Question	Answer	Marks	Guidance
1	**[Level 3]** Correct answer of 3.26 Amps **AND** explains why the fuse melts **AND** correct statements on use of 3, 5 13 Amp fuse. Quality of written communication does not impede communication of the science at this level (5 – 6 marks) **[Level 2]** Correct answer of 3.26 Amps **AND** explains why the fuse melts. Quality of written communication partly impedes communication of the science at this level (3 – 4 marks) **[Level 1]** Evidence of a calculation using power = voltage x current **OR** describe why the fuse melts. 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)		**This question is targeted at grades up to A*.** **Indicative scientific points at level 3 may include:** 3.26 or 3.3 (amps) **AND** 3 amp fuse melts as current too large **AND** best fuse to use is the value just above 3.26 or 3.3 (amps) which is 5 amp fuse 13 amp fuse not used because a large current (above the 3.26 amps) is needed before it melts **Indicative scientific points at level 2 may include:** 3.26 or 3.3 (amps) **AND** 3 amp fuse melts as current too large **Indicative scientific points at level 1 may include:** evidence of power = voltage x current evidence of current = power / voltage 750 / 230 too much current / (fuse gets too) hot Allow answers in terms of power only – maximum of [3] marks. **Use the L1, L2, L3 annotations in scoris.** **Do not use ticks.**
	Total	**6**	

SECTION A

Question			Answer	Marks	Guidance
2	(a)		most heat lost from hot / poorly insulated areas **indicated by** colours white / yellow / red (1) least heat lost from cool / well insulated areas **indicated by** colours black / dark blue / purple (1)	2	must correctly link heat loss area to correct colour must correctly link heat loss area to correct colour look also for a combination of ideas: eg red areas are hot and lose most heat, purple areas are cold (2) if no mark awarded idea of white is hotter **and** dark is colder scores (1)
	(b)		**all 4** payback times correct in table or elsewhere in answer 48 / 6 / 3 / 2 (1) **then** idea that they (C and D) have a short / low payback times (1) they (C **and** D) • save more (annually than A and B) / AW • are cheaper to fit (than A and B) / AW • reduce energy losses by 50% / AW (1) maximum of (1) for each marking point	3	**eg** D – greatest annual saving (1) **eg** C is cheapest to fit (1)

Question			Answer	Marks	Guidance
	(c)	**(**	70% (3) **but if answer is incorrect** (7000 ÷ 10000) x 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) x 100 (1)
		(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)
			Total	**9**	

Question			Answer)	Marks	Guidance
3	(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
4	(a)	(	radiation (1)	1	Ignore 'Infra red' **but** infrared radiation (1)
		(ii)	idea or description of convection (1) (warm water rises because) water expands or density falls (1)	2	e warm water rises / ora (1) **not heat rises** **ignore** water circulates **ignore** conduction eg warm water rises when it expands and becomes less dense (2)
	(b)	(i)	170 000 (2) **but if answer is incorrect** 200 000 x 0.85 (1)	2	 **allow** 200 000 x 85 / 100 (1)
		(ii)	**any one from:** double glazed top traps air / is a good insulator / reduces convection (1) black surface of cylinder is a good absorber (of radiation) (1) idea of shiny surface reflects (radiation back in) (1)	1	**ignore** 'double glazing traps heat' **allow** reduces energy loss by conduction (1) eg shiny surfaces reflects heat back in (1) **ignore** light
	(c)	(i)	$3 \times 10^8 \div 0.001$ / AW (2) **but if answer is incorrect** $3 \times 10^8 \div 1$ (1)	2	e $\frac{3 \times 10^8}{1 \times 10^{-3}}$ (2) eg $3x\ 10^8 = 3 \times 10^{11} \times 0.001$ (2) eg $3x\ 10^8 = 3 \times 10^{11} \times 1 \times 10^{-3}$ (2) **allow** $3 \times 10^8 / 3 \times 10^{11} = 0.001$ (2) **allow** $3 \times 10^8 / 3 \times 10^{11} = 1 \times 10^{-3}$ (2)

Question			answer	Marks	Guidance
		(ii)	shorter wavelength means higher frequency (1) **but** higher frequency has greater energy (2)	2	**allow** shorter waves have higher energy (1)
			Total	**10**	

Question			Answer	Marks	Guidance
5	(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
6	(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**	

Question			answer	Marks	Guidance
7	(a)		36% / 0.36 [2] **but if answer is incorrect** 180 ÷ 500 (x 100) [1]	2	if answer is 36 without % and working shown [2] just 36 or 0.36% [1] if another unit added max [1] eg 36 J [1] 0.36 N [1]
	(b)		idea of use of waste heat or energy / idea of recycle the waste heat or energy [1] **but** idea of use the waste heat to warm homes / buildings / to heat power station [2] **or** idea of recycling the waste heat back into the power station to heat water or make steam [2]	2	**allow** re-use the wasted energy or allow [1] **allow** use wasted heat in power station [1] **ignore** alternative energy **ignore** insulation **ignore** generate more electricity **allow** recycle the steam [2]
			Total	**4**	

Question	Answer	Marks	Guidance
8 a	**Idea that:** water heated /steam is produced / fuels release heat / AW (1)	**1**	**allow** Heat energy is used (to produce electricity) (1) **ignore** burning Heat unqualified = 0 fuel is heated =0
b	renewable energy (1) less polluting gases (1) fossil fuels finite (1)	**1**	 **allow** reduces CO_2 output / greenhouse gases (1**)** **allow** fossil fuels are running out (1) **allow** no fuel costs (1) **not** just environmentally friendly
c	19800 (MJ) (3) **But if answer is incorrect** 330 (MW) (2) 66% of 500 or .66 x 500 (1)	**3**	**if no other marks scored allow** evidence of power x time (1) **allow** 500 – 170 OR 330 (2) **allow** 34% of 500 or 0.34 x 500 = 170 (1)
	Total	**5**	