AQA GCSE Physics

Practice answers

Question	Answers	Extra information	Mark	AO / Specification reference
01.1	temperature change = 50°C - 20 °C = 30 °C		1	AO2 4.1.1.3
01.2	energy transferred = mass × specific heat capacity × change in temperature = 1.2 x 900 x 30 = 32 400 J		 1 1	AO2 4.1.1.3
01.3	energy is wasted/transferred to the thermal energy store of surroundings.		1	AO2 4.1.2.1
02.1	use loft insulation		1	AO1 4.1.2.1
02.2	the thicker the layer of bricks the slower the energy is transferred/the rate of energy transfer is less/less energy is transferred per second		1	AO1 AO2.1 4.1.2.1
02.3	a low thermal conductivity thermal conductivity is related to the rate of energy transfer /low thermal conductivity means a low rate of energy transfer		1 1	AO1 AO2 4.1.2.1

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03.1	swimming pool: energy transferred = mass × specific heat capacity × change in temperature 28.8×10^6 = mass × 4200 × (28 - 18) $\text{mass} = \frac{28.8\times10^6}{(4200\times10)}$ = 685 kg = 690 kg paddling pool: *energy transferred = mass × specific heat capacity × change in temperature* $88\,000\times10^6$ = mass × 4200 × (25 - 18) $\text{mass} = \frac{88000\times10^6}{(4200\times7)}$ = 2.99×10^6kg = 3.0×10^6kg swimming pool contains about $\frac{3.0\times10^6}{690} = 4300$ times as much water as the paddling pool		1 1 1 1 1 1	AO1 AO2 AO3 4.1.1.3
03.2	there is more energy in the thermal energy store of the swimming pool the paddling pool is at a higher temperature.	accept other reasonable suggestions	1 1	AO3 4.1.1.3 4.1.2.1
04	**Level 3:** Correct calculation of specific heat capacity, definition of specific heat capacity and power used to explain effect of doubling specific heat capacity.		5-6	AO2

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	Level 2: Calculation of specific heat capacity with conversion errors/comment about heating liquid B but without reference to definition of specific heat capacity.		3-4	AO3 4.3.2.2
	Level 1: Comment about the difference in heating liquid B/attempt at calculating specific heat capacity with errors.		1-2	
	No relevant content.		0	
	Indicative content • energy transferred = mass × specific heat capacity × change in temperature • convert 1.8 kJ to 1800 J and 10 g to 0.01 kg • substituting, 1800 = 0.01 × specific heat capacity × 50 • rearranging, specific heat capacity = $\frac{1800}{(0.01 \times 50)}$ • solving, specific heat capacity = 3600 J/kg °C • liquid B has twice the specific heat capacity, so it would take twice as much energy to raise the temperature (of the same mass by 50°C) • (if he uses the same heater/a heater with the same power) it would take twice as long.			
05.1	mass, speed	both needed for the mark	1	AO1 4.1.1.2
05.2	**Level 3:** Clear and coherent description of energy stores and transfers involved in both situations. Difference clearly stated with reason.		5-6	AO3 4.1.1.1
	Level 2: Beginning or end stores described and transfers involved in both situations. Difference stated but no reason given.		3-4	

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	Level 1: One or more relevant stores stated, with no description of transfer mechanism, or difference.		1-2	
	No relevant comment.		0	

	Indicative content
	accelerating car:
	• more energy in the chemical store (petrol) at the beginning
	• as it accelerates there is an increasing amount transferred to
	  ○ the kinetic energy store
	  ○ the thermal energy store of the car
	  ○ the surroundings
	motorway car:
	• more energy in the chemical store (petrol) at the beginning
	• this is transferred to the kinetic energy store
	• to keep it at a constant level, energy is passed on to
	  ○ the thermal energy store of the car
	  ○ the surroundings
	both cases:
	• energy is transferred by
	  ○ mechanical working/force of the engine
	  ○ friction			

05.3	oil provides lubrication so less energy is transferred to the thermal energy store of the surroundings/less energy is dissipated		1 1	AO2 4.1.2.1

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06.1	the type of insulation/material of can/starting temperature of water/colour of can/lid or no lid		1	AO2 4.1.2.1
06.2	72 in the third column/temperature after 15 minutes for 2cm misreading the thermometer/starting temp of water was higher/any sensible suggestion		1 1	AO3
06.3	sensible suggestion with benefit repeat the experiment more than once and calculate average /makes outliers easier to see/improves accuracy use a bigger range of thicknesses/trend in data is easier to see	one mark for suggestion one mark for benefit only if it clearly links to suggestion	2	AO3
07.1	crosses should be plotted along the following points: (0,20), (2,35), (4,45), (6,50), (8,52) with a curved line of best fit that passes through all points	one mark for correct variable on x-axis and y-axis one mark for appropriate scale on the x-axis and y-axis one mark for three of four points of data plotted correctly two marks for all data points plotted correctly one mark for drawing a line of best fit	5	AO2 AO3 4.1.1.3
07.2	the rate of temperature increase decreases over time the slope of the line decreases/the line becomes less steep/gradient decreases		1 1	AO2.2 4.1.1.3

