

Higher

GCSE

Combined Science B Twenty First Century Science

J260/07: Physics (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for June 2025

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It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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MARKING INSTRUCTIONS

PREPARATION FOR MARKING

RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor.
3. Log-in to RM Assessor and mark the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% (traditional 50% Batch 1 and 100% Batch 2) deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader by telephone, email or via the RM Assessor messaging system.

5. **Crossed-Out Responses**

Where a candidate has crossed out a response and provided a clear alternative then the crossed-out response is not marked. Where no alternative response has been provided, examiners may give candidates the benefit of the doubt and mark the crossed-out response where legible.

Rubric Error Responses – Optional Questions

Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM Assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple-Choice Question Responses

When a multiple-choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate). *When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.*

Contradictory Responses

When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only one mark per response)

Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth two or more marks)

If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space).

Longer Answer Questions (requiring a developed response)

Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there then add a tick to confirm that the work has been seen.
7. There is a NR (No Response) option. Award NR (No Response)
 - if there is nothing written at all in the answer space
 - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
 - OR if there is a mark (e.g. a dash, a question mark) which isn't an attempt at the question.

Note: Award 0 marks – for an attempt that earns no credit (including copying out the question).

8. The RM Assessor **comments box** is used by your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

If you have any questions or comments for your Team Leader, use the phone, the RM Assessor messaging system, or email.

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response:

Read through the whole answer from start to finish, using the Level descriptors to help you decide whether it is a strong or weak answer. The indicative scientific content in the Guidance column indicates the expected parameters for candidates' answers, but be prepared to recognise and credit unexpected approaches where they show relevance. Using a 'best-fit' approach based on the skills and science content evidenced within the answer, first decide which set of level descriptors, Level 1, Level 2 or Level 3, best describes the overall quality of the answer.

Once the level is located, award the higher or lower mark:

The higher mark should be awarded where the level descriptor has been evidenced and all aspects of the communication statement (in italics) have been met.

The lower mark should be awarded where the level descriptor has been evidenced but aspects of the communication statement (in italics) are missing.

In summary:

The skills and science content determines the level.

The communication statement determines the mark within a level.

Level of response question on this paper is **3d**

11. Annotations available in RM Assessor

Annotation	Meaning
	Correct response
	Incorrect response
	Omission mark
	Benefit of doubt given
	Contradiction
	Rounding error
	Error in number of significant figures
	Error carried forward
	Level 1
	Level 2
	Level 3
	Benefit of doubt not given
	Noted but no credit given
	Ignore

12. Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
✓	Separates marking points
DO NOT ALLOW	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
()	Words which are not essential to gain credit
<u>—</u>	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

13. Subject-specific Marking Instructions

INTRODUCTION

Your first task as an Examiner is to become thoroughly familiar with the material on which the examination depends. This material includes:

- the specification, especially the assessment objectives
- the question paper
- the mark scheme.

You should ensure that you have copies of these materials.

You should ensure also that you are familiar with the administrative procedures related to the marking process. These are set out in the OCR booklet **Instructions for Examiners**. If you are examining for the first time, please read carefully **Appendix 5 Introduction to Script Marking: Notes for New Examiners**.

Please ask for help or guidance whenever you need it. Your first point of contact is your Team Leader.

The breakdown of Assessment Objectives for GCSE (9-1) in Combined Science B:

