PEARSON EDEXCEL GCSE COMBINED SCIENCE (HIGHER) · 1SC0

PHYSICS



MARK SCHEME

TOPIC 14: PARTICLE MODEL (PAPER 2)

SCORE	PERCENTAGE
/160	%

STEMUP

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Mark Scheme

Q1.

Question number:	Answer	Additional guidance	Mark
(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	

Question Number:	Answer	Additional guidance	Mark
(ii)	any two improvements from:	both marks can be scored in one answer space ignore repeating readings ignore increase voltage / power / energy ignore use of clamp to hold thermometer / heater	(2) AO 3 3b
	add lid /cover (1)		
	add lagging / insulation (1)	accept use better insulator or better insulated / thicker cup accept use calorimeter ignore use glass beaker unless cup is inside it ignore different type of cup	
	add a stirrer (1)		
	use a more sensitive thermometer (1)	accept use digital / electric thermometer / data logger	
	ensure heater fully submerged (1)		

(**Q16 1SC0/2PF, June 2018**)

Q2.

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

Question Number:	Answer	Additional Guidance	Mark
(ii)	any two improvements from: add lid /cover (1) add lagging / insulation (1) add a stirrer (1) use a more sensitive thermometer (1) ensure heater fully submerged (1)	both marks can be scored in one answer space ignore repeating readings ignore increase voltage / power / energy ignore use of clamp to hold thermometer / heater accept use better insulator or better insulated / thicker cup accept use calorimeter ignore use glass beaker unless cup is inside it ignore different type of cup accept use digital / electric thermometer / data logger	(2) AO 3 3b

(**Q01 1SC0/2PH, June 2018**)

Q3.

Question number	Answer	Additional guidance	Mark
(i)	two from: lagging (1) lid (1) repeat and average (1) surround heater/thermometer with oil (1)	 repeat with different time/temp rise/power Allow to reach maximum temperature at switch off.	(2)

Question number	Answer	Additional guidance	Mark
(ii)	temperature rise = 34 (°C) (1) substitution (1) $\frac{50 \times 300}{0.92 \times 34}$ evaluation (1) 480 (J/kg°C)	ecf temperature rise award full marks for correct answer without working	(3)

(**Q03c 1SC0/2PF/S2, SAM**)

Q4.

Question number	Answer	Additional guidance	Mark
(i)	rearrangement (and substitution) (1) (c) $= \frac{1050}{0.058 \times 78}$ evaluation (1) 230 (J/kg °C)	$c = \frac{\Delta Q}{m \times \Delta\theta}$ award 1 mark if 78 seen accept 232(J/kg °C) award full marks for correct answer without working.	(2)

Question number	Answer	Additional guidance	Mark
(ii)	any two of the following reduce heat loss from water/insulate beaker/add cover (1) make the temperature rise larger/use a larger piece of copper/ use a smaller amount of water (1) (use)a stirrer (1) account for heat gained by glass beaker (1) transfer the hot copper faster (1) use a different heating method (1) measure the temperature of the boiling water (1)	ignore more accurate measurements e.g. thermometer, balance etc. ignore taking repeats start with colder water	(2)

(**Q05b 1SC0/2PF, Nov 2020**)

Q5.

Question number	Answer	Additional guidance	Mark
(i)	Rearrangement (and substitution) (1) (c) $= \frac{1050}{0.058 \times 78}$ evaluation (1) 230 (J/kg °C)	 $c = \frac{\Delta Q}{m \times \Delta\theta}$ award 1 mark if 78 seen accept 232(J/kg °C) award full marks for correct answer without working.	(2)

Question number	Answer	Additional guidance	Mark
(ii)	any two of the following reduce heat loss from water/insulate beaker/add cover (1) make the temperature rise larger/use a larger piece of copper/ use a smaller amount of water (1) (use) a stirrer (1) account for heat gained by glass beaker (1) transfer the hot copper faster (1) use a different heating method (1) measure the temperature of the boiling water (1)	ignore more accurate measurements e.g. thermometer, balance etc. ignore taking repeats start with colder water	(2)

(**Q01b 1SC0/2PH, Nov 2020**)

Q6.

