OCR GCSE GATEWAY PHYSICS A · J249

PHYSICS



MARK SCHEME

P7.1 WORK DONE

SCORE	PERCENTAGE
/102	%

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Question			Answer/Indicative content	Marks	Guidance
1	a		Oil will not freeze (as easily as water) / **ORA** (1)	1	
	b		Reduces risk of burns to people / children (1)	1	
	c		Time conversion: 10 × 60 = 600 seconds (1) 800 × 600 / 480 000 (J) (1)	2	**ALLOW** 480 (kJ)
	d	i	Substitute into formula for specific heat capacity / 10 × 40 × 1 700 (1) 680 000 (J) (1)	2	**ALLOW** 680 (kJ)
		ii	Any two from: Some energy used to heat the radiator case (rather than the oil) (1) Energy passed from oil to air in room / oil undergoes cooling whilst heating up (1) Energy is dissipated to surroundings (1) It is not 100% efficient at transferring energy (1)	2	
			Total	**8**	
2			Any 2 from: (Moving) ball has KE (1) Ball heats up (1) Some energy lost as heat to surroundings / moving air / particles in floor (1)	2	
			Total	**2**	
3			Re-arrange and substitute into WD = F × D: 217 000 / 6 500 (1) 33.4 (m) (1)	2	
			Total	**2**	

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Question			Answer/Indicative content	Marks	Guidance
4			Idea there is fixed energy in system / can't be (more than) 100% efficient (1) Idea that extra energy is heeded for this to happen (1)	2	
			Total	2	
5			Energy for oil is 672 000 (J) (1) Energy for water is 1 680 000 (J) (1) Recall P=E/t (1) Calculation to show: 672 000 / 400 = 1680 AND 1680000 / 1000 = 1680 (1)	4	
			Total	4	

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Question			Answer/Indicative content	Marks	Guidance
6	a		A (is 40g) [1] (because it has) most or more mass / most or more energy / most or more water / biggest volume / (so will cool slowest) [1]	2	Must be comparative Examiner's Comments Most candidates realised that the correct graph was A, but failed to give the correct explanation that it had the most water. The answer needed to be comparative. Several candidates gave the answer that it contained 40g of water, which was not credited as it was in the question.
	b	i	W [1]	1	Examiner's Comments The majority of candidates correctly answered W.The majority of candidates correctly answered W.
		ii	Z [1]	1	Examiner's Comments The majority of candidates correctly answered Z, X being the most common incorrect answer.
		iii	W warms quicker than Y ORA Y warms slower than W[1] ice has lower specific heat capacity ORA water has a higher specific heat capacity [1]	2	Ignore all references to melting, boiling or cooling allow ice warms faster than water [2] Examiner's Comments This question provided a few good answers from candidates who realised that the specific heat capacity of ice is less than that of water. Examiners were after a simple answer of ice warms faster than water.

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Question			Answer/Indicative content	Marks	Guidance
		iv	more energy / longer time needed to boil than melt / AW [1] latent heat of vaporisation is higher than that for fusion / AW [1]	2	E.g. takes longer to change water to gas than ice to water Examiner's Comments There was much confusion between specific heat capacity and the two different specific latent heats, with few candidates being able to explain the difference in time between Z and X.
			Total	8	

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Question			Answer/Indicative content	Marks	Guidance
7	a		1800 (J) [1]	1	Examiner's Comments This question about energy use in the home was well answered. Many were able to sensibly interpret the Sankey diagrams and use the concept of efficiency. This enabled them to use processed information in their answers. Most used the Sankey diagrams correctly to give the right answer of 1800J.
	b		60% or 0.6 [2] if answer is incomplete or incorrect then: $\frac{600}{1000}$ (x 100%) [1]	2	**allow** 60 with incorrect or no unit [1] eg 60 J/s or 60 scores [1] **allow** 0.6% [1] Examiner's Comments Many gave the correct efficiency calculation but it was common to see answers that failed to write '%' so limiting them to [1] mark.
	c		lowest (useful) energy output / input [1] (usefully) uses a greater proportion of energy / wastes a lower proportion of energy / AW [1]	3	**Eg.** Uses least amount of energy [1] **allow** longer time idea explained e.g. Energy = Power x time, and less power but longer time for slow cooker [1] **only** uses 160J/s (output) 200J/s (input) or **only** wastes 40J [1] **ignore** higher / most efficiency **allow** wastes less energy (than others) [1]

