Question	Answer	Marks	Guidance
1	**[Level 3]** **Describes how KE changes in both sections AND describes how GPE changes in both sections** **AND calculates the maximum KE or difference in height.** Quality of written communication does not impede communication of the science at this level. (5 – 6 marks) **[Level 2]** **Describes how KE AND how GPE changes for both sections** **OR describes correctly how KE changes over both sections and calculates maximum KE** **OR describes correctly how GPE changes over both sections and calculates maximum KE** **OR calculates difference in height.** Quality of written communication partly impedes communication of the science at this level. (3 – 4 marks) **[Level 1]** **Realises that KE depends on speed and describes changes over part of journey** **OR describes how GPE changes over part of journey** **OR attempts to calculate maximum KE /height** **OR loss in KE = gain in PE (on either section)** **ORA** Quality of written communication impedes communication of the science at this level.(1-2 marks) **[Level 0]** Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)	6	**This question is targeted at grades up to A*** **Ignore points after C** **Indicative scientific points at all levels may include:** • KE increases from **A** to **B** • KE decreases from **B** to **C** • GPE decreases from **A** to **B** • GPE increases from **B** to **C** • loss in GPE = gain in KE • KE = $\frac{1}{2}mv^2$ • maximum KE = 51200J • GPE = mgh • 51200 = mgh = 400 x10 x h • height = 12.8m **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
	Total	**6**	

Question			Answer	Marks	Guidance
2	(a)		**Level 3** Answers should include the mechanisms of IR **AND** microwave cooking **causing** the relevant particles **to gain KE**. Also the answer should give a clear explanation of how IR cooking needs more energy or takes a longer time. **Quality of written communication does not impede communication of the science at this level.** **(5–6 marks)** **Level 2** Answers should include the simple mechanisms of IR **AND** microwave cooking causing the relevant particles to heat up. Also the answer should give some explanation of how IR cooking needs more energy or takes a longer time. Quality of written communication partly impedes communication of the science at this level. **(3–4 marks)** **Level 1** Answers should include a simple mechanism of IR **OR** microwave cooking causing the relevant particles to heat up. Quality of written communication impedes communication of the science at this level. **(1–2 marks)** **Level 0** Insufficient or irrelevant science. Answer not worthy of credit. **(0 marks)**	6	**This question is targeted up to A*** **Indicative scientific points may include:** **Level 3:** • (microwaves) penetrate the food and are absorbed by water / fat particles which **gain KE / vibrate or move faster** • (microwave) less energy / cooking time needed as energy only used to heat food • (IR) only heat surface particles which **gain KE / vibrate or move faster** • (IR) idea that more energy / cooking time needed as oven / dishes need heating first • conduction to centre (for either type of wave) involving **transfer of KE or movement between particles** / AW • less food heated by conduction or convection with microwaves so less energy / cooking time needed **Level 2:** • (microwaves) penetrate the food and heat water / fat particles • (microwave) less energy / cooking time needed as energy only used to heat food • (IR) only heat surface particles • (IR) idea that more energy / cooking time needed as oven needs heating first **Level 1:** • (microwaves) heat the water / fat particles • (microwave) reflect from oven walls • (IR) only heat surface particles • (IR) idea that IR waves heat the oven / dishes • (microwaves) more efficient • microwaves penetrate further than IR **ignore** characteristics **not** on mark scheme

Question			Answer	Marks	Guidance
	(b)		comment on the data in terms of any **one** from: • less people studied / less evidence in A compared with C • shorter time study in A compared with C • more research for mobile phones than against • study about old people / not about young people (eg C) • idea that study about human / rat cells may not be representative or reproduced in humans (B) (1) • conflict in conclusions (eg A&B or B&C) **then** consideration of the risk against the possible benefits (1)	2	eg idea of safety / social interaction for children / young people / teenagers versus risk of use (1)
			Total	**8**	

Question			answer	Marks	Guidance
3	(a)		500 000 (MJ) (1)	1	
	(b)		idea that readings change each side of the 0 / idea that readings are positive and negative or flow in two directions (during a cycle) / AW (1)	1	**ignore** merely up and down / same frequency, etc. **ignore** merely 'all have peaks and troughs' **allow** all change (in) direction (1) **allow** all change from + to – (1)
			Total	**2**	

Question			Answer	Marks	Guidance
4			weight – 2500 (N) (1) distance – 2(m) (2) but if final answer is incorrect then look for: d = W/F 5000/2500 and award (1)	3	 **allow** 5000 divided by incorrect calculated weight Eg weight = 25N (0) 5000 / 25 scores (1) **but** 5000 / 25 = 200 scores (2) 200m without working scores 0
			Total	**3**	

Question			answer	Marks	Guidance
5	(a)		30240 (from the calculation) **and** E / the 35000 heater (2) **but** if the answer incorrect or no heater selected 0.6 x 12 x 4200 **or** 30240 (1)	2	no mark for just choosing E with no working or answer no mark for choosing E with an incorrect calculation
	(b)	(i)	$\frac{48000}{20}$ or 2260 × 20 and liquid A indicated or named scores (2) **but** $\frac{48000}{(53 \text{ or } 20)}$ or s.l.h. × (20 or 53) without comment or incorrect comment scores (1)	2	Allow correct rearrangements: **Eg $\frac{48\,000}{2260}$ = 21,2 (38938) or 21 and liquid A [2]** A chosen with incorrect calculation scores (0)
		(ii)	melting or freezing / solidification	1	**allow** condensation / sublimation **allow** acceptable named change of state **ignore** evaporation **ignore** liquid to gas / boiling
			Total	**5**	