Question number	Answer	Additional guidance	Mark
(i)	substitution (1) $830 = \frac{3.9}{\text{volume}}$ rearrangement and evaluation (1) (volume =) 0.0047 (m^3) **OR ALTERNATIVE METHOD** rearrangement (1) $(\text{volume} =) \frac{\text{mass}}{\text{density}}$ substitution and evaluation (1) (volume =) 0.0047 (m^3)	accept values that round to 0.0047; e.g. 0.004699 volume = $\frac{3.9}{830}$ accept values that round to 0.0047; e.g. 0.004699 award full marks for correct answer without working if no other mark scored allow 1 mark for values that round to 0.0042 (use of incorrect density)	**(2)** **AO2**

Question number	Answer	Additional guidance	Mark
(ii)	(the volume will) decrease (1)		**(1)** **AO3**

Question number	Answer	Additional guidance	Mark
(iii)	an explanation linking three from specific heat capacity is (much) less than specific latent heat (1) specific heat capacity is 2.1(kJ/kg °C) and specific latent heat is 190 (kJ/kg) (1) less (thermal) energy is transferred (to surroundings during R to S) (1) (thermal) energy transferred (to surroundings) at similar / constant rate (1)	allow reverse arguments less heat is dissipated	**(3)** **AO3**

(**QU03c 1SC0/2PH, June 2025**)

Q7.

Question Number	Answer	Additional guidance	Mark
(i)	substitution (1) (ΔQ =) 0.96 x 920 x 17 evaluation (1) 15000 (J)	0.96 x 920 x (35-18) accept 15014 (.4) 15000 to any other power of ten scores 1 mark award full marks for the correct answer without working	**(2)** **AO2.1**

Question Number	Answer	Additional guidance	Mark
(ii)	add insulation (around aluminium block) (1)	accept any named insulator allow polish aluminium block allow wrap in foil or put in a box ignore 'lids' unless with a (named) insulator	**(1) AO3b**

Question Number	Answer	Additional guidance	Mark
(iii)	any **one** from: energy needs (time) to transfer (through the aluminium) (1) heater and thermometer are not close together (1) there is a gap between the thermometer and the block (1)	 accept heat for energy accept travel/conduct/spread for transfer	**(1) AO1.1**

(**QU02c 1SC0/2PF, June 2025**)

Q8.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined 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. Fibre glass • has lower R-value • similar R-value (to polystyrene) • derived from sand so plentiful / cheap • non-flammable • dangerous to install • concludes / uses other arguments to say that it is a suitable or unsuitable material Polystyrene • high(est) R-value so suitable on that score • (but) involves petroleum / oil extraction so (could be) environmentally damaging • melting / flammable / fire hazard / release of toxic fumes • concludes / uses other arguments to say that it is a suitable or unsuitable material	**(6)** **AO2, AO3**

AO targeting: 3 marks AO2 strand 1 and 3 marks AO3 strand 1a and 1b

Level	Mark	Descriptor
	0	• No awardable content
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)

Level	Mark	Additional Guidance	General additional guidance – the decision within levels e.g. - At each level, as well as content, the scientific coherency of what is stated will help place the answer at the top, or the bottom, of that level.
	0	No rewardable material.	
Level 1	1–2	Additional guidance at least two pieces of information from the table used OR one piece of information on the table and makes a simple choice	Possible candidate responses R is 4.0 for polystyrene + fibreglass is not flammable OR we should use fibreglass
Level 2	3–4	Additional guidance compares at least two properties OR compares one property and gives a conclusion about suitability uses information from the two materials used AND makes some comparison(s) / concludes logically about suitability	Possible candidate responses fibreglass has a lower R-value and is not flammable, but polystyrene is OR fibreglass is not flammable, but polystyrene is, so fibreglass better
Level 3	5–6	Additional guidance compares at least two properties AND gives a conclusion (both materials involved, allow one to be discussed in greater detail than the other) WITH logical connections between elements argued from the table.	Possible candidate responses fibreglass and polystyrene have similar R-values. Fibreglass is not flammable, but polystyrene is, so fibreglass is better

(**QU06d 1SC0/2PF, June 2023**)

Q9.