Question			Answer/Indicative content	Marks	Guidance
			BUT 80% or 0.8 efficient / [2]		eg **only** wastes 20% or 0.2 [2] **allow** 80 (linked to efficiency) with incorrect or no unit [1] eg. 80 J/s or 80 scores [1] **allow** 0.8% [1] evidence of the correct efficiency calculation [1] eg 160/200 [1] **Examiner's Comments** Most calculated the efficiency of the slow cooker as 80% and went on to say it had the lowest energy input for 3 marks. Those that did use calculations could still get [2] marks from the alternatives given in the mark scheme –e.g. It's the most efficient [1] and only wastes 40 [1].
			Total	6	

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Question			Answer/Indicative content	Marks	Guidance
8	a		**any two from** use light (energy) from sun / sunlight / light [1] converted to electricity [1] charges the battery [1]	2	 **allow** absorb light / light hits photocell [1] Examiner's Comments Most candidates stated that photocells absorbed sunlight and changed it into electricity. Candidates could also say “to charge a battery” as a marking point. A significant number of candidates thought that photocells stored energy to use at night.
	b		by the (charged) battery / AW [1] **but** battery provides electricity / power(at night) / AW [2] **or** battery has stored energy [2]	2	**allow** battery makes it work [1] **allow** by the sensor triggering the battery [1] Examiner's Comments Examiners were looking for the idea that the battery provides power at night, or the battery had stored energy (from the daytime).
	c		no need for wires / no need for mains supply / can be used in remote locations / renewable energy resource / AW [1]	1	**allow energy** is free /saves money[1] **allow** no need for generator Examiner's Comments Approximately a third of the candidates were able to give a valid advantage. Several candidates stated that it was free, but that was only accepted if it related to the energy. The most suitable answer involved the idea that they could be used where there was no mains power supply.
			Total	**5**	

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Question			Answer/Indicative content	Marks	Guidance
9		i	70% (3) **but if answer is incorrect** (7000 ÷ 10000) × 100 (2) **but if this is incorrect** useful energy = 7000(J) (1)	3	**ignore** 0.7 on answer line unless % clearly crossed out and no other unit added 0.7 **on its own** scores max (2) alternatively **allow** (3000 ÷ 10000) × 100 (1) **Examiner's Comments** Most candidates obtained 3 marks for calculating the efficiency correctly and giving 70%. Occasionally 7000/3000 was used, but candidates who wrote this usually got the useful energy mark. Also 30% was obtained on a few occasions.
		ii	idea that wasted energy is given to surroundings / atmosphere / energy is conserved / AW (1) wasted energy and useful energy add up to input energy (so not totally lost / energy just transferred) / AW (1)	1	**allow** idea that 3000J / wasted energy is converted to different forms of energy (1) Eg. 3000J lost as heat (1) **ignore** lost as sound **allow** the idea of energy conservation (1) **eg.** 7000J + 3000J output = 10000J input eg. combined width / size of output arrows = input (1) **Examiner's Comments** This proved a challenge for some in that they had difficulties in communicating their idea. Some communicated the idea of conservation clearly or used numbers to illustrate it. Eg. 10 000 input = 3 000 + 7 000 output [1]. Others were able to explain that the energy was not lost but wasted as heat [1].
			Total	**4**	
10	a		toaster (1)	1	
	b		fridge (1)	1	
			Total	**2**	

