Thermal Physics GCSE AQA Higher Physics Past Papers Answers

01.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	0.1 (ºC)		1	AO3/3a 4.1.1.3 WS2.3
2	power = energy transferred / time	allow P = E / t	1	AO1/1 4.1.1.4
3	correct substitution ie 1050 / 300 3.5 (W)	 accept 3.5 (W) with no working shown for **2** marks	1 1	AO2/1 AO2/1 4.1.1.4
4	1050 = m x 4200 x 0.6 m = 1050 / (4200 x 0.6) m = 0.417 (kg)	(substitution) (rearrangement) (answer) accept 0.417 (kg) with no working shown for **3** marks	1 1 1	AO2/2 4.1.1.3
5	any **one** from: • energy used to heat metal pan (as well as the water) • energy transfer to the surroundings (through the insulation) • angle of solar radiation will have changed during investigation • intensity of solar radiation may have varied during investigation		1	AO3/3a 4.1.1.3 WS3
Total			8	

02.

Question	Answers	Extra information	Mark	AO/ Spec. Ref
1	risk of electric shock (if someone touched the case)	allow risk of electrocution (if someone touched the case)	1	AO1 4.2.3.2
2		an answer of 11 (A) scores **3** marks		AO2 4.2.4.1
	$2530 = I \times 230$	this mark may be awarded if P is incorrectly / not converted	1	
	$I = \dfrac{2530}{230}$	this mark may be awarded if P is incorrectly / not converted	1	
	$I = 11$ (A)	this answer only	1	
		an answer of 0.011 (A) scores **2** marks		
3		an answer of 0.12 (kg) **or** an answer that rounds to 0.12 (kg) scores **5** marks		AO2 4.2.4.2 4.1.1.3
	$E = 2530 \times 14$	this mark may be awarded if P is incorrectly / not converted	1	
	$E = 35\,420$ (J)	this answer only	1	
	$35\,420 = m \times 4200 \times 70$	allow their calculated E = $m \times 4200 \times 70$	1	
	$m = \dfrac{35\,420}{4200 \times 70}$	allow m = $\dfrac{\text{their calculated E}}{4200 \times 70}$	1	
	$m = 0.12$ (kg)	allow an answer that is consistent with their calculated value of E	1	
Total			**9**	

03.

Question	Answers		Mark	AO/ Spec. Ref.
1	**Level 3**: The design/plan would lead to the production of a valid outcome. All key steps are identified and logically sequenced.		5–6	RP2 WS2.2 4.1.2.1 AO1
	Level 2: The design/plan would not necessarily lead to a valid outcome. Most steps are identified, but the plan is not fully logically sequenced.		3–4	
	Level 1: The design/plan would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.		1–2	
	No relevant content		0	
	Indicative content • Wrap N layers of newspaper around the metal can • Heated water in a kettle **or** Using a Bunsen burner • Put hot water in the metal can • Use a measuring cylinder to measure the volume of water • Measure initial and final temperature with the digital thermometer • Use a stopclock / stopwatch to measure a time of 5 minutes • Calculate temperature decrease • Repeat with different number of layers of newspaper • Repeat with no layers of newspaper • Use same initial temperature of hot water • Use same volume of water each time Level 3: Workable method which includes changing the number of layers and includes at least one control variable (same volume of water or same starting temperature)			
2	the digital thermometer and the datalogger have the same resolution	allow both measure to 1 d.p. ignore accuracy ignore precision they give the same result is insufficient	1	RP2 WS2.3 4.1.2.1 AO3
	only need to measure the start and end temperature **or** only need 2 readings **or** only need to calculate the temperature change		1	
Total			8	

04.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	Initial temperature was a control variable		1	WS3.7 4.3.2.2 AO3
2	copper		1	4.1.2.1 AO3
	greater change in mass (than the other metals)	this mark is dependent on scoring the first mark allow more ice melted (than the other metals) allow the ice melted faster (than the other metals)	1	
3	variation in initial mass of ice cube **or** surface area of the ice cube touching the metal	allow variation in initial volume of ice cube allow melting of ice while handling allow variation in room temperature allow initial temperature of metal block	1	WS3.7 4.1.2.1 AO3