Question number	Answer	Additional guidance	Mark
(i)	933 (1)	do not accept -933 ignore K ignore degrees ignore °	**(1)** **AO2**

Question number	Answer	Additional guidance	Mark
(ii)	A description to include any **two** from: (motion is) random (1) various {speeds / velocities / kinetic energies} (1) bump into each other / collide (1) fast(er than solid) (1)	 move freely / move in any direction / move around different speeds range of speeds slide over / past each other / touch each other / in contact with each other more kinetic energy (than in solid) ignore bulk properties of liquids e.g. take shape of container. ignore vibrate "random speeds" on its own scores 1 mark	**(2)** **AO1**

(**QU02c 1SC0/2PH, June 2023**)

Q10.

Question number	Answer	Additional guidance	Mark
i	rearrangement **and** substitution (1) $(\Delta\theta =) \frac{210 (x10^3)}{5.8 \times 860}$ evaluation (1) 42 (°C)	$(\Delta\theta =) \frac{210 (x10^3)}{4988}$ accept any value which rounds to 42 e.g. 42.10 award full marks for the correct answer without working 4.2 to any other power of 10 scores 1 mark	**(2) AO2.1**

Question number	Answer	Additional guidance	Mark
ii	an explanation linking any **two** from not **all** the energy supplied goes to the <u>brick</u> (1) not all the energy supplied stays in the <u>brick</u> (1) energy transferred to the storage heater parts (1)	ignore: • energy is lost / wasted, unqualified • not 100% efficient • arguments about sound energy accept heat for energy throughout less (thermal) energy given to <u>brick</u> energy transfers from the <u>brick</u>	**(2) AO2.1**

	energy transferred to the surroundings (1) argument linking $\Delta\theta$ to ΔQ **using** $\Delta\theta = \frac{\Delta Q}{m \times c}$ (1)	energy dissipated from the equation, if energy supplied to the block is smaller the change of temperature will be smaller 'brick transfers (thermal) energy to the surroundings' scores 2 marks	

(**QU06c 1SC0/2PH, June 2024**)

Q11.

Question number	Answer	Additional guidance	Mark
(i)	Substitution: Density = mass/ volume (1) = 28 x10^{-3}/ 3.6 x 10^{-6} (1) Evaluation = 7777 kg / m^3 (1)	 (recalled / used) ignore any power of ten (pot) error here do not penalise any sf errors (7.77 etc. would get 2 marks: losing the pot mark in the evaluation)	**(3)**

Question number	Answer	Additional guidance	Mark
(ii)	(Use $\Delta Q = m \times c \times \Delta \theta$) substitution thermal energy gained = 0.028 x 510 x 80 (1) evaluation = 1100 (J) (1)	 ignore any pot error here 1142 (J)	**(2)**

Question number	Answer	Mark
(iii)	An explanation that combines identification – knowledge (2 marks) and reasoning / justification (1 mark) Solid state → particles vibrate (1) → about fixed positions (1) Liquid state → particles move randomly / freely (1)	**(3)**

(**Q04a 1SC0/2PH/S2, SAM**)

Q12.

Question number	Answer	Additional guidance	Mark
	substitution (1) 100 ÷ 13 answer (1) 7.7 (g/cm^3)	award full marks for correct numerical answer without working allow 7.692 (g/cm^3)	**(2)**

(**Q01bi 1SC0/2PF, SAM 2016**)

Q13.

Question number	Answer	Additional guidance	Mark
(i)	933 (K)	do not accept **-933**	**(1)** **AO2**

Question number	Answer	Additional guidance	Mark
(ii)	A description to include any **two** from: (motion is) random (1) various {speeds / velocities / kinetic energies} (1) bump into each other / collide (1) fast(er than solid) (1)	 move freely / move in any direction / move around different speeds range of speeds slide over / past each other / touch each other / in contact with each other more kinetic energy (than in solid) ignore bulk properties of liquids e.g. take shape of container. ignore vibrate "random speeds" on its own scores 1 mark	**(2)** **AO1**

(**QU06c 1SC0/2PF, June 2023**)

Q14.

Question number	Answer	Additional guidance	Mark
	rearrangement (1) $(l =) \frac{\Delta Q}{\Delta m}$ substitution (1) $l = \frac{270000}{0.12}$ answer (1) 2 250 000 (J/kg °C)	award full marks for correct numerical answer without working 2250 (J/kg °C) gains 2 marks as power of 10 error	**(3)**

(**Q02c 1SC0/2PF, SAM 2016**)

Q15.