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Question			Answer/Indicative content	Marks	Guidance
11			B ✓	1 (AO2.2)	Examiner's Comments Q10 and Q11 required candidates to rearrange the equations provided to calculate the useful output energy transfer per minute, or the height of the water tank. Almost every candidate wrote out their workings by the side of the question stem and then selected the correct answer. See Exemplar 1 below. Exemplar 1 11 A pump lifts 500 kg of water to a water tank at the top of a building. The water gains 240 000 J of gravitational potential energy. The gravitational field strength is 10 N/kg. Use the equation: Potential energy = Mass × Height × Gravitational field strength Calculate the height of the water tank. 240000 / 500×10 A 4.8 m B 48 m C 240 m D 480 m Your answer B [1]
			Total	1	

Question			Answer/Indicative content	Marks	Guidance
12		i	AWARD **ALL** CANDIDATES 2 MARKS	**2** (AO1 × 2.1) (AO1 × 1.2)	Examiner's Comments We have adjusted the mark scheme to allow for a typo within this question.
		ii	KE transferred to thermal energy / heat in brakes / surroundings / AW ✓✓ OR (KE of car) is reduced / transferred ✓ Brakes gain / absorb thermal energy / heat ✓	**2** (AO1.1) (AO1.2)	**ALLOW** surroundings gain thermal energy / heat dissipated to surroundings **IGNORE** just brakes get hot Examiner's Comments The majority of candidates knew that the kinetic energy store would decrease or be transferred and so were credited with one mark. Fewer candidates gained the second mark as although they referred to heat or thermal energy they did not specify that the energy was transferred to the brakes or surroundings (i.e. into a thermal energy store).
		iii	AWARD **ALL** CANDIDATES 3 MARKS	**3** (AO2 × 2.1) (AO1.2)	
			Total	**7**	
13			**C** ✓	**1 (AO 2.2)**	Examiner's Comments About two-thirds of the candidates got this question correct: the commonest wrong answer here was A, presumably looking at the symmetry in the bottom part of the diagram.
			Total	**1**	
14			**D** ✓	**1 (AO 2.1)**	Examiner's Comments Candidates were required to carry out a simple substitution into a given equation were generally answered well.
			Total	**1**	

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Question			Answer/Indicative content	Marks	Guidance
15			C ✓	1 (AO 2.2)	Examiner's Comments Candidates were required to carry out a simple substitution into a given equation were generally answered well. The most common error was not squaring the speed and choosing distractor B.
			Total	1	

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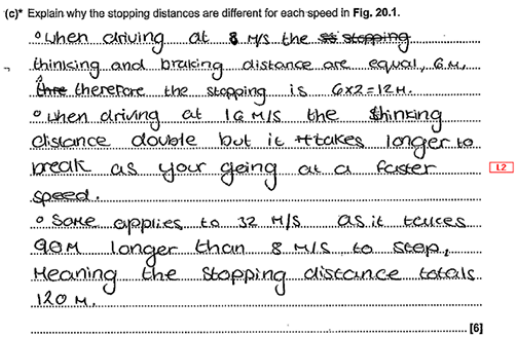
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Question			Answer/Indicative content	Marks	Guidance
16			Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. Level 3 (5–6 marks) Explains quantitatively why the stopping distances are different for each speed in the table in terms of braking distance and thinking distance. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* Level 2 (3–4 marks) Explains qualitatively why the stopping distances are different for each speed in the table in terms of braking distance or thinking distance increasing with speed from the table *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* Level 1 (1–2 marks) States basic ideas about thinking distance / braking distance / stopping distance OR identifies variation of thinking distance / braking distance / stopping distance with speed *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* 0 marks - *No response or no response worthy of credit.*	6 (AO 2 x 1.1) (AO 2 x 2.1) (AO 2 x 3.2b)	AO1.1a Demonstrates knowledge and understanding of thinking, braking and stopping distance • Thinking distance is the distance the car travels while the driver reacts • Braking distance is the distance travelled while the brakes are applied • Stopping distance is thinking distance + braking distance AO2.1 Applies knowledge and understanding of thinking, braking and stopping distance in relation to the details in the table • Increasing the speed, increases the thinking distance • Increasing the speed, increases the braking distance • Increasing the speed, increases the stopping distance AO3.2b Analyses information to make judgements and draw detailed conclusions from table • Thinking distance is directly proportional to the speed • When speed doubles, thinking distance doubles • Braking distance is proportional to speed2 • When speed doubles, braking distance quadruples <u>Examiner's Comments</u> This question gave candidates the opportunity to apply their knowledge and understanding of stopping distances. The question is deliberately set to be open ended so that candidates had the opportunity of structuring their answers logically. Higher ability candidates explained that the stopping distance was equal to the sum of