4		an answer of 0.016 (kg) scores **5** marks		4.3.2.2 4.3.2.3 AO2
	$E = m \times 2100 \times 15$		1	
	$E = m \times 334\ 000$		1	
	$5848 = 31\ 500\ m + 334\ 000\ m$ **or** $5848 = 365\ 500\ m$		1	
	$m = \dfrac{5848}{(31\ 500 + 334\ 000)}$ **or** $m = \dfrac{5848}{(365\ 500)}$		1	
	$m = 0.016$ (kg)		1	
		allow **2** marks for an answer that rounds to 0.186 or 0.0175 if no other mark scored allow **1** mark for either $5848 = m \times 2100 \times 15$ **or** $5848 = m \times 334\ 000$		
Total			**9**	

05.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	the (mean) kinetic energy of the particles increases	allow the (mean) speed of the particles increases 'kinetic energy increases' is insufficient by itself do not accept particles vibrating	1	4.3.2.1 AO1
	which increases the (internal) energy of the water	ignore description of evaporation	1	
2	Particles in a gas have more potential energy than particles in a liquid.		1	4.3.1.1 AO1
3	Energy given to water $E = mL$ with quantities defined		1	4.3.3.1 AO1
	power output (of Bunsen burner) $= \dfrac{\text{energy transferred (to water)}}{\text{time}}$	allow $P = \dfrac{E}{t}$ with quantities defined	1	
	power output $= \dfrac{\text{change in mass} \times \text{specific latent heat}}{\text{time}}$	allow $E = Pt$ equated with $E = mL$ or stated in words **or** $P = \dfrac{mL}{t}$ with quantities defined	1	
	time should be converted to seconds **or** use a time of 300 seconds		1	
Total			**7**	

06.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	the heating element of the kettle takes time to heat up	allow the kettle takes time to heat up	1	AO3 4.1.1.3
2	$\Delta\Theta = 78$ (°C)		1	AO2 4.1.1.3 4.3.2.2
	$155\,000 = m \times 4200 \times 78$	allow a correct substitution using an incorrect value of $\Delta\Theta$	1	
	$m = \dfrac{155\,000}{4200 \times 78}$	allow a correct rearrangement using an incorrect value of $\Delta\Theta$	1	
	$m = 0.4731$ (kg)	allow a correct calculation of mass using an incorrect value of $\Delta\Theta$	1	
	$m = 0.47$ (kg)		1	
3	$\text{Gradient} = \dfrac{\Delta\theta}{t}$	allow gradient = rate of temperature increase allow calculation of gradient	1	AO1 4.1.1.3 4.3.2.2 4.1.1.4
	$Pt = mc\Delta\Theta$		1	
	$P = \text{gradient} \times mc$		1	
Total			9	

07.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	nuclei decreases	do not accept atoms	1 1	AO1 4.4.4.2
2	m = 0.004 (kg) E = 0.004 × 5200 × 50 000 000 E = 1.04 × 10^9 (J) **or** E = 1 040 000 000 (J)	 allow a correct substitution of an incorrectly/not converted value of m allow a correct calculation using an incorrectly/not converted value of m	1 1 1	AO2 4.3.2.2 4.1.1.3
3	any **two** from: • to make sure the fusion process is possible • to develop an understanding of the process • to make adaptations to the process • to assess the efficiency of the process • to make predictions • assess safety risks • to assess environmental impact • set-up cost is lower (for small scale experiments)		2	AO3 4.1.3

4	releases carbon dioxide which causes global warming **OR** releases particulates which causes global dimming or which causes breathing problems **OR** releases sulfur dioxide which causes acid rain **OR** releases nitrogen oxides which causes breathing problems or which causes acid rain	allow releases greenhouse gases allow which causes climate change	1 1	AO1 4.1.3
Total			9