Question Number	Answer	Additional guidance	Mark
(i)	substitution into $\Delta Q = m \times c \times \Delta\theta$ (1) $84\,000 = 0.25 \times 4200 \times \Delta\theta$ rearrangement $\frac{\Delta Q}{m \times c}$ (1) $(\Delta\theta =) \frac{84\,000}{0.25 \times 4200}$ $(= 80)$ evaluation (1) (temperature before heating =) 20 (°C)	accept substitution and rearrangement in either order answer of 80 (°C) scores 2 marks award full marks for the correct answer without working	**(3)**

Question Number	Answer	Additional guidance	Mark
(ii)	substitution into Q = m × L (1) 0.34 = 0.15 × L re-arrangement and evaluation (1) $(L = \frac{0.34}{0.15})$ 2.3 (MJ/kg)	 allow values that round to 2.3 (MJ/kg) allow 1 mark for POT error award full marks for the correct answer without working	**(2)**

Question Number	Answer	Additional guidance	Mark
(iii)	A description that makes reference to any **two** of the following (density) increases between 0°C and 4 °C (1) reaches a maximum at 4 °C (1) (density) decreases above 4 °C (1)	 increases initially / at first / up to 4 °C then decreases if no other marks scored then credit reference to large volume means low density (OWTTE) for 1 mark only	**(2)**

(**Q04b 1SC0/2PH, June 2019**)

Q16.

Question	Answer	Additional guidance	Mark
	substitution into $Q = m \times L$ (1) (Q =) 60 ($\times 10^{-3}$) $\times$ 2.26 ($\times 10^{6}$) evaluation (1) 1.36×10^{5} (J)	 136 000 (J) 135 600 (J) accept numbers that round to 1.4×10^{5} (J) award full marks for the correct answer without working any answer rounding to 1.4 to any other power of 10 scores 1 mark	**(2)** **AO2.1**

(QU06c 1SC0/2PF, June 2024)

Q17.

	Answer	Additional guidance	Mark
	substitution into $Q = m \times L$ (1) (Q =) 60 ($\times 10^{-3}$) $\times$ 2.26 ($\times 10^{6}$) evaluation (1) 1.36×10^{5} (J)	 136 000 (J) 135 600 (J) accept numbers that round to 1.4×10^{5} (J) award full marks for the correct answer without working any answer rounding to 1.4 to any other power of 10 scores 1 mark	**(2)** **AO2.1**

(**QU02c 1SC0/2PH, June 2024**)

Q18.

Question number	Answer	Additional guidance	Mark
(i)	an explanation linking any three of the following : use a measuring cylinder /beaker or use a eureka can /displacement can/container with spout (1) (partly) fill measuring cylinder /beaker (with water) note the reading or fill (eureka) can to spout (1) immerse piece of copper (in water) (1) note difference in readings of water level (in measuring cylinder /beaker) or collect water from spout in a measuring cylinder /beaker (1)	give credit for other acceptable methods If no other marks scored then allow 1 mark for attempt to measure volume directly: e.g. fill copper tube with water, tip out and measure volume or measure dimension(s) of copper tube	**(3)**

Question number	Answer	Additional guidance	Mark
(ii)	recall and substitution (1) density= $\frac{m}{V}$ (density=) $\frac{0.058}{6.5 (\times 10^{-6})}$ evaluation (1) 8.9×10^{3} (kg/m³)	 accept values that round to 8900 e.g. 8923(kg/m³) or 9000 8.9 to any other power of ten gains 1 mark award full marks for correct answer without working.	**(2)**

(**Q05a 1SC0/2PF, Nov 2020**)

Q19.

Question number	Answer	Additional guidance	Mark
(i)	an explanation linking any three of the following : use a measuring cylinder / beaker or use a eureka can /displacement can/container with spout (1) (partly) fill measuring cylinder / beaker (with water) note the reading or fill (eureka) can to spout (1) immerse piece of copper (in water) (1) note difference in readings of water level (in measuring cylinder / beaker) or collect water from spout in a measuring cylinder / beaker (1)	give credit for other acceptable methods If no other marks scored then allow 1 mark for attempt to measure volume directly: e.g. fill copper tube with water, tip out and measure volume or measure dimension(s) of copper tube	(3)

Question number	Answer	Additional guidance	Mark
(ii)	recall and substitution (1) density= $\frac{m}{V}$ (density=) $\frac{0.058}{6.5 (\times 10^{-6})}$ evaluation (1) 8.9×10^3 (kg/m³)	accept values that round to 8900 e.g. 8923(kg/m³) or 9000 8.9 to any other power of ten gains 1 mark award full marks for correct answer without working.	(2)

(**Q01a 1SC0/2PH, Nov 2020**)

Q20.

