Question			Answer	Marks	Guidance
1			**[Level 3]** Describes the construction of the transformer **AND** performs a calculation to determine the turns ratio or output current **AND** explains the process of electromagnetic induction. Quality of written communication does not impede communication of the science at this level. **(5–6 marks)** **[Level 2]** Describes the construction of this transformer **AND** **EITHER** performs a simple calculation **OR** gives a partial explanation of electromagnetic induction. Quality of written communication partly impedes communication of the science at this level. **(3–4 marks)** **[Level 1]** Describes two features of the basic construction of a transformer. Quality of written communication does 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.** **Level 3 relevant points:** • two coils wrapped around core made of iron secondary less turns than primary • 46 x more turns on primary or calculate current = 2300mA • varying magnetic field in primary and varying magnetic field in secondary inducing an emf. **Level 2 diagram or description of transformer construction:** • two coils wrapped around (iron) core with secondary less turns than primary • ratio 230:5 or 2% or sensibly attempted calculation using transformer equation. **Level 1 diagram or description of transformer construction:** • two coils of wire • wrapped on (iron) core • step down transformer **Use the L1, L2, L3 annotations in Scoris. Do not use ticks.**
			Total	**6**	

Question			Answer	Marks	Guidance
2	(a)	(	(idea that) the braking distance is greater (for concrete at 3mm) / AW (1)	1	**allow** correct comparisons at other tyre depths eg 26.5 is less than 35.5 (1)
		(ii)	Any two from: same speed / KE (1) same driving conditions (1) same braking force (1) same mass / load in car (1)	2	 **allow** specific examples Eg. same weather conditions (1) Eg. same depth of water on road (1) Eg. Same driver (1) **allow** same tyre size / pressures (1) **ignore** same road surface materials **allow** same braking action (1)
		(iii)	no with 45% (3) 45% (2) **but if 45% incorrect then** 42 – 29 or 13 scores (1)	3	**allow** 44% to 46% (2) 45% on its own or 'Yes with 45%' scores (2) allow and credit reverse arguments: eg. 'It goes from 29 to 42, a 50% increase would be 43.5m' (2) **SO** it is an impossibility to be a 76% (2x38%) increase (1).

Question			Answer	Marks	Guidance
	(b)	**(i)**	30 000 (km) (3) **but if final answer incorrect** $\frac{5.1}{0.17}$ or 30 scores (2) **but if none of the above** 5.1 (mm) scores (1)	3	**allow** 30001(km) (3) **allow** $\frac{5.2}{0.17}$ (2) **allow** 5.2 (mm) (1)
		(ii)	(idea that) tyres would have a large braking distance (1) Braking distance significantly increases less than 3mm (1)	1	**allow** stopping distance instead of braking distance
			Total	**10**	

Question			answer	Marks	Guidance
3			**Level 3 (5–6 marks)** Answers must refer correctly to one explanation of the comparative power / energy losses **related to currents** in each circuit. Quality of written communication does not impede communication of the science at this level. **Level 2 (3–4 marks)** Answers refer in part to the **relative power / energy losses OR changes in current in each circuit.** Quality of written communication partly impedes communication of the science at this level. **Level 1 (1–2 marks)** Answers are limited to correct **references to voltage OR** show an appreciation of how the experiment **models real situations**. Quality of written communication impedes communication of the science at this level. **Level 0 (0 marks)** Insufficient or irrelevant science. Answer not worthy of credit.	6	**This question is targeted at grades up to A*** Indicative scientific points may include: **Level 3** • less power loss in B due to reduced current and heating effect • power loss is proportional to current^2 **Level 2** Answers show that • less power / energy is wasted at higher voltages / ORA • TA decreases current and TB increases current **Level 1** • TA is step-up and TB is a step-down transformer • TA increases voltage and TB reduces voltage • Simple idea of **less** energy loss linked to brighter lamp in transformer circuit • resistance wires represent transmission lines in National Grid **Use the L1, L2, L3 annotations in Scoris. Do not use ticks.**
			Total	**6**	