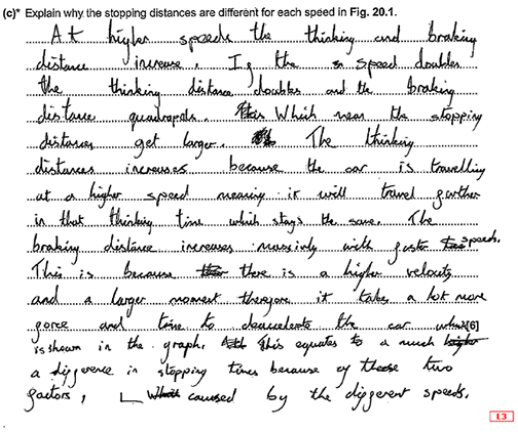
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Question	Answer/Indicative content	Marks	Guidance
			the thinking distance and braking distance before stating that the stopping distances increased with speed. Often candidates demonstrated the change in stopping distance using the data from the table. For the highest marks, candidates were expected to analyse the data quantitatively from the table. A few candidates used part (a) and stated that thinking distance doubled with speed and carried out a similar analysis for braking distance, stating that as speed doubled, braking distance quadrupled. Common misconceptions included thinking time increasing with speed, drivers being under greater pressure at high speed, braking forces increasing with speed. Other candidates discussed factors that affected thinking distance and braking distance rather than using the data in the table. **Exemplar 2**  (c)* Explain why the stopping distances are different for each speed in Fig. 20.1. • When driving at 8 m/s the ~~ss~~ stopping thinking and braking distance are equal, 6 m, ~~then~~ therefore the stopping is 6x2=12 m. • When driving at 16 m/s the thinking distance double but it takes longer to break as your going at a faster speed. • Same applies to 32 m/s as it takes 90 m longer than 8 m/s to stop, Meaning the stopping distance totals 120 m. [6] This is a four mark, Level 2 response. The candidate has calculated the stopping distance for each speed and provided a limited analysis. They have made good use of mathematical expressions to show that stopping distance is equal to the product of thinking and breaking distance. The information presented is relevant, however there are limited links made between the bullet points. To progress to a Level 3 response the candidate could have added a short introduction and a final bullet point linking the analysis at each speed together

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Question			Answer/Indicative content	Marks	Guidance
					in a summary sentence. Exemplar 3  (c)* Explain why the stopping distances are different for each speed in Fig. 20.1. At higher speeds the thinking and braking distance increase. In the a speed doubles the thinking distance doubles and the breaking distance quadrupals. Which mean the stopping distances get larger. The thinking distances increases because the car is travelling at a higher speed meaning it will travel further in that thinking time which stays the same. The breaking distance increases massively with greater the speed. This is because there is a higher velocity and a larger moment therefore it takes a lot more force and time to decelerate the car which is shown in the graph. this equates to a much larger a difference in stopping times because of these two factors, which caused by the different speeds. [6] This is a six mark Level 3 response. This is very clear analysis of the data in the table that is linked together in a clear logical structured way. Although the candidate has not annotated their script (except in their response to (a) it is clear that they have processed the data in the table. They have described the complex mathematical relationships (for example 'if the speed doubles the thinking distance doubles and the breaking distance quadruples') although it would have been easier to present this conclusion numerically.
			Total	6	