Question number	Answer	Additional guidance	Mark
	substitution (1) $(r) = \frac{7.22(\times 10^{-2})}{2.69(\times 10^{-5})}$ evaluation (1) (ρ =) 2680	 2.68 to any power of ten seen allow any value that rounds to 2680; e.g. 2684 accept 2700 allow values in standard form e.g. 2.68 x 10^3	**(3)** **AO2**

	unit (1) kg / m^3	kg m^{-3} allow for three marks: 2.68 to any power of ten **with** a consistent unit, e.g. 2680 kg/m^3 2680 g/dm^3 2.68 g/cm^3 2.68 kg/dm^3 0.00268 kg/cm^3 2 680 000 g/m^3 allow for two marks: • 2680 with no or incorrect unit • 2.68 to any other power of 10 **with** an inconsistent unit of density • correct substitution **with** an inconsistent unit of density allow for one mark: • 2680 to any other power of ten with no or incorrect unit • appropriate unit of density with no or an incorrect value	

(**QU06b 1SC0/2PF, June 2023**)

Q21.

Question number	Answer	Additional guidance	Mark
	substitution (1) $(r) = \frac{7.22(\times 10^{-2})}{2.69(\times 10^{-5})}$ evaluation (1) (ρ =) 2680 unit (1) kg / m^3	2.68 to any power of ten seen allow any value that rounds to 2680; e.g. 2684 accept 2700 allow values in standard form e.g. 2.68 x 10^3 kg m^{-3} allow for three marks: 2.68 to any power of ten **with** a consistent unit, e.g. 2680 kg/m^3 2680 g/dm^3 2.68 g/cm^3 2.68 kg/dm^3 0.00268 kg/cm^3 2 680 000 g/m^3	**(3)** **AO2**

		allow for two marks: • 2680 with no or incorrect unit • 2.68 to any other power of 10 **with** an inconsistent unit of density • correct substitution **with** an inconsistent unit of density allow for one mark: • 2680 to any other power of ten with no or incorrect unit • appropriate unit of density with no or an incorrect value	

(**QU02b 1SC0/2PH, June 2023**)

Q22.

Question Number	Answer	Additional guidance	Mark
(i)	substitution (1) $(\Delta Q) = 1.5 \times 4200 \times 50$ evaluation (1) 320 000 (J)	 accept 315 000 (J) 310 000 (J) award full marks for the correct answer without working 320 000 000 315 000 000 310 000 000 score 1 mark (mass in grams)	**(2)**

Question Number	Answer	Additional guidance	Mark
(ii)	substitution (1) $3500 = \frac{670\,000}{t}$ rearrangement (1) $(t=) \frac{670\,000}{3500}$ evaluation (1) 190(s)	accept substitution and rearrangement in either order accept any answer that round to 190(s) power of ten error award 2 marks maximum award full marks for the correct answer without working	**(3)**

(**Q04c 1SC0/2PF, June 2019**)

Q23.

Question	Answer	Additional guidance	Mark
(i)	30 (°C) (1)		**(1) AO3.1**

Question	Answer	Additional guidance	Mark
(ii)	substitution (1) (c =) $\frac{96000}{0.82 \times 30}$ evaluation (1) (c =) 3900 (J/kg °C)	allow ECF from (a)(i) throughout allow values that round to 3900 e.g. 3902.4 (J/kg °C) award full marks for the correct answer without working	**(2) AO3.1**

(**QU04a 1SC0/2PF, June 2024**)

Q24.