Question			Answer	Marks	Guidance
4	(a)		**[Level 3]** A **detailed** explanation of the conduction in the glass together with a link to the energy transfer from air in the room to the glass **or** from the glass into the (cold) air outside. Quality of written communication does not impede communication of the science at this level. (5-6 marks) **[Level 2]** Limited explanation of one process by which energy is transferred between particles and leads to energy loss from the room or window. The description may not be specific to the window or glass. Quality of written communication partly impedes communication of the science at this level. (3-4 marks) **[Level 1]** An incomplete explanation, naming some processes by which energy is transferred or lost from the room. 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/A*** **Indicative scientific points at Level 3 may include:** warm air particles: • move around quickly • hit glass particle making them vibrate (move) more **glass particles**: • vibrate more / gain **KE** • pass vibrations / **KE** through glass cold air particles: • hit (warm) glass particles • gain **KE** / bounce off with more speed **Indicative scientific points at Level 2 may include one of :** warm air particles: • move around quickly • hit glass particle making them vibrate or move more glass particles: • vibrate or move more / gain energy • pass vibrations or movement or energy through glass cold air particles: • hit (warm) glass particles • gain energy / bounce off with more speed • change of air density causes convection (outside) **Indicative scientific points at Level 1 may include:** • idea of particles passing on energy • idea of conduction through window / glass • idea of convection in air outside / in the room • idea of radiated heat from outer surfaces of window **ignore** heat escapes or draughts **ignore** heat particles / particles move through glass **ignore** references to double glazing **Use the L1, L2, L3 annotations in Scoris; do not use ticks**

Question			Answer	Marks	Guidance
	(b)	(i)	61.67 / 61.7 / 61.66 / 62 [3] **if answer incorrect then** 41.67 / 41.7 / 41.66 / 42 [2] **or** 2100 000 / (12 x 4200) scores [1]	3	**allow** 61.666666 etc [3] **allow** 61 / 61.6 [2] **allow** 41.666666 etc [2] **allow** 41 / 41.6 [1]
		(ii)	heat or energy heating steel / metal / case / radiator [1] idea of heater / steel / case / metal / radiator conducting [1] heat / energy being given out or lost to or from the room / surroundings / atmosphere / air / AW [1]	1	**ignore** lost / wasted unless qualified **ignore** references to electricity **but** **allow** steel or metal conducts electricity [1] **allow** explanation eg heat passes through the steel [1] **ignore** references to change of state or boiling point of water **ignore** efficiency
	(c)		water or 'it' heats (gets to 50°C or maximum) slower / AW / ORA for oil [1] water or 'it' contains more energy / has higher (specific) heat capacity / ORA for oil [1] **linked to** water or 'it' stays hotter for longer / gives out more heat or energy to the room / AW [1]	3	**does not have to appear in this order to gain full marks** **allow** idea that water reaches 50^{o}C more gradually or heats up more gradually **but ignore** merely its gradual **allow** water (graph) has a lower gradient / AW / ORA **ignore** efficiency **ignore** cost **ignore** references to boiling points **allow** oil cools down quicker / gives out less heat to the room
			Total	**13**	

Question			Answer	Marks	Guidance
5	a		**any two from** global warming has happened before human race / pre-measurable times / AW [1] other natural events in past may be responsible [1] some scientists have an economic interest in supporting or disregarding the global warming [1] difficulties in data collection / variable average temperatures [1] different interpretations of data / evidence / results [1] idea of conflicting or different data / evidence / results [1]	2	**allow** difficult to tell what greenhouse gases are naturally made or man-made **or** how much global warming is due to natural or man made activities[1] **allow** volcanoes **allow** idea of natural warming / cycle of warming and cooling or description eg ice age followed by warming **ignore** global warming affected by many factors **allow** difficult to prove a causal link **allow** no definite proof either way **but ignore** merely no definite proof **ignore** not conclusive on its own

Question			Answer	Marks	Guidance
5	b		**[Level 3]** Explanation should include detail of at least two of the mechanisms involved in terms of different wavelengths. Quality of written communication does not impede communication of the science at this level. (5-6 marks) **[Level 2]** Explanation should include at least on of the general mechanisms involved in terms of different wavelength of radiation. Correct order of wavelength not essential. Quality of written communication partly impedes communication of the science at this level. (3-4 marks) **[Level 1]** Simple description of the mechanisms or processes involved. 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/A*** **Indicative scientific points at Level 3 may include:** • Sun is very hot so wavelength of radiation emitted is very small • short wavelength radiation comes from the Sun • short wave radiation from Sun is absorbed by and heats the Earth • the Earth radiates or emits heat as longer wavelength • the longer wavelength radiation that heats the Earth is infrared radiation • greenhouse gases or atmosphere absorb some of the longer waves **Indicative scientific points at Level 2 may include:** • absorption of infrared radiation warms the greenhouse gases • radiation at most wavelengths can pass through the Earth's atmosphere • Earth radiates or emits heat out / back • certain wavelengths are absorbed or some reflected **Indicative scientific points at Level 1 may include:** • (greenhouse) gases produced trapped (in atmosphere) • Sun's radiation reaches or is absorbed by Earth • Earth gives out heat / radiation / energy • radiated heat cannot penetrate the atmosphere / is trapped / reflected • radiated heat cannot be absorbed by the atmosphere • atmosphere warms the Earth **ignore** ultraviolet reference to ozone layer limits mark to max 2 **Use the L1, L2, L3 annotations in Scoris; do not use ticks.**
			Total	**8**	

