in terms of students' abilities to access practical questions. It seems clear that students who have carried out an appropriate amount of practical work in schools are able to answer such questions much better than students who have not.

Mark	0	1	2	3
% of Candidates	4.4	13.0	24.4	58.2
Cumulative %	4.4	17.4	41.8	100.00

Chemistry paper 2H question 7d

(d) A solid ionic compound is dissolved in water to form a solution.

Describe a simple experiment to show that charged particles are present in this solution.

(3)

Question Number	Answer	Additional guidance	Mark
7(d)	A description to include the following points • insert electrodes (into aqueous solution)(1) • connect to electrical supply /powerpack /battery/cell (1) • bulb lights / ammeter shows current / electrolyte decomposes (1)	first two marks can be given for a suitable diagram allow anode **and** cathode allow carry out an electrolysis experiment alone / see if solution conducts electricity (1) allow pass an electric current through (the solution) (1) ignore electricity alone allow correct observation at one electrode (1)	**(3)** AO 3 3a

This question asked students to describe a method to show that charged particles were present in a solution. This is a difficult concept for many students and was set at high demand. It assessed AO3 and was targeted at specification point 1.33. The question discriminated well across the higher grades but, again, it was apparent that those who had carried out practical work were at an advantage. A relatively high proportion of students, just as in the previous example, were unable to present any meaningful points. The question was simply put on a clear area of the specification, so there should have been no obstacles to the students providing a reasonable answer.

Mark	0	1	2	3
% of Candidates	35.3	20.9	27.6	16.2
Cumulative %	35.3	56.2	83.8	100.00

Physics paper 2F/H question 8ai/2ai

8 (a) A student uses the apparatus in Figure 17 to determine the specific heat capacity of water.

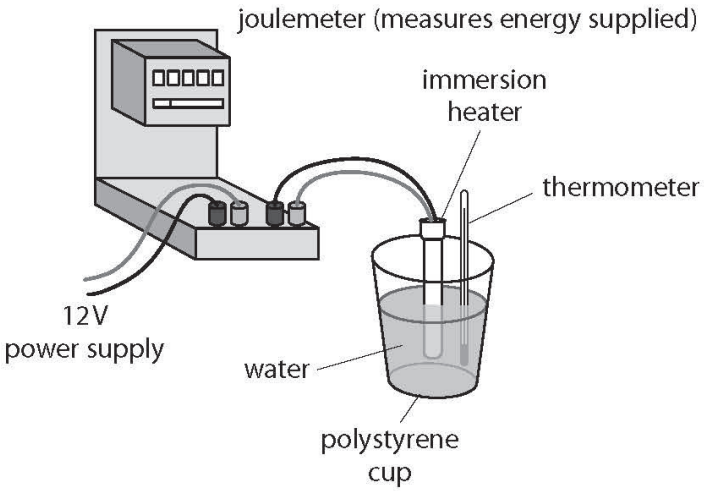


Figure 17

(i) State the measurements needed to calculate the specific heat capacity of water.

(4)

Question number:	Answer	Additional guidance	Mark
8(a)(i)			(4) AO 1 2
	(measurement of) the mass of water (1)	accept volume / weight of water ignore amount	
	(measurement of) the temperature (rise/change) (1)	accept (take) thermometer reading	
	(measurement of) the energy supplied / from heater (1)	accept (take) reading of the joulemeter ignore 'change in thermal energy' (from equation)	
	detail of any of the above (1)	e.g. measure temp at the start and end or measure mass of empty cup or start and end readings on the meter	

This question was a relatively simple practical-based question, asking for the measurements needed to calculate the specific heat capacity of water. As it was set at medium demand, a diagram was provided to help the students organise their thoughts. There was very little text alongside the diagram so the presentation of the question should have provided no obstacle to successful answers. The question was set as AO1, assessing specification point 14.11 and at medium demand. The question discriminated very well across the targeted grades.

Mark	0	1	2	3	4
% of Candidates (F tier)	29.0	26.6	26.5	14.9	3.0
Cumulative % (F tier)	20.9	55.6	82.1	97.0	100.00
% of Candidates (H tier)	5.5	11.1	30.0	31.3	22.1
Cumulative % (H tier)	5.5	16.6	46.6	77.9	100.00

Data interpretation questions

Clearly in such questions, sufficient information has to be provided to allow the students to answer. Too much information may lead to confusion. However, some sifting of information is usually needed by the students, and is 'set' depending on the level at which the question is asked. The level of 'sifting' required is always carefully judged by the examining teams.

These questions may lead to questions asking for conclusions or judgements. In these questions we apply the same 'rules'; that is, providing sufficient information to answer the question with every attempt made and not to give so much information as to result in confusion.

Biology paper 2F question 4c

(c) Algae are green plants.

Figure 10 shows the number of algae in a lake in the United Kingdom during one year.