Question Number	Answer	Additional guidance	Mark
(i)	29(g)		(1)

Question Number	Answer	Additional guidance	Mark
(ii)	25(cm^3)		(1)

Question Number	Answer	Mark
(iii)	**D** density = $\frac{\text{mass}}{\text{volume}}$ **D** is the only correct answer **A** is incorrect because the equation density = mass+ volume is incorrect **B** is incorrect because the equation density = mass – volume is incorrect **C** is incorrect because the equation density = mass x volume is incorrect	(1)

Question Number	Answer	Additional guidance	Mark
(iv)	Any two improvements from: use balance that reads to one or more decimal places/more decimal places (1) use tare/zero balance for first measurement (1) use measuring cylinder with smaller divisions (1) use larger volume of liquid (1) repeat and average (1) read measuring cylinder at eye level (1)	 Accept use more accurate/precise balance in this context Allow reset for tare Allow more accurate/ different scale / different divisions / thinner measuring cylinder Allow use more liquid / larger mass of liquid Allow avoid parallax error / read from bottom of meniscus	(2)

(**Q04b 1SC0/2PF, June 2019**)

Q25.

Question number	Answer	Additional guidance	Mark
	volume substitution (1) 1.5 x 1.0 x 0.2(0) (= 0.3) substitution in equation (1) mass = 2100 x (0.3(0)) evaluation (1) = 630 (kg)	 ecf from calculated value of volume for this mark only award 2 marks for 6.3 x any other power of 10 5670 gains 1 mark from use of 1.5+1.0+0.2=2.7 award full marks for correct answer without working	**(3)** **AO2**

(**Q06b 1SC0/2PF, Nov 2021**)

Q26.

Question number	Answer	Additional guidance	Mark
	volume substitution (1) 1.5 x 1.0 x 0.2(0) (= 0.3) substitution in equation (1) mass = 2100 x (0.3(0)) evaluation (1) = 630 (kg)	 ecf from calculated value of volume for this mark only award 2 marks for 6.3 x any other power of 10 5670 gains 1 mark from use of 1.5+1.0+0.2=2.7 award full marks for correct answer without working	**(3)** **AO2**

(**Q02b 1SC0/2PH, Nov 2021**)

Q27.

Question number	Answer	Additional guidance	Mark
	calculation of change in volume (1) (530 cm^3 – 490 cm^3) = 40 (cm^3) substitution (1) $7.9 = \frac{mass}{40}$ rearrangement and evaluation (1) (mass = 7.9 x 40) (mass =) 316 (g) evaluation to 2 sig fig (1) 320 (g)	measurement mark – using scale allow use of incorrect volume answers without working 316 scores 3 marks 0.316 kg scores 3 marks 316 to any other power of 10 scores 2 marks 4187 or 3871 scores 2 marks (incorrect volume) any answer written to 2sf independent mark answers without working 320 scores 4 marks 320 to any other power of ten scores 3 marks 4200 scores 3 marks 3900 scores 3 marks	**(4)** **AO2**

(**QU06b 1SC0/2PF, June 2022**)

Q28.

Question number	Answer	Additional guidance	Mark
	calculation of change in volume (1) (530 cm^3 – 490 cm^3) = 40 (cm^3) substitution (1) $7.9 = \frac{mass}{40}$ rearrangement and evaluation (1) (mass = 7.9 x 40) (mass =) 316 (g) evaluation to 2 sig fig (1) 320 (g)	measurement mark – using scale allow use of incorrect volume answers without working 316 (g) scores 3 marks 0.316 kg scores 3 marks 316 to any other power of 10 scores 2 marks 4187 or 3871 scores 2 marks (incorrect volume) **any answer** written to 2sf independent mark answers without working 320 scores 4 marks 320 to any other power of ten scores 3 marks 4200 scores 3 marks 3900 scores 3 mark	**(4)** **AO2.2**

(**QU02b 1SC0/2PH, June 2022**)

Q29.

Question number	Answer	Additional guidance	Mark
	substitution (1) 566 000 = 0.25 x L rearrangement (1) $\frac{566\ 000}{0.25}$ evaluation (1) 2 260 000 (J/kg)	substitution and rearrangement in either order award full marks for correct answer without working	**(3)**

(**Q03d 1SC0/2PF/S2, SAM**)

Q30.

Question number	Answer	Additional guidance	Mark
	269 (K)	allow use of 273.14? 269.14 (K)	**(1)** **AO2**

(**Q02d 1SC0/2PH, Nov 2021**)

Q31.