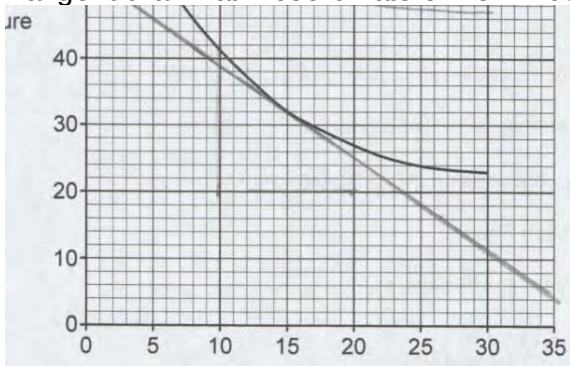
	Assessment Objective
AO1	Demonstrate knowledge and understanding of scientific ideas and scientific techniques and procedures.
AO1.1	Demonstrate knowledge and understanding of scientific ideas.
AO1.2	Demonstrate knowledge and understanding of scientific techniques and procedures.
AO2	Apply knowledge and understanding of scientific ideas and scientific enquiry, techniques and procedures.
AO2.1	Apply knowledge and understanding of scientific ideas.
AO2.2	Apply knowledge and understanding of scientific enquiry, techniques and procedures.
AO3	Analyse information and ideas to interpret and evaluate, make judgements and draw conclusions and develop and improve experimental procedures.
AO3.1	Analyse information and ideas to interpret and evaluate.
AO3.1a	Analyse information and ideas to interpret.
AO3.1b	Analyse information and ideas to evaluate.
AO3.2	Analyse information and ideas to make judgements and draw conclusions.
AO3.2a	Analyse information and ideas to make judgements.
AO3.2b	Analyse information and ideas to draw conclusions.
AO3.3	Analyse information and ideas to develop and improve experimental procedures.
AO3.3a	Analyse information and ideas to develop experimental procedures.
AO3.3b	Analyse information and ideas to improve experimental procedures.

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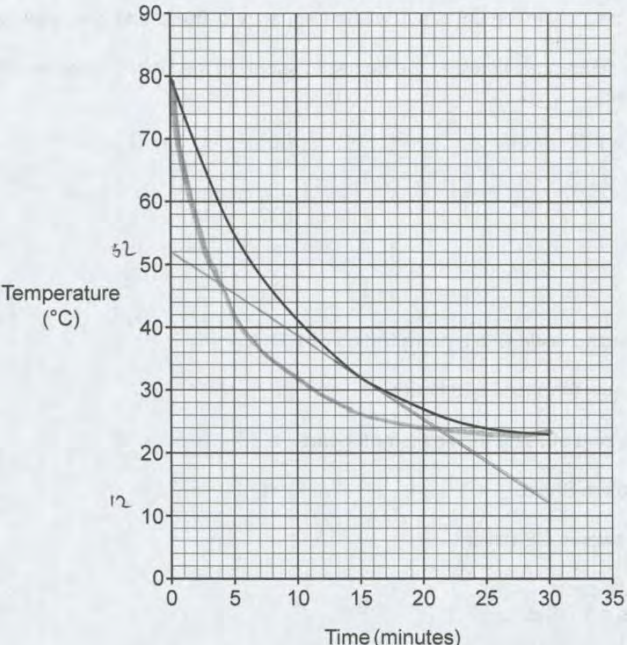
Question			Answer	Marks	AO element	Guidance
1	(a)		First check answer on answer line If answer = 12 (m) award 4 marks Select: average speed = distance $\div$ time ✓ Substitute: 20 = distance $\div$ 0.6 ✓ Rearrange: Distance = 20 x 0.6 ✓ = 12(m) ✓	4	1.1 3.1a 2.1 x 2	ALLOW standard letters and rearrangements ALLOW substitution into incorrectly rearranged algebraic or word equation ALLOW Distance = speed x time OR $d = s \times t$ ALLOW up to 3 marks maximum for use of incorrect time between 0.5 and 0.7 s giving an answer between 10 and 14 (m)
	(b)		First check answer on answer line If answer = 40 (m) award 4 marks 174kJ converted to 174000J ✓ Substitute: 174000 = 4350 x distance ✓ Rearrange: distance = 174000 $\div$ 4350 ✓ = 40 (m) ✓	4	2.1	ALLOW substitution into incorrectly rearranged algebraic or word equation ALLOW distance = work done $\div$ force OR $d = W \div F$ ALLOW maximum of 3 marks for POT error
	(c)		Distance travelled during reaction time is lower / gives the driver more time to react ✓ Work needed by brakes to reduce kinetic energy is lower / it is easier to reduce the kinetic energy of the car ✓	2	1.1	ALLOW decreases thinking distance ALLOW decreases braking distance / time needed to brake If no other mark scored ALLOW 1 mark for decreases stopping distance / time OR reduce the chance of collision / injury during a collision