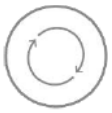
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Question			Answer/Indicative content	Marks	Guidance
17		i	Reduces <u>pressure</u> / spreads the <u>force</u> / AW ✓	1 (AO 1.1)	<u>Examiner's Comments</u> Many candidates found it difficult to use appropriate technical language in their answers to this question (for example, force and pressure). Many candidates wrote vague responses such as 'it would cover more of the body' without explaining why this was important. Higher ability candidates used specific technical language such as 'reducing the pressure' or 'spreading the force'. AfL The parts of a question form a story that develops a central theme. In part (a) looks at the pressure the car applies to the road, part (b) looks at the pressure that the force resulting from breaking applies to passengers, and part (c) applies this knowledge to the specific context of child safety seats. Where candidates follow these story lines, it helps them to improve the quality of their answers. However in (i) and (c) most candidates did not make the connection after they were asked to calculate pressure in (a).
		ii	Absorb energy (in a crash) ✓	1 (AO 1.1)	ALLOW higher level answers: eg. Reduces force / acceleration E.g. Increases time / distance to stop <u>Examiner's Comments</u> Higher ability candidates realised that the material was stretchy to absorb energy in a crash. Other responses referred to more generalised reasons such as allowing seatbelts 'to fit around different sized people.' Some candidates described the seat belt material as 'having a little give' or 'movement' without explicitly explain how this would increase time, reducing the rate of deceleration and thus the force exerted on the passenger.

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Question			Answer/Indicative content	Marks	Guidance
			Total	2	
18			B ✓	1 (AO 2.1)	Examiner's Comments Questions 14 required candidates to recall and use the equation for efficiency and for question 15, candidates had to rearrange the equation provided for kinetic energy to calculate the speed of the car. A common error that candidates made in question 15 was to use the incorrect equation: KE = 0.5 x mass x speed. Other candidates could be seen to correctly rearrange the equation but forgot to square root their answer so chose option D.  AfL The majority of candidates who were successful at these questions wrote their calculations by the side of each question.
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
19			FIRST CHECK THE ANSWER ON ANSWER LINE **If answer = 0.8 (kWh) award 3 marks** Recall (Energy transferred =) power x time ✓ 0.2 × 4 ✓ (Energy =) 0.8 (kWh) ✓	3 (AO 1.2) (AO 2.1) (AO 2.1)	**ALLOW** correct equation in any form **ALLOW** 200 x 4 or 200 x 4 x 60 x 60 or 200 x 14400 or 200 x 4 x 60 or 0.2 x 4 x 60 x 60 or 0.2 x 14400 or 0.2 x 4 x 60 for one mark **ALLOW** 800 or 2 880 000 or 2880 or 48 000 or 48 for two marks Examiner's Comments This question required candidates to recall the equation: energy transferred = power x time. The majority of candidates could substitute the values provided for power and time into the equation correctly and gained full credit. There was evidence that some candidates did not read the unit on the answer line carefully enough as they attempted to change kW into Watts and/or hours into minutes or seconds, and therefore scored 1 or 2 marks.
			Total	3	

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Question			Answer/Indicative content	Marks	Guidance
20			**Maximum 2 marks from:** Higher speed increases braking distance ✓ **BUT** Double speed quadruples braking distance / braking distance is (directly) proportional to the speed squared AW ✓✓ **Maximum 2 marks from:** (Idea that) higher speed (car has) more KE ✓ **BUT** Double speed quadruples KE / KE is (directly) proportional to the speed squared / AW ✓✓	3 (AO 2.1) (AO 3.1ax2) (AO 2.1) (AO 3.1ax2)	**ALLOW** numerical values from graph, e.g. at 10 (m/s), bd = 7.5 (m) but at 20 (m/s) bd = 30 (m). **ALLOW** numerical values from graph, e.g. at 10 (m/s), bd = 7.5 (m) but at 20 (m/s) bd = 4×7.5 (= 30m) for 2 marks Examiner's Comments This question covered Assessment Objectives 2 and 3 and assessed candidates' ability to apply their knowledge of kinetic energy and braking distance as well as to interpret the graph. The majority of candidates scored 2 marks for linking a higher speed to increased kinetic energy and braking distance. Although some candidates recognised that the relationships were linked to a 'square factor' they could not express it clearly and therefore only the more able candidates gained full credit for recognising that speed is directly proportional to kinetic energy and/or braking distance.
			Total	3	
21		i	(Store of) KE (in moving car) ✓ (transferred thermally) to (store of) thermal energy / heat (in brakes/pads/discs/tyres) ✓	2 (AO 2×2.1)	Examiner's Comments This question assessed candidates' ability to apply their knowledge of energy stores. Most candidates scored at least 1 mark for identifying either kinetic energy or thermal energy but it was generally only the more able candidates that identified both energy stores correctly.
		ii	**Any one from:** (Idea of) heat dissipated/transferred (to air) more quickly ✓ KE is reduced more quickly ✓	1 (AO 2.1)	**IGNORE** to thermal energy of road/surroundings Examiner's Comments It was evident that most candidates found this question very challenging, with usually only the most able gaining 1 mark.
			Total	3	