Question	Answer	Additional guidance	Mark
	substitution (1) $8.96 = \frac{14.1}{V}$ rearrangement (1) $(V =) \frac{14.1}{8.96}$ evaluation (1) $(V =) 1.57\ (cm^3)$	allow substitution and rearrangement in either order allow substitution of correct values into a visible, incorrectly rearranged algebraic equation for this mark only $(V =) \frac{m}{\rho}$ accept numbers that round to 1.57 allow 1.6	**(3)** **AO2.1**

		award full marks for the correct answer without working allow 1.6 or answers rounding to 1.57 to any other power of 10 scores 2 marks	

(**QU06a 1SC0/2PF, June 2024**)

Q32.

	Answer	Additional guidance	Mark
	substitution (1) $8.96 = \frac{14.1}{V}$ rearrangement (1) $(V =) \frac{14.1}{8.96}$ evaluation (1) $(V =) 1.57\ (cm^3)$	allow substitution and rearrangement in either order allow substitution of correct values into a visible, incorrectly rearranged algebraic equation for this mark only $(V =) \frac{m}{\rho}$ accept numbers that round to 1.57 allow 1.6 award full marks for the correct answer without working allow 1.6 or answers rounding to 1.57 to any other power of 10 scores 2 marks	**(3)** **AO2.1**

(**QU02a 1SC0/2PH, June 2024**)

Q33.

Question number	Answer	Additional guidance	Mark
	estimation (1) reading off scale either 1750 **or** 1350 seen evaluation (1) 400 (cm^3)	 allow estimate in range 1300-1400 **or** 1700-1800 for 1 mark accept any answer between 350 and 450 (cm^3) award full marks for the correct answer without working if no other marks scored accept an answer between 350 and 450 to any other power of 10 for one mark	**(2)** **AO2.2**

(**QU02d 1SC0/2PH, June 2024**)

Q34.

Question number	Answer	Additional guidance	Mark
(i)	substitution into $\Delta Q = m \times s \times \Delta T$ (1) $(\Delta Q) = 1.41 \times 4200 \times (100-25)$ evaluation (1) (energy =) 444,150 (J) answer to 2 sf (1) 440,000 (J)	ignore POT error for this mark independent mark allow 3 sf 444,000 award full marks for the correct answer without working award 1 mark for answers with values 148,050 or 592,200 (incorrect temp and sf) award 2 marks for answers with values 150,000 or 148,000 or 590,000 or 592,000 (incorrect temp but allowed sf)	**(3)** **AO2**

Question number	Answer	Additional guidance	Mark
(ii)	substitution into $\Delta Q = m \times L$ $450{,}000 = (1.41 - 1.21) \times L$ (1) rearrangment $L = \frac{450{,}000}{0.2}$ (1) evaluation (L) = 2 200 000 (J/kg) (1)	allow substitution and rearrangement in either order accept 2 250 000 award full marks for the correct answer without working award 1 mark for answers that round to 330,000 or 370,000 (incorrect mass used)	**(3)** **AO2**

(**Q06a 1SC0/2PH, Nov 2021**)

Q35.

Question Number:	Answer	Additional guidance	Mark
	recall and substitution (1) (density ρ)=$\frac{380}{410}$ evaluation (1) 0.93 (g/cm^3)	 allow substitution of a mass / a volume accept any value that rounds to 0.9 allow truncated 0.92 (g/cm^3) only accept 1(g/cm^3) if working shown. award full marks for correct answer without working	**(2)** AO 2 1

(**Q19 1SC0/2PF, June 2018**)

Q36.

Question Number:	Answer	Additional guidance	Mark
	substitution (1) $(Q =) \frac{380 \times 3.34\ (\times 10^5)}{(1000)}$ evaluation (1) 1.27×10^5 (J)	 127 kJ 126920 (J) accept answers that round to 1.27×10^5 e.g. 1.2692×10^5 accept 130 kJ or 1.3×10^5 (J) POT error max. 1 mark award full marks for correct answer without working	**(2)** AO 2 1

(**Q18 1SC0/2PF, June 2018**)

Q37.

Question Number:	Answer	Additional Guidance	Mark
	substitution (1) $(Q =) \frac{380 \times 3.34 (\times 10^5)}{(1000)}$ evaluation (1) 1.27×10^5 (J)	 127 kJ 126920 (J) accept answers that round to 1.27×10^5 e.g. 1.2692×10^5 accept 130 kJ or 1.3×10^5 (J) POT error max. 1 mark award full marks for correct answer without working	**(2)** AO 2 1

(**Q03 1SC0/2PH, June 2018**)

Q38.