Question	Answers	Extra information	Mark	AO / Specification reference
07.3	energy transferred = mass × specific heat capacity × change in temperature 15 800 = 1 × specific heat capacity × (52 - 20) specific heat capacity = $\frac{15800}{32}$ = 493.75 = 494 J/kg °C (to three significant figures)	allow 494 with no substitution for two marks	1 1 1	AO2 4.1.1.3
07.4	iron	allow error carried forward for incorrect calculation from question 07.3	1	AO3 4.1.1.3
08.1	type of material		1	AO2 4.1.2.1
08.2	suitable variable e.g., temperature drop over 10 minutes		1	AO2 4.1.2.1
08.3	suitable method e.g., wrap a can with a certain thickness of insulating material fill the can with water at a certain temperature put a lid on the can record the temperature drop after ten minutes repeat experiment three times, find average temperature drop repeat whole experiment using a different insulating material each time best insulator is the one with the smallest temperature drop rank materials in order of smallest to largest temperature drop.	four marks are available for describing the method in detail, one mark is available for describing the repetition of measurements one mark is available for describing how to rank them	1 1 1 1 1 1	AO2 4.1.2.1
08.4	any sensible suggestion e.g., thickness of insulation starting temperature of water		1	AO3 4.1.2.1

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09.1	the temperature decreased thermal energy was transferred from the inside of the room to the outside of the room		1 1	AO2 4.1.2.1
09.2	the thermal conductivity of the walls temperature difference across the walls		1 1	AO1 4.1.2.1
09.3	line drawn: • same initial temperature • shallower gradient explanation: • the line is above the first line • because energy is transferred more slowly through the thicker walls • the temperature at any time during the night will be higher		1 1 1 1 1	AO2 AO3 4.1.2.1
10.1	D		1	AO3 4.1.2.1

Question	Answers	Extra information	Mark	AO / Specification reference
10.2	<u>assuming (**two** from):</u> • the thickness of the walls is the same • the same amount of energy is transferred • temperature difference across walls is the same the thermal conductivity of A is bigger than the thermal conductivity of B by a factor of $\frac{0.45}{0.18} = 2.5$ so energy travels 2.5 times more slowly through material B time to cool down will be 2.5 times longer 2 hours × 2.5 = 5 hours	one mark for each correct assumption up to a maximum of two marks	2 1 1	AO3 4.1.2.1
10.3	if the thermal conductivity decreases, the rate of energy transfer decreases so the time it takes the temperature to go down will increase		1 1	AO3 4.1.2.1
11.1	there is a hazard/risk of injury/the teacher did a risk assessment that suggested that they not do it		1	AO2 4.1.1.3
11.2	so that the temperatures could be compared/the energy transferred per second was the same		1	AO2 4.1.1.3

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11.3	for both liquids: as the time increases the temperature increases at an increasing rate **and** the oil increases at a higher rate than the water/temperature of oil stays steady for a longer time		1 1 1	AO2 4.1.1.3
11.4	assuming the energy supplied to each liquid is the same assuming the mass of each liquid is the same the temperature change of the oil is higher at the end so the oil has a lower specific heat capacity		1 1 1 1	AO3 4.1.1.3
12.1	energy to raise to melting point= mass × specific heat capacity × change in temperature = 0.005 x 371 x (29.8 - 20) = 18(.2) J		1 1 1 1	AO2 4.1.1.3
12.2	energy is proportional to mass energy = 3 x 18.2 = 54(.6) J		1 1	AO2 4.1.1.3
12.3	it would be about 3 times less if the specific heat capacity is three times bigger, it takes three times the energy to produce the same temperature rise	or words to that effect	1 1	AO2 4.1.1.3
13.1	gravitational potential energy = mass × gravitational field strength × height		1	AO1
13.2	estimate mass of human = 50 kg – 100 kg gravitational potential energy = 75 × 9.8 × 0.5 = 367.5 J		1 1 1	AO2 4.1.1.2

Question	Answers	Extra information	Mark	AO / Specification reference
13.3	energy stored in a spring = 0.5 × spring constant × extension^2 assuming all the energy stored in the muscles/tendons is transferred to the gravitational potential energy store 367.5 = 0.5 × *spring constant* × 0.01^2 spring constant = $\frac{367.5}{(0.5 \times 0.01^2)}$ = 7 350 000 N/kg		1 1 1 1	AO2 AO3 4.1.1.2
13.4	gravitational potential energy is proportional to mass if the height is the same mass is 2000 times smaller, so gravitational potential energy is 2000 times smaller spring constant is proportional to energy if the extension is the same spring constant is 2000 times smaller		1 1 1 1	AO3 4.1.1.2