Question			Answer	Marks	AO element	Guidance
2	(a)	(i)	Any two from: Volume / mass of water ✓ Starting / initial temperature of water ✓ Room temperature ✓ Shape / size of containers ✓ Thickness of insulating material ✓	2	3.3a	ALLOW amount ALLOW type of metal used for containers
		(ii)	Metal is a (thermal) conductor OR plastic is a (thermal) insulator ✓ AND any one from: Better (rate of) energy transfer to insulating material (to see the thermal conductivity of the insulating material) ✓ With metal the effect of the insulation is clearer / plastic would make the effect of the insulation less clear ✓	2	1.1	ALLOW reverse argument
	(b)	(i)	Tangent drawn at x-coordinate of 15 minutes ✓ 	1	2.2	Straight line tangent must touch curve at 15 minutes without a gap either side of the curve. DO NOT ALLOW multiple tangents drawn

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Question			Answer	Marks	AO element	Guidance
		(ii)	First check answer on answer line If answer = -1.3 ± 0.2 ($^{\circ}\text{C}/\text{min}$) award 2 marks Evidence of change in $y \div$ change in x ✓ $= -1.3 \pm 0.2$ ($^{\circ}\text{C}/\text{min}$) ✓	2	2.2	ALLOW 'counting squares' for this mark if correctly links to drawn triangle ECF for their drawn straight line tangent Note answer must be negative
		(iii)	Curve starts at 80°C and is steeper at the start ✓ Levels off to between 20° and 24° ✓	1 1	3.2a	 The graph shows a curve starting at 80°C at time 0. The curve decreases and levels off between 20°C and 24°C. A straight line tangent is drawn at the start of the curve, indicating the initial rate of change.

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Question			Answer	Marks	AO element	Guidance
3	(a)		(In the UK) The voltage is 230 V ✓ The frequency is 50 Hz ✓	2	1.1	If no other mark scored ALLOW 1 mark for voltage in the UK is higher but frequency in lower ORA
	(b)		First check answer on answer line If answer = 1.54 (US Dollars) award 4 marks Select: Energy = power x time ✓ Substitute: (Energy=) 1.2×8 ✓ = 9.6 (kWh) ✓ Cost = $9.6 \times (16/100) = 1.54$ (US dollars) ✓	4	1.1 2.1 x 3	ALLOW standard letters and rearrangements Note 9.6 seen scores first 3 marks ALLOW 1.536 US dollars ALLOW ECF for final mark for incorrectly calculated energy multiplied by 0.16
	(c)		4.8 (A) ✓ 0 (A) ✓	2	2.1	

Question	Answer	Marks	AO element	Guidance
(d)*	Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Detailed explanation of why Circuit B is used in the home rather than Circuit A and why the lamps in Circuit B are brighter than the lamps in Circuit A with correct links to at least two of current, potential difference or resistance. AND Detailed description of the features of each circuit <i>There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.</i> Level 2 (3–4 marks) Clear explanation of why Circuit B is used in the home rather than Circuit A and why the lamps in Circuit B are brighter than the lamps in Circuit A. AND Clear description of the features of each circuit <i>There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.</i> Level 1 (1–2 marks) Limited explanation of why Circuit B is used in the home rather than Circuit A OR why the lamps in Circuit B are brighter than the lamps in Circuit A. AND Limited description of the features of each circuit <i>There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.</i> 0 marks <i>No response or no response worthy of credit.</i>	6	3 x 1.1 3 x 2.1	AO2.1 Applies knowledge and understanding of ideas to compare the two circuits • In B all the components have the same potential difference – in A each lamp shares total potential difference • In B a lamp has more current than a lamp in A • In B a lamp works at normal power / brightness – in A a lamp works at less than normal power • In B each lamp can be switched on and off independently – in A both lamps are on or off at the same time • In B if one lamp breaks, the others still work – in A if one lamp breaks all of them switch off AO1.1 Demonstrates knowledge and understanding of series and parallel circuits Circuit A • Is a series circuit • Must be complete for the current to flow • Adding more lamps increases the resistance of the whole circuit (and so reduces the current to all of them) • The potential difference of the source is shared between all the lamps Circuit B • Is a parallel circuit • Contains more than one complete loop • The potential difference across each lamp is the same as the potential difference of the source • Adding more lamps in parallel reduces the resistance of the circuit (and so increases the current from the source)