Question number	Answer	Mark
(i)	C	**(1)**

Question number	Answer	Additional guidance	Mark
(ii)	Equating the same variable in both equations (1) $\Delta Q = m \times c \times \Delta\theta = P \times t$ Rearrangement (1) $t = \frac{(m \times c \times \Delta\theta)}{P}$ Substitution and evaluation (1) $t = \frac{(1 \times 4200 \times 77)}{3500}$ = 92 s	 allow $\Delta\theta$ seen as 95 – 18 92.4 evaluation must be seen to at least 2 s.f. at some point in the working	**(3)**

(**Q10a 1SC0/2PH, SAM 2016**)

Q39.

Question number	Answer		Mark
(i)	An answer that combines the following points of understanding to provide a logical description: • when steam condenses, its molecules move closer together, so the internal energy decreases (1) • when the water from the condensed steam cools, its molecules move more slowly, therefore storing less kinetic energy (1)	allow as water cools, the distance between the particles decreases which increases the intermolecular forces	**(2)**

Question number	Answer	Additional guidance	Mark
(ii)	equating the variables in the three equations/principle of conservation of energy (1) $(m_w \times l_w) + (m_w \times c_w \times \Delta\theta_w) = (m_m \times c_m \times \Delta\theta_m)$ rearrangement (1) $m_m = \frac{(m_w \times l_w) + (m_w \times c_w \times \Delta\theta_w)}{(c_m \times \Delta\theta_m)}$ substitution of correctly calculated quantities (1) $= \left(\frac{\left(\left(\frac{25}{1000}\right) \times 2260000\right) + \left(\left(\frac{25}{1000}\right) \times 4200 \times 35\right)}{3840 \times 60} \right)$ evaluation (1) 0.26 (kg)	allow in words or with suitable alternative subscripts temperature changes and l_w must be correct allow maximum of 3 marks for calculations that omit the energy from cooling of water	**(4)**

Question number	Answer	Mark
(iii)	Any two of the following reasons: • more steam must condense and transfer the energy that is dissipated to the jug during the process (1) • more steam must condense and transfer the energy that is dissipated to the surroundings during the process (1) • more steam must condense and transfer the energy needed to cause the milk to froth (1) • more steam must condense to replace any steam that might leave the milk without condensing (1)	(2)

(**Q10b 1SC0/2PH, SAM 2016**)

Q40.

Question number	Indicative content	Mark
*	Answers will be credited according to candidate's deployment of knowledge and understanding of the material in relation to the qualities and skills outlined 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. **AO1 (6 marks)** • Use of top pan balance to measure mass • Insulate beaker to reduce heat loss • Ammeter connected in series with heater • Voltmeter connected in parallel with heater • Use of $E = I \times V \times t$ to determine energy supplied to the water • Accept use of joule-meter to measure energy supplied • Use of $\Delta E = m \times c \times \Delta\theta$ to determine the specific heat capacity of the water • Measure p.d. across heater • Use stopwatch to measure time liquid is heating • Measure current in heater • Determine mass of water as mass of (beaker and water) – mass of beaker • Measure temperature before and after heating	(6)

Level	Mark	Descriptor
	0	No awardable content.
Level 1	1–2	Demonstrates elements of physics understanding, some of which is inaccurate. Understanding of scientific, enquiry, techniques and procedures lacks detail. (AO1) Presents a description which is not logically ordered and with significant gaps. (AO1)
Level 2	3–4	Demonstrates physics understanding, which is mostly relevant but may include some inaccuracies. Understanding of scientific ideas, enquiry, techniques and procedures is not fully detailed and/or developed. (AO1) Presents a description of the procedure that has a structure which is mostly clear, coherent and logical with minor steps missing. (AO1)
Level 3	5–6	Demonstrates accurate and relevant physics understanding throughout. Understanding of the scientific ideas, enquiry, techniques and procedures is detailed and fully developed. (AO1) Presents a description that has a well-developed structure which is clear, coherent and logical. (AO1)

(**Q05c 1SC0/2PF, SAM 2016**)