

Question	Answer	Marks	Guidance
1	<p><b>[Level 3]</b> Correct answer of 3.26 Amps <b>AND</b> explains why the fuse melts <b>AND</b> 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)</p> <p><b>[Level 2]</b> Correct answer of 3.26 Amps <b>AND</b> explains why the fuse melts. Quality of written communication partly impedes communication of the science at this level (3 – 4 marks)</p> <p><b>[Level 1]</b> Evidence of a calculation using power = voltage x current <b>OR</b> describe why the fuse melts. Quality of written communication impedes communication of the science at this level (1 – 2 marks)</p> <p><b>[Level 0]</b> Insufficient or irrelevant science. Answer not worthy of credit. (0 marks)</p>		<p><b>This question is targeted at grades up to A*.</b></p> <p><b>Indicative scientific points at level 3 may include:</b> 3.26 or 3.3 (amps) <b>AND</b> 3 amp fuse melts as current too large <b>AND</b> 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</p> <p><b>Indicative scientific points at level 2 may include:</b> 3.26 or 3.3 (amps) <b>AND</b> 3 amp fuse melts as current too large</p> <p><b>Indicative scientific points at level 1 may include:</b> evidence of power = voltage x current evidence of current = power / voltage 750 / 230 too much current / (fuse gets too) hot</p> <p>Allow answers in terms of power only – maximum of [3] marks.</p> <p><b>Use the L1, L2, L3 annotations in scoris. Do not use ticks.</b></p>
	<b>Total</b>	<b>6</b>	

**SECTION A**

Question		Answer	Marks	Guidance
2	(a)	<p>most heat lost from hot / poorly insulated areas <b>indicated by</b> colours white / yellow / red (1)</p> <p>least heat lost from cool / well insulated areas <b>indicated by</b> colours black / dark blue / purple (1)</p>	2	<p>must correctly link heat loss area to correct colour</p> <p>must correctly link heat loss area to correct colour</p> <p>look also for a combination of ideas: eg red areas are hot and lose most heat, purple areas are cold (2)</p> <p>if no mark awarded idea of white is hotter <b>and</b> dark is colder scores (1)</p>
	(b)	<p><b>all 4</b> payback times correct in table or elsewhere in answer 48 / 6 / 3 / 2 (1)</p> <p><b>then</b> idea that they (C and D) have a short / low payback times (1)</p> <p>they (C <b>and</b> D)</p> <ul style="list-style-type: none"> <li>• save more (annually than A and B) / AW</li> <li>• are cheaper to fit (than A and B) / AW</li> <li>• reduce energy losses by 50% / AW (1)</li> </ul> <p>maximum of (1) for each marking point</p>	3	<p><b>eg</b> D – greatest annual saving (1) <b>eg</b> C is cheapest to fit (1)</p>

Question		Answer	Marks	Guidance
	(c) (	70% (3)  <b>but if answer is incorrect</b>  $(7000 \div 10000) \times 100$ (2)  <b>but if this is incorrect</b>  useful energy = 7000(J) (1)	3	<b>ignore</b> 0.7 on answer line unless % clearly crossed out and no other unit added 0.7 <b>on its own</b> scores max (2)         alternatively <b>allow</b> $(3000 \div 10000) \times 100$ (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	<b>allow</b> idea that 3000J / wasted energy is converted to different forms of energy (1) Eg. 3000J lost as heat (1) <b>ignore</b> lost as sound   <b>allow</b> the idea of energy conservation (1) <b>eg.</b> 7000J + 3000J output = 10000J input eg. combined width / size of output arrows = input (1)
		<b>Total</b>	<b>9</b>	