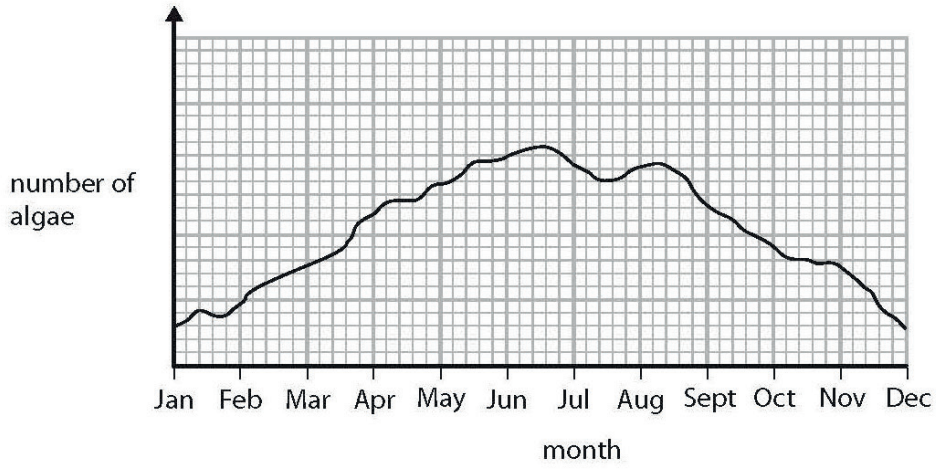


Figure 10

Explain the changes in the number of algae in the lake from February to June.

(3)

Question number	Answer	Mark
4(c)	An explanation that combines identification via a judgment (1 mark) to reach a conclusion via justification/reasoning (2 marks): Judgement: • the number of algae increase (1) Two reasons: • increased {temperature / light intensity} / longer daylight (1) • for (more) photosynthesis (for growth) (1) OR • increased minerals / nitrate ions / eutrophication in the lake (1) • (more) protein / chlorophyll (for growth) (1)	**(3)** AO 3 2a AO 3 2b

This question required students to interpret data presented as a line graph and then to provide an explanation for the trend shown. The graph was straightforward and the amount of text was kept to the minimum necessary. The question was AO3 and assessed specification point 9.2. It was set at low to medium demand. Nearly all students were able to achieve marks, though complete explanations were not that common.

Mark	0	1	2	3
% of Candidates	10.1	48.6	32.2	9.1
Cumulative %	10.1	58.7	90.9	100.00

Biology paper 1H question 8bi

(b) Figure 16 shows the results of this investigation.

The student calculated the rate of reaction using

$$\frac{1}{\text{time in seconds}}$$

concentration of hydrogen peroxide solution (%)	time taken for disc to rise (s)	rate (s^{-1})
5	325	0.003
10	245	0.004
15	132	0.008
20	72	0.014

Figure 16

(i) State and explain a conclusion based on these results.

(4)

Question Number	Answer		Mark
8(b) (i)	**Conclusion for 1 mark** • increasing the concentration of hydrogen peroxide {increases the rate of reaction/decreases the time taken for the disc to rise} (1) **and any three from:** • provides more substrate (1) • increases collisions (1) • more active sites occupied (1) • forming more enzyme-substrate complexes (1) • oxygen is released faster (1)	 accept hydrogen peroxide for substrate accept more oxygen released	**(4)** AO 3 2a AO 3 2b

This question asked students to interpret data presented in a table, in order to make a conclusion. The data and the text provided was limited to only the essential information necessary. This enabled students to access this AO3 question assessed specification point 1.9. The question was set at high demand, as it was about rate of reaction involving enzymes (so was clearly within the context of question 8 overall). The question discriminated well, with the great majority of students able to access the information presented. However, as a result of the difficulty of the concept being examined, only a small percentage of students were able to achieve full marks.

Mark	0	1	2	3	4
% of Candidates	8.2	45.1	24.0	17.1	5.7
Cumulative %	8.2	53.3	77.3	94.4	100.00

Physics paper 2F question 6c

(c) A student measures the current in the lamp for several values of potential difference across the lamp.

Figure 13 shows the student's results.

potential difference across the lamp in volts (V)	current through the lamp in amps (A)
0.06	0.05
0.12	0.08
0.18	0.10
0.24	0.12
0.30	0.13
0.36	0.13

Figure 13

The student uses the results in Figure 13 to write this conclusion.

'As the potential difference across the lamp increases, the current in the lamp increases and the relationship is directly proportional.'

Comment on the student's conclusion.

(3)

Question Number:	Answer	Additional guidance	Mark
6(c)	a comment that makes reference to any three of the following points: • idea that the current increases with the p.d. /voltage (1) • until (current) reaches a constant value (1) • the current is not directly proportional to p.d. (1) • uses idea that the values do not go up in equal steps / does not show doubling	(staying) at 0.13(A)	(3) AO 3 2a AO 3 2b

This question asked students to interpret data in order to comment on a given conclusion, which can be difficult for students. The question was set within the overall context of question 6 about electricity and charge. Question 6c was about a current in a lamp. The assessment objective was AO3 and assessed specification point 10.17. The level of demand was low/medium as both the data provided and the conclusion given were relatively straightforward to understand.

Mark	0	1	2	3
% of Candidates	19.8	25.4	32.9	21.8
Cumulative %	19.8	45.2	78.1	100.00

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