08.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	the gradient for ice is steeper than the gradient for water (liquid)	allow the temperature of the ice increased faster than the temperature of the water	1	AO3 4.3.2.2
	which means that less energy is needed to increase the temperature by a fixed amount		1	
2	water took more time to vaporise than the ice took to melt		1	AO3 4.3.2.3
	which means that less energy is needed to change the state from solid to liquid (than from liquid to vapour)		1	
3	any **two** from: • ice/water would take more time to increase in temperature • ice/water would take more time to change state • the change in temperature with time would not be linear	allow gradients would be less steep allow horizontal lines would be longer	2	AO3 4.3.2.2 4.3.2.3 RPA1
4	E = 69 000 (J)		1	AO2 4.3.2.3
	69 000 = 0.030 × L	allow a correct substitution of an incorrectly/not converted value of E	1	
	$L = \dfrac{69\,000}{0.030}$	allow a correct rearrangement using an incorrectly/not converted value of E	1	
	L = 2 300 000 **or** L = 2.3 × 10^6	allow a correct calculation using an incorrectly/not converted value of E	1	
	J/kg	allow a unit consistent with their numerical answer eg 2300 kJ/kg	1	
Total			**11**	

09.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	independent variable: (type of) insulation / material	do not accept thickness of material	1	AO1 4.1.2.1 RPA2
	dependent variable: time		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2	0.1 (°C)		1	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3	viewing angle affects measurement **or** parallax error	allow judgement needed in reading the position (of the liquid in the thermometer) allow the level of the liquid may be between lines allow number of lines may be miscounted ignore harder to read ignore lines are close together ignore human error	1	AO3 4.1.2.1 RPA2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4	$E = 10\,500\,(J)$		1	AO2 4.1.1.3
	$m = \dfrac{10\,500}{4200 \times (85-65)}$	allow a correct substitution **and** rearrangement using an incorrectly / not converted value of E	1	RPA2
	$m = 0.125\,(kg)$	allow a correct calculation using an incorrectly / not converted value of E	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5	(same) temperature decrease in a shorter time means a higher thermal conductivity	allow converse answer	1	AO1 4.1.2.1 RPA2
	(because) the rate of energy transfer is higher		1	

Total Question			9

10.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	measuring cylinder	allow burette allow beaker with scale / graduations	1	AO3 4.3.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2	boiling water		1	AO3 4.3.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3	change in mass = 0.009 (kg)		1	AO2
	$25\,200 = 0.009\,L$	allow a correct substitution using an incorrectly calculated value of m	1	AO2
				AO2
	$L = \dfrac{25\,200}{0.009}$	allow a correct rearrangement using an incorrectly calculated value of m	1	AO2
	$L = 2.8 \times 10^6$ or $L = 2\,800\,000$	allow a correctly calculated answer using an incorrectly calculated value of m	1	AO1 4.3.2.3
	J/kg	if a unit other than J/kg is given it must match the numerical answer	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4	less energy (than 25 200 J) was transferred to the water		1	AO3 4.3.2.3
	(so) student's value of *L* was too high	2nd mark conditional on scoring 1st mark	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5	the measured change in mass is too high (for the energy supplied)	allow a smaller mass of water actually changed state at boiling point	1	AO3 4.3.2.3
	(so) student's value of L is too low	2nd mark conditional on scoring 1st mark	1	

Total Question			11

11.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	so the thermometer temperature was the same as the temperature of the iron block		1	AO3 4.1.1.3 RPA1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2	$\Delta\theta = (54 - 28) = 26$ (°C)		1	AO2 4.1.1.3
	$26\ 000 = 2.0 \times c \times 26$	allow a correct substitution using an incorrect value of $\Delta\theta$ obtained from the graph	1	RPA1
			1	
	$c = \dfrac{26\ 000}{2.0 \times 26}$	allow a correct rearrangement using an incorrect value of $\Delta\theta$ obtained from the graph		
			1	
	$c = 500$ (J/kg °C)	allow an answer consistent with their value of $\Delta\theta$ obtained from the graph		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3	the calculated specific heat capacity will be more accurate		1	AO3 4.1.1.3 RPA1
	the iron block will transfer thermal energy to the surroundings at a lower rate		1	

| Total Question ☐ | | | 7 | |