Question		Answer)	Marks	Guidance
3	(a)	$416 - 364 = 52$ (3) <b>or</b> $6.5 \times 4 \times 2 = 52$ (3)  <b>But</b> if answer is incorrect then: Distas: $6.5 \times 4 \times 16 = 416$ (1)  Skinner: $6.5 \times 4 \times 14 = 364$ (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)  <b>allow</b> $6500 \times 4 \times 2$ (2)  <b>allow</b> $6.5 \times 4 \times 2$ (2)
	(b)	$0.69$ (2)  <b>but</b> if answer is incorrect r incomplete then:  690 <b>or</b> $230 \times 3$ scores (1)	2	
	(c)	inconvenient to use / night use only (1)	1	ignore fire risks
		<b>Total</b>	<b>6</b>	

Question			answer	Marks	Guidance
4	(a)	(	radiation (1)	1	Ignore 'Infra red' <b>but</b> 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) <b>not heat rises</b> <b>ignore</b> water circulates <b>ignore</b> conduction  eg warm water rises when it expands and becomes less dense (2)
	(b)	(i)	170 000 (2)  <b>but if answer is incorrect</b>  200 000 x 0.85 (1)	2	   <b>allow</b> 200 000 x 85 / 100 (1)
		(ii)	<b>any one from:</b> 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	<b>ignore</b> 'double glazing traps heat' <b>allow</b> reduces energy loss by conduction (1)     eg shiny surfaces reflects heat back in (1) <b>ignore</b> light
	(c)	(i)	$3 \times 10^8 \div 0.001$ / AW (2)  <b>but if answer is incorrect</b>  $3 \times 10^8 \div 1$ (1)	2	e $\frac{3 \times 10^8}{1 \times 10^{-3}}$ (2) eg $3 \times 10^8 = 3 \times 10^{11} \times 0.001$ (2) eg $3 \times 10^8 = 3 \times 10^{11} \times 1 \times 10^{-3}$ (2)  <b>allow</b> $3 \times 10^8 / 3 \times 10^{11} = 0.001$ (2) <b>allow</b> $3 \times 10^8 / 3 \times 10^{11} = 1 \times 10^{-3}$ (2)

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

Question			Answer	Marks	Guidance
5	(a)	(i)	2.07 (kilowatts) (2)  <b>if answer incorrect then</b>  2070 or $9 \times 230$ (1) or $\frac{9 \times 230}{1000}$ (1)	2	<b>allow</b> 2.1 or 2 (kilowatts) (2)
		(ii)	24.84 (Kilowatt hours) (2) <b>if answer incorrect then</b> 2.07 x 12 or 2.1 x 2 or 12 x 2 (1)	2	<b>allow</b> 25 or 24.8 <b>allow</b> 24 or 25.2 <b>allow ecf from 3ai</b> 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 <b>or</b> uses most energy / electricity at night (1)  <b>then one from:</b>  (so) cheaper to pay just 6p then <b>or</b> 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	<b>allow</b> clear calculation and comparison of <b>all</b> appliances eg 425p @ 10p rate (allow +/- 5p) (1 mark) 331p @ 12p / 6p rate (allow +/- 5p) (1 mark) <b>but</b> 2 marks for both calculations correct difference = 93 – 95p higher @ 10p rate (2 marks)  if no marks awarded <b>max one</b> mark: <b>allow</b> comparison of 2.40 (10p rate) to 2.16 (12p / 6p rate) (1)  <b>allow</b> comparison of 72p to £1.20 (1)  <b>ignore</b> comparison of 18p to 20p
			<b>Total</b>	<b>6</b>	

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



Question		answer	Marks	Guidance
7	(a)	36% / 0.36 [2]  <b>but if answer is incorrect</b>  $180 \div 500 \quad (\times 100)$ [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]  <b>but</b>  idea of use the waste heat to warm homes / buildings / to heat power station [2]  <b>or</b>  idea of recycling the waste heat back into the power station to heat water or make steam [2]	2	<b>allow</b> re-use the wasted energy or allow [1] <b>allow</b> use wasted heat in power station [1]  <b>ignore</b> alternative energy <b>ignore</b> insulation <b>ignore</b> generate more electricity  <b>allow</b> recycle the steam [2]
<b>Total</b>			<b>4</b>	

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