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Question			Answer	Marks	AO element	Guidance
						Aspects of the communication statement might typically be missing when: • Irrelevant information is provided • Information presented is incoherent • Information presented is contradictory • Information presented does not have a logical structure • Use of correct terminology is not secure/present within answer
Question			Answer	Marks	AO element	Guidance
4	(a)	(i)	10 (cm) ✓	1	1.2	
	(a)	(ii)	First check answer on answer line If answer = 7.2 (cm) award 3 marks $\sqrt{4^2 + 6^2}$ ✓ = 7.21110.... (cm) ✓ Answer given to 2SF = 7.2 (cm) ✓	3	2.1 x 2 1.2	ALLOW incorrect calculated answer rounded to 2sf for final mark
	(a)	(iii)	The first answer is a scalar quantity / does not depend on direction ✓ The second answer is (the magnitude of) a vector quantity / has a direction associated with it. ✓	2	1.1	ALLOW actual distance travelled / total length of path travelled by ant DO NOT ALLOW 'distance the ant travels' as this is a repeat of the question ALLOW straight line/shortest distance from start to finish
	(b)		The momentum of the ant ✓ The velocity of the ant ✓	2	1.1	Boxes 2 and 4 ticked. ALLOW any unambiguous indication. Mark independently. If 3 or more ticks treat each additional tick as a contradiction of one correct tick

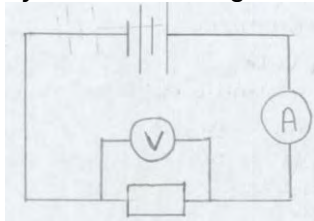
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Question			Answer	Marks	AO element	Guidance
5	(a)	(i)	146 neutrons ✓ 95 protons ✓	2	1.1	
		(ii)	Same number of protons ✓ Different number of neutrons ✓	2	1.1	ALLOW same atomic number ALLOW different atomic mass ALLOW amount for number when referring to protons or neutrons
		(iii)	Alpha (particle) ✓ It must have two protons AND two neutrons ✓	2	1.2	ALLOW symbol α or 'helium nucleus' or Helium-4 symbol IGNORE 'helium' or 'He' alone ALLOW atomic number of 2 instead of 2 protons and (atomic) mass of 4 instead of 2 neutrons ALLOW atomic number decreases by 2 AND mass number decreases by 4
	(b)		The activity of the americium falls by half every 430 years ✓ (Activity) will remain (almost) constant / high for a long time ✓	2	1.1	ALLOW takes a (very) long time for activity to halve ALLOW remains radioactive / emits radiation for a (very) long time ALLOW reverse argument, e.g. if activity too low the smoke alarm won't work properly