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Question			Answer/Indicative content	Marks	Guidance
22	a	i	**Any one from:** Ratio of 1:1 at a height of 40 cm ✓ ratio (seems to) increase by 0.1 when height decreases by 20 cm (until ratio is 1:1) / AW ✓	1 (AO3.2a)	**ALLOW** when drop height was 40 cm, bounce height was the same / bounce ratio coming closer to 1:1 each time / bounce height cannot be higher than drop height Examiner's Comments Many candidates answered this question correctly by referring to the previous bounce height being the same. This question again required candidates to interpret data from a table.
		ii	Some of the energy from the KE store is transferred to other energy stores as ball hits the ground AW ✓	1 (AO2.1)	**ALLOW** ball will lose energy (when it hits the ground) Examiner's Comments There was a clue in the question regarding energy. It was anticipated that candidates would understand that there is likely to be energy losses both as the ball travels through the air and as it bounces. It was hoped that there would be reference to energy being transferred from the kinetic energy store to other energy stores as the ball bounces.

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Question			Answer/Indicative content	Marks	Guidance
	b		**Any two from:** Lower head to read bounce height / take bounce height readings at eye level / AW ✓ Take multiple readings and <u>average</u> them ✓ Take readings at other intervals (eg. 90, 70, 50) ✓	2 (AO2×3.3b)	**ALLOW** second person to read bounce height / idea of video camera and play back **ALLOW** drop from greater heights <u>Examiner's Comments</u> This was another question which required candidates to consider experimental procedures. Many candidates suggested taking other readings. Some candidates tried to suggest methods of improving the measurement of the bounce height but often the explanations were vague and lacked the necessary detail. AfL Candidates should be encouraged to consider improvements to experiments that are carried out as part of their practical course.
	c	i	(Mass = 60 ÷ 1000 =) 0.06 (kg) ✓	1 (AO1.2)	<u>Examiner's Comments</u> The majority of the candidates correctly answered this question. Many candidates who did not gain this mark wrote 0.6 kg.

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		ii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.48 (J) award 2 marks Energy = 0.06 × 0.8 × 10✓ Energy = 0.48 (J)✓	2 (AO2×2.1)	ALLOW ECF from **(c)(i)** E = (c)(i) × 10 × 0.8 ✓ E = answer to (c)(i) × 8 ✓ ALLOW E = 60 × 10 × 0.8 = 480 (J) for one mark <u>Examiner's Comments</u> This was well answered. Candidates should again be encouraged to show their working. There should be clear substitution of the numbers into the given equation. The advantages of this method are that candidates will then be able to use their calculator without having to look for the numbers and easily be able to check their answer later. It also enables candidates to gain one mark if there is an error in the calculation.
			Total	7	