Question			Answer	Marks	Guidance
6	(a)		416 – 364 = 52 (3) **or** 6.5 X 4 X 2 = 52 (3) **But** if answer is incorrect then: Distas: 6.5 x 4 x 16 = 416 (1) Skinner: 6.5 x 4 x 14 = 364 (1)	3	Assume units are pence unless stated otherwise If conversion has not been done, 52000(p)/£520 (2) If conversion has been attempted unsuccessfully, allow 52 and its powers of ten e.g. 5.2/520(2) **allow** 6500 x 4 x 2 (2) **allow** 6.5 x 4 x 2 (2)
	(b)		0.69 (2) **but** if answer is incorrect r incomplete then: 690 **or** 230 x 3 scores (1)	2	
	(c)		inconvenient to use / night use only (1)	1	ignore fire risks
			Total	**6**	

Question			Answer	Marks	Guidance
7	(a)	(i)	2.07 (kilowatts) (2) **if answer incorrect then** 2070 or 9x230 (1) or $\frac{9\times230}{1000}$ (1)	2	**allow** 2.1 or 2 (kilowatts) (2)
		(ii)	24.84 (Kilowatt hours) (2) **if answer incorrect then** 2.07 x 12 or 2.1 x 2 or 12 x 2 (1)	2	**allow** 25 **or** 24.8 **allow** 24 **or** 25.2 **allow ecf from 3ai** eg 24840 (2) 2484 (2) 2070 x 12 (1) 207 x 12 (1)
	(b)		heater uses most energy / electricity and is only used at night **or** uses most energy / electricity at night (1) **then one from:** (so) cheaper to pay just 6p then **or** new cost / 10p cost more expensive / AW (1) increase in price 10 – 6 = 4p too much (if using large 9 amp heaters or for 12 hours at night) (1) saving of 2p on appliances used during day does not off set increased cost of those used at night (1)	2	**allow** clear calculation and comparison of **all** appliances eg 425p @ 10p rate (allow +/- 5p) (1 mark) 331p @ 12p / 6p rate (allow +/- 5p) (1 mark) **but** 2 marks for both calculations correct difference = 93 – 95p higher @ 10p rate (2 marks) if no marks awarded **max one** mark: **allow** comparison of 2.40 (10p rate) to 2.16 (12p / 6p rate) (1) **allow** comparison of 72p to £1.20 (1) **ignore** comparison of 18p to 20p
			Total	**6**	

Question			Answer	Marks	Guidance
8	(a)		**number of kWh** 0.75 (kWh) [2] **but if answer incorrect** 0.5 x 1.5 [1] **cost of using iron** 13.5 (pence) [1]	3	**Use ✓'s in this question** **allow** 750 [1] **allow** ecf from kWh calculated eg 7.5 kWh.....135p / £1.35 [1] 750 kWh.....13500p / £135 [1] **allow** 13 or 14 (p) if correct working shown
	(b)		8.5 (A) [2] **if answer is incorrect** 1955 ÷ 230 [1]	2	
	(c)	(	**advantage** less cost / AW [1] **disadvantage any one from** available at inconvenient times / inconvenient / AW[1] another meter required / extra wiring / time switches for storage heaters [1] day-time electricity can be more expensive than non-off peak users / extra standing charge [1]	2	**ignore** few people using it then **allow** he can only use electrical appliances at night / night time use only / can only be used at night / appliances or 'it' is noisy (to use) at night / risk from unattended appliances = inconvenience **ignore** just chance of a fire **ignore** not always available / cannot use it at peak times **ignore** more efficient
		(ii)	**any one from** idea of evens out demand / avoids spikes in demand [1] electricity cannot be stored (so not wasted) [1]	1	**allow** don't have to / cannot switch off power stations / can keep it running continuously / avoids need to run or build more power stations **allow** lowest level of acceptability: evens out selling times **allow** idea of reducing waste of electricity or energy at **night** **ignore** pollution during the day
			Total	**8**	