Question			Answer	Marks	AO element	Guidance
6	(a)		Any four from: The velocity is greater/faster at 4 s ✓ The gradient lower at 4 s / gradient gives the acceleration ✓ The acceleration is lower at 4 s ✓ The weight / force of gravity is the same at 2 and 4 s ✓ The air resistance is greater at 4 s / air resistance increases with speed ✓ The resultant force on the object is smaller at 4 s ✓	4	3.1a	ALLOW reverse argument throughout ALLOW 18m/s at 2s and 28m/s at 4s ALLOW velocity increases (at a) slower (rate) at 4s ALLOW drag DO NOT ALLOW resultant force is zero
	(b)	(i)	First check answer on answer line If answer = 12 (m/s) award 3 marks Substitute: $25.8 = 0.6v - 0.6 \times (-31)$ ✓ Rearrange: $v = (25.8 - 0.6 \times 31) \div 0.6$ ✓ = 12 (m/s) ✓	3	2.1	Minus sign must be seen in 31 or 25.8 for this mark ALLOW $v = (\text{change in momentum} + mu) / m$ Note answer of (-)74 scores rearrange mark only ALLOW -12 (m/s) for 3 marks
		(ii)	First check answer on answer line If answer = 52 (N) award 3 marks Substitute: $25.8 = \text{resultant force} \times 0.5$ ✓ Rearrange: $(F =) 25.8 \div 0.5$ ✓ = 52 (N) ✓	3	2.1	ALLOW algebraic or word rearrangement e.g. Force = change in momentum ÷ time ALLOW 51.6 (N)
		(iii)	First check the answer on answer line If answer = 290 (J) award 3 marks Use of kinetic energy = $\frac{1}{2} \times \text{mass} \times (\text{speed})^2$ ✓ (KE =) $\frac{1}{2} \times 0.60 \times 31^2$ ✓ = 290 (J) ✓	3	1.1 2.1 x 2	ALLOW standard letters ALLOW 288 or 288.3 (J) ALLOW 2 marks maximum for POT error
		(iv)	There is less energy in the gravitational store (of ball) at maximum height after bouncing than at release height OR not all energy in kinetic store is transferred back into gravitational store ✓ (because) Energy transferred into ground / surroundings / air / thermal store of ball ✓	2	3.2b	ALLOW air does work on the ball

Question			Answer	Marks	AO element	Guidance
7	(a)		Wire connected in series to a battery / cell ✓ Ammeter (correct symbol) connected in series to measure the current in the wire ✓ voltmeter (correct symbol) connected in parallel to measure the potential difference of the wire ✓	3	1.2	ALLOW a labelled power supply in place of a battery; the wire can be a labelled line or a resistor symbol or a recognisable drawn wire.  IGNORE other components if circuit is workable ALLOW ECF for 2nd and 3rd marks if incorrect symbol used for wire DO NOT ALLOW voltmeter in parallel with battery if other components are connected in series
	(b)	(i)	Straight line passing through (0,0), (10, 0.45) and (30, 1.35) ✓	1	2.2	ALLOW other straight lines that pass through (0,0) and have no more than two plotted points on either side DO NOT ALLOW multiple lines
		(ii)	First check the answer on answer line If answer = 455 (cm) award 3 marks Resistance is (directly) proportional to length OR $R = L \times \text{constant}$ (or equivalent) OR calculation of constant e.g. $50 \div 2.2$ or $22.72 \text{ (cm}/\Omega\text{)}$ ✓ Length = $20 \times (50 \div 2.2)$ ✓ $= 454.54\dots \text{ (cm)}$ ✓	3	1.2	ALLOW coordinate from LOBF used instead of 2.2Ω and 50cm giving an answer consistent with line drawn ALLOW any answer that rounds to 455 (cm) ALLOW 450 (cm)