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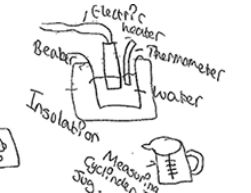
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Question			Answer/Indicative content	Marks	Guidance
23			Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question. **Level 3 (5–6 marks)** Detailed description of the procedure and the measurements (including a labelled diagram). **AND** Correct calculation of the change in thermal energy. *There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.* **Level 2 (3–4 marks)** Detailed description of the procedure and the measurements (with a diagram). **OR** Description of the procedure and the measurements (with a diagram). **AND** Correct calculation of the change in thermal energy. *There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.* **Level 1 (1–2 marks)** Basic description of the procedure and the measurements. **OR** Correct calculation of the change in thermal energy. *There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.* **0 marks** *No response or no response worthy of credit.*	6 (AO2×3.3a) (AO2×2.2) (AO2×2.1)	**AO3.3a Analyse information and ideas to develop experimental procedures** • liquid placed in beaker • heater immersed in liquid • heater connected to power supply • insulation arranged to reduce heat loss • thermometer • instrument(s) to determine energy e.g. stopwatch, circuit **AO2.2 Apply knowledge and understanding of scientific enquiry, techniques and procedures - measurements** • Explanation of obtaining mass of 200 g • Initial temperature measured • Temperature rise / change / temperature after measured • Method to determine the energy e.g. use of joule meter / E = ItV method / power of heater and time. **AO2.1 Apply knowledge and understanding of scientific ideas to calculate change in thermal energy** • use of E = m x c x t • E = 0.2 × 4 200 × 20 • E = 16 800 J **Examiner's Comments** This question gave candidates the opportunity to apply their knowledge and understanding of practical procedures related to specific heat capacity. The question is open ended so that candidates have the opportunity of demonstrating their knowledge as well as having the opportunity to structure their answers logically. This question stated "You may include a diagram in your answer." A diagram of the experimental arrangement would have been very helpful. Many candidates did not include a diagram. The advantage of

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Question	Answer/Indicative content	Marks	Guidance
			drawing a diagram is that it will also assist candidates in their procedures. Diagrams should be labelled. Several candidates drew diagrams with a beaker, heater and thermometer. Some candidates incorrectly drew diagrams of Bunsen burners heating water. The question also required candidates to calculate the change in internal energy for the water. Higher ability candidates stated the equation from the data sheet and then clearly substituted the numbers from the question before calculating the answer. Candidates who did not calculate the change in internal energy correctly often did not include an equation. The question gave candidates the opportunity to discuss practical procedures. Again, several candidates used insulation and adding a lid. Some discussed stirring the water. A circuit diagram showing how the electrical heater was connected would have been useful. For the highest marks, it was expected that candidates would explain how a mass of 0.2 kg was measured and how the energy could be measured experimentally. Some candidates did mention the use of a stopwatch. **Exemplar 3** You may include a diagram in your answer. Change in internal energy = mass x SHC x change in temp. 0.2 x 4200 x 20 = 16800 J  The student should accurately measure out the water, then pour into beaker. Then put the heater into the water and the thermometer, making sure they don't touch otherwise it will make the test inaccurate. Then time the experiment and find out how much the energy heater gives out a second. Then heater the water 20°c and stop the time and turn off heater. Make sure to read thermometer on eye level for most accuracy. [6]

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Question			Answer/Indicative content	Marks	Guidance
					This candidate has drawn a diagram showing the container is insulated with a heater and thermometer. The calculation is clearly shown using an appropriate equation. The candidate then describes the experiment; this could have included much more detail such as explaining how the water would be measured. This candidate hints at an energy determination when the energy per second of the heater is mentioned. The candidate also gives some extra detail when suggesting that the heater and thermometer should not touch. The description of the procedure lacked appropriate detail but the calculation was correct. The information given by the candidate was relevant and was presented with some structure. Overall this response was assessed as being a Level 2 response worth four marks.
			Total	6	