Question			answer	Marks	Guidance
6	(a)		idea that **B** has a lower specific heat capacity or SHC / AW / ora (1)	1	**allow A** initially has more energy to transfer / ora **allow** correct explanation in terms of temperature gradient (1) eg B may have been in colder surroundings (1)
	(b)		Idea of energy flow from liquid / to the surroundings which warm up / AW (1)	1	eg emit energy to warm up surroundings (1) **allow** hot to cold warming the surroundings (1) eg 'heat flows from hot to cold and warms the air' (1) eg air warms up because it gains energy (1) but merely 'emits energy' (0) and merely 'surroundings warm up' (0)
	(c)	(i)	70000 (J) (2) **but if answer is incorrect** 200 000 x 0.35 (1)	2	**allow** 70kJ if k J clearly written (2) **allow** 200 000 x 350 or 70 000 000 (1)
		(ii)	(constant temperature means) change of state / fusion / freezing / AW (1) (energy given out as intermolecular) bonds formed / AW (1)	2	**allow** description of correct change of state. eg changes from liquid to solid (1) **not '**intra-molecular' **not '**bonds broken' **allow** idea of molecules or particles stop moving freely and form a (fixed) structure (1)
			Total	**6**	

Question			Answer	Marks	Guidance
7	(a)		0.115 (kW) (2) **but if answer incorrect** 0.5 x 230/1000 (1) **or** 115 (1)	2	**allow** 0.11/0.12 (kW) (2)
	(b)		5 (hours) (2) **but if answer incorrect** 0.45 / 0.09 (1)	2	 **allow** 0.45 / 90 or 0.005 (1)
	(c)		monitor desktop PC (keyboard) mouse (1)	1	all 3 correct = 1 mark
	(d)		Correct idea from Fatima **AND** a correct idea from Claire (1) **AND** any **one** from • idea that it depends on the number of people taking up these initiatives (1) • Claire's idea is impractical (1)	2	Eg. Fatima's and Claire's idea • reduce global warming • or use less energy • or use less (fossil) fuels or resources used • or reduce greenhouse gases / CO_2 eg. would only apply to short / local journeys (1) eg. unrealistic that people would give up using cars (1) eg. some vehicles essential, eg health reasons / jobs / living in country (1)
			Total	**7**	

Question			answer	Marks	Guidance
8	(a)		**Z** is most economical / more fuel efficient / best fuel consumption / lowest fuel costs [1] (idea that) Trevor has read fuel consumption data the wrong way around / back to front / 16.1 or **X** is the worst consumption / least km per lr / ORA [1] **and one from** **least environmental harm**; **Y** quietest or gives out less **noise** pollution or least dB **and** is best in terms of lowest CO_2 or greenhouse gas emissions or pollution **given out or emitted** [1] **OR** **Z** is close (to **Y**) in terms of low(er) noise pollution **and** CO_2 or greenhouse gas emissions or pollution **given out or emitted** [1]	3	**use ✓'s in this question** **allow** car with biggest engine or highest top speed or **V** has low or poor fuel consumption **/** AW OR **X** is least fuel efficient / AW [1] **allow** choice of **Y** because of high km/hr / close to **Z** fuel consumption / small engine size [1] **allow** most economical or fuel efficient cars go further on a litre of petrol **allow** car with biggest engines or highest top speed or acceleration (figures) or **V** has highest CO_2 emissions / pollutes most **and** is noisier or noisiest / AW **ignore** references to pollution on its own **allow** a correctly reasoned choice eg choose **Z** because it is fairly quiet **and** has close to the lowest CO_2 emissions [1] eg he should choose **Z** as it has the best fuel economy **and** is fairly quiet and has close to the lowest CO_2 emissions [2] **ignore** references to pollution on its own
	(b)	(i)	12 (kW) [2] **but if answer is incorrect** (500 x 850) ÷ 35 or 12143 or 12.1(43) [1]	2	**allow** 12000 – 12200 [1] **allow** power = (force x distance) ÷ time [1] **ignore** number of decimal places if answer is left in watts [1]

Question			Answer	Marks	Guidance
8	b	(ii)	**any one from** car **V because** it has biggest engine size [1] car **V because** it has the highest top speed / speed of 210 (km/hr) [1] car **V because** it has highest acceleration [1]	1	 **allow** 201 (km/hr) /engine size 1800 (cm^3) / 5 seconds to reach 90 km/hr as these clearly indicate **V** **allow V because** it has the highest power
	(c)		**driver: any one from** need to recharge battery / need a charging point / AW [1] limited range / problems of recharging or refuelling [1] limited top speed / lower performance [1] no pollution or harmful gases at point of use **/** given out [1] more economical to run [1] could be no congestion charge [1] **pedestrians: any one from** dangers from more vehicles on roads / in city centres [1] accident danger increased because the cars are quiet / difficult to hear [1] idea of less noise pollution [1] no pollution or harmful gases at point use / given out [1] danger from vehicle on pavement **if** scooter/ Segway is named [1]	2	**use ✓'s in this question** **allow** scooter type carries only one person [1] **allow idea** using electric cars still produces pollution / gases / CO_2 when electricity is produced **allow** idea of burning fossil fuels to produce electricity or electricity is made in a power station / power stations produce pollution **only award point of use mark once** **ignore** vehicle purchase cost **allow** lower speeds safer for pedestrians if the low speed mark is not gained for the driver response **allow** idea of less emissions to breath in if pollution mark not awarded in driver response **only award point of use mark once**
			Total	**8**	