Question			Answer	Marks	AO element	Guidance
8	(a)		Any two from (similarities): Both EM / electromagnetic waves ✓ Both transverse waves ✓ Both travel in a vacuum ✓ Both travel at the same speed (in a vacuum) / 3.0×10^8 m/s ✓ Both can reflect / refract / diffract / interfere ✓ Both transfer energy ✓ Any two from (differences): UV has a shorter wavelength / Radio waves have a longer wavelength ✓ UV has a higher frequency / Radio waves have a lower frequency ✓ UV is ionising radiation / Radio waves are not ionising ✓ UV waves have more energy / Radio waves have less energy ✓	4	1.1	ALLOW both are part of EM spectrum Note that it must be a comparative e.g. IGNORE short wavelength. ALLOW UV can damage / kill cells or radio waves cannot damage / kill cells
	(b)		Any one from: The atom might lose an electron / be ionised ✓ An electron in the atom may move to a <u>higher</u> energy level ✓	1	1.1	ALLOW electron removed from / knocked out of shell / orbit ALLOW shell / orbit for energy level

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Question			Answer	Marks	AO element	Guidance
9			Any four points from: As temperature rises the particles gain kinetic energy / speed ✓ Particles collide with more force / harder ✓ Particles collide more frequently / often ✓ The momentum of gas particles change when they collide with the walls of the balloon ✓ The balloon exerts forces on the particles ✓ The particles exert (equal and opposite) force on the balloon ✓ (as temperature increases) rate of change of momentum increases ✓ (At a constant volume) temperature is (directly) proportional to pressure (so pressure increases) ✓ Pressure = force applied to balloon ÷ area of balloon surface ✓	4	1.1	ALLOW particles move faster

Question			Answer	Marks	AO element	Guidance
10	(a)		First check the answer on answer line If answer = 2.79 (g/cm³) award 4 marks Volume = $(84 - 50) = 34 \text{ (cm}^3\text{)}$ ✓ Mass = $(95.06 - 0.2) = 94.86 \text{ (g)}$ ✓ Substitute: (Density =) $94.86/34$ ✓ = 2.79 (g/cm ³) ✓	4	1.2 x 2 2.1 x 2	ALLOW 2.8 (g/cm ³) if 94.86 seen ECF final two marks for correct use of incorrect mass or/and volume e.g. $95.06/84 = 1.13$ scores 2 marks
	(b)		First check the answer on answer line If answer = 750 (J/kg°C) award 4 marks Substitute: $4310 = 0.078 \times \text{SHC} \times (100 - 26)$ ✓ Rearrange: (SHC =) $4310 / (0.078 \times 74)$ ✓ = 746.7082467 (J/kg°C) ✓ = 750 (J/kg°C) (rounded to 2sf) ✓	4	2.1	ALLOW word or algebraic rearrangement, e.g. Specific heat capacity = change in internal energy / (mass x change in temperature) IGNORE negative in the answer ALLOW incorrect calculated answer rounded to 2sf for final mark Note – To score the final mark, the final answer must be rounded to 2sf to match the minimum significant figures in the data
	(c)	(i)	The value of density is just out of range / greater than internet values AND the value of specific heat capacity is close / not equal to internet value ✓	1	3.2a	

Question			Answer	Marks	AO element	Guidance
		(ii)	Any two points from: Use a measuring cylinder that measures to the nearest 1 cm³ or a balance that measures to the nearest 0.001 g or use a thermometer that measures to the nearest 0.1°C ✓ Insulate the beaker containing the 200 g water ✓ lower the rock into the measuring cylinder gently to prevent water loss ✓ Measure mass of (dry) rock before placing rock in measuring cylinder (to measure volume) ✓ Move rock from hot water to colder water quickly (to minimise energy loss) ✓ Use a rock sample with a high mass to reduce percentage uncertainty in calculated value ✓	2	3.3a	ALLOW increase resolution of equipment OR 'better resolution' ALLOW place the rock into the water without string as string will add volume
		(d)	Particles in a solid are packed closely together ✓ Particles in a gas are spaced far apart ✓ In a solid (a given amount of) mass occupies a smaller volume / in a gas (a given amount of) mass occupies a larger volume ✓ Therefore, Pumice is less dense. ✓	4	2.1	IGNORE reference to arrangement, must refer to spacing IGNORE reference to movement, must refer to spacing ALLOW fewer particles per unit volume in a gas / more particles per unit volume in a solid

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