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Question			Answer/Indicative content	Marks	Guidance
24	a		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 0.8 (kWh) award 3 marks Recall (Energy transferred =) power × time ✓ 0.2 × 4 ✓ (Energy =) 0.8 (kWh) ✓	3 (AO 1.2) (AO 2.1) (AO 2.1)	**ALLOW** correct equation in any form **ALLOW** 200 x 4 or 200 x 4 x 60 x 60 or 200 x 14400 or 200 x 4 x 60 or 0.2 x 4 x 60 x 60 or 0.2 x 14400 or 0.2 x 4 x 60 for one mark **ALLOW** 800 or 2 880 000 or 2880 or 48 000 or 48 for two marks Examiner's Comments Candidates needed to recall the equation, substitute in the numbers and calculate the answer. Few candidates wrote the equation. Candidates should be encouraged to look at the unit on the answer line. In this question the unit is kW × h which should then give the hint that it is power measured in kW multiplied by time measured in hours. A large number of candidates took the numbers and multiplied them together and also divided them giving possible answers of 0.8 kW h (correct) and 20 kW h (incorrect) – this did not score any marks since the candidate is not demonstrating that they understood the physics. Conflicting physics was not credited. Exemplar 6 $0.2 \times 4 = 0.8$ $\frac{4}{0.2} = 20$ kWh Energy transferred = 20 kWh [3] This candidate has written 0.2 × 4 = 0.8 which would have scored all three marks. However, the candidate then states that 4 / 0.2 = 20 kWh which incorrect physics and

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Question			Answer/Indicative content	Marks	Guidance
					means that the question will not gain credit. This candidate could have gained one mark by writing the equation that needed to be recalled. By writing this equation and then substituting in the numbers, the candidate may not have needed to possibly guess whether to multiply or divide the numbers.
	b		FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 38.28 (W) award 3 marks Recall (Power =) potential difference x current ✓ 12 × 3.19 ✓ (P =) 38.28 (W) ✓	3 (AO 1.2) (AO 2.1) (AO 2.1)	**ALLOW** correct equation in any form **ALLOW** 38.3 (W) or 38 (W) Examiner's Comments This question again required candidates to recall an equation, substitute numbers and calculate an answer. Candidates who used this method scored well. Again, a significant number of candidates wrote both answers which multiplied and divided the numbers.
			Total	6	

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Question			Answer/Indicative content	Marks	Guidance
25			**Maximum 2 marks from:** Higher speed increases braking distance ✓ **BUT** Double speed quadruples braking distance / braking distance is (directly) proportional to the speed squared AW ✓✓ **Maximum 2 marks from:** (Idea that) higher speed (car has) more KE ✓ **BUT** Double speed quadruples KE / KE is (directly) proportional to the speed squared / AW ✓	3 (AO 2.1) (AO 3.1a x2) (AO 2.1) (AO 3.1a x2)	**ALLOW** numerical values from graph, e.g. at 10 (m/s), bd = 7.5 (m) but at 20 (m/s) bd = 30 (m). **ALLOW** numerical values from graph, e.g. at 10 (m/s), bd = 7.5 (m) but at 20 (m/s) bd = 4×7.5 (= 30m) for 2 marks Examiner's Comments Many answers to this question were vague. This question again required candidates to indicate the direction of the change in speed, e.g. as the speed increases. A small minority of candidates realised that both the kinetic energy and the braking distance increased with increasing speed. Very few used their graph to show that as the speed doubled the braking distance and kinetic energy quadrupled.
			Total	3	
26			A ✓	1 (AO1.1)	
			Total	1	
27			B ✓	1 (AO2.1)	
			Total	1	

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Question			Answer/Indicative content	Marks	Guidance
28		i	(From) Chemical energy (store) ✓ (To) Thermal energy (store of the water in the kettle) ✓	2 (AO2 × 2.1)	ALLOW chemical energy store decreases ALLOW thermal energy store increases ALLOW heat / internal energy for thermal IGNORE sound/electrical energy IGNORE intermediate energy transfers/stores and any energy transfers/stores after thermal (store of the water)
		ii	FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 138 000 (J) award 4 marks (Recall: energy transferred =) power x time ✓ (Power = 5.0 x 230 =) 1150✓ (Time = 2 x 60 =) 120✓ (Energy transferred =) 1150 × 120 = 138 000 (J) ✓	4 (AO1.2) (AO2.1) (AO2.1) (AO2.1)	ALLOW equation in any form ALLOW ecf for incorrect power calculated ALLOW ecf for incorrect/no conversion of time
			Total	6	

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