Eduqas Physics GCSE
Topic 1.2: Conservation, dissipation and national and global energy sources
Mark Schemes for Questions by topic

1.

Mark	Answer
6	**Indicative content:** Conduction in solids occurs because the atoms are regularly positioned and are close together. The atoms in the hot part of the solid vibrate faster than those elsewhere. They pass on their energy to their neighbours by collisions and so the energy travels through the solid. In metals this is improved by free electrons which move at speed from the hot region, colliding with metal ions in the lattice, transferring their energy in the process. Convection occurs in gases because the particles in the hotter region have more energy and push each other further apart in violent collisions. This region becomes less dense and rises above the cooler region setting up a circulating current, transferring thermal energy to all parts of the gas. **5-6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit

2.

Question			Marking details	Mark
7.	(a)	(i)	radiation	1
		(ii)	conduction	1
	(b)		Warm air is less dense than cold air (1) so it rises (1)	2
	(c)	(i)	20[%]	1
		(ii)	The cost [of insulation] is the <u>least</u> of all (accept "<u>just</u> £600")(1) and the annual saving is the <u>greatest</u> (accept "<u>shortest</u> payback time") (1)	2
		(iii)	conducted through the ceiling (1) then convected through the attic space(1).	2
			Question total	**[9]**

3.

Sub-section		Mark	Answer	Accept	Neutral answer	Do not accept
(a)		2	Only water above it is heated (1) Because hot water rises or is less dense / due to convection (1) **The 2nd mark must be linked to the 1st mark.**	Water below the heater can't get hot = 1st mark	Hot water expands / particles move further apart	Heat rises Hot air rises
(b)	(i)	2	Foam / air is a [good] insulator or poor conductor (1) Because it has <u>trapped</u> air inside it (1) **The 2nd mark must be linked to the 1st mark.**	Pockets of air Reduces convection currents <u>outside</u> (1) because the outer temperature is lower (1)		Harder for heat to travel through air Air holes
	(ii)	2	Shiny surfaces are <u>poor emitters</u> (1) of <u>heat radiation</u> (1)	Infra-red instead of heat radiation Poor radiator of heat = 2 marks Reflect infra-red radiation back in (1)		Reflects heat back in
(c)		2	Less electricity used / fewer power stations will be needed (1) which means less fuel (or a named fuel) is used or mined / less pollution (in any terms) is emitted from the power stations (1) **The 2nd mark must be linked to the 1st mark.**		The atmosphere heats up less	Reference to the ozone layer
(d)		6	**Indicative content:** **Heater 1:** $4 \times 0.5 = 2$ [kWh] Cost = $2 \times 16 = 32$ p **Heater 2:** $2 \times 3 = 6$ [kWh] Cost = $6 \times 5 = 30$ p Heater 1 is 2p more expensive than heater 2. **Heater 1:** $E = Pt = 2$ [kWh] **Heater 2:** $E = Pt = 6$ [kWh] Heater 2 uses up to 3 times more energy than heater 1 there is a 4 kWh difference. This will have an impact on the environment as more natural energy resources will be used up, more pollution/is produced which increases the greenhouse effect.			More water used up.

Sub-section	Mark	Answer	Accept	Neutral answer	Do not accept
		5-6 marks **See indicative content – correct calculation for both heaters and a full comparison made** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3-4 marks** **Calculation of units used and costs for both, comparison between the two made with advice to householder – all 3 attempted or 2 done well** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1-2 marks** **Calculation of units used for both or one correct or some commentary provided** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.			
Total	**14**				

4.

Question			Marking details	Marks
4.	(a)	(i)	1 000 x 25 = 25 000 [kg] mark is for the answer on answer line	1
		(ii)	25 000 (**ecf**) x 120 (1) = 3 000 000 [J] (1)	2
	(b)		$\dfrac{1.8}{2}$ x 100 (1) = 90[%] (1) Answer 0.9 – 1 mark	2
	(c)		back up or quick start (1) when demand increases e.g. at breakfast time / break in a sporting event / another power station has broken down (1) **Either mark can be awarded on its own but only award 2 marks if they are linked.**	2
	(d)	(i)	reduce energy or heat losses / increase efficiency (do not accept just reduce the current or there is no heat loss)	1
		(ii)	[low voltages are] saf<u>er</u> / high voltages are dangerous / for safety	1
			Question total	**[9]**

5.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			1	6.00 [units]	6.0 or 6		
(b)	(i)		2	Substitution: power = $\dfrac{(150 \times 25)}{6\ \textbf{ecf}} = \dfrac{3\ 750}{6\ \textbf{ecf}}$ (1) = 625 [W] (1)			
	(ii)		3	No of units = 1.1 ecf (addition and conv - 1) × 16 = 17.6 [units] (1) Cost = 17.6 **ecf** × 15 = 264 p or £2.64 (answer with unit -1)	1 100 **ecf** × 16 = 1 760 [units] award the 2nd mark		£2.64 p
	(iii)		1	Smaller outside wall area / less energy (or heat) is lost	Smaller number of outside walls / other side of one wall is also heated / smaller temperature difference	Reference to insulation	
(c)			3	Foil near <u>inner (or first)</u> wall <u>reflects</u> some / foil is a <u>poor absorber</u> (1) whilst the <u>outer (or second)</u> foil is a <u>poor emitter</u> (1) of <u>radiant</u> heat / heat <u>radiation</u> / infra-red (1)	IR		
TOTAL			10				

6.

Question				Marking details	Marks
2.	(a)			$\rho = \dfrac{104}{80}$ (1) = 1.3 (1) kg/m³ (1) **Alternative:** $\rho = \dfrac{104000}{80000000}$ (1) = 0.0013 (1) g/cm³ (1)	3
	(b)	(i)		A	1
		(ii)		A	1
		(iii)		Because <u>hot</u> air rises / expands (don't accept heat rises or least dense)	1
	(c)			**Indicative content** The silver sheet reflects infra-red radiation back into the radiator and reflects heat back into the room. The ridged panels / bubble wrap trap insulating pockets of air between the radiator and the wall, reducing heat lost through the wall by conduction. Plastic is also an insulator. The outside air temperature of the wall will be reduced by both factors above, so convection will be reduced. **5 – 6 marks** The candidate constructs an articulate, integrated account correctly linking relevant points, such as those in the indicative content, which shows sequential reasoning. The answer fully addresses the question with no irrelevant inclusions or significant omissions. The candidate uses appropriate scientific terminology and accurate spelling, punctuation and grammar. **3 – 4 marks** The candidate constructs an account correctly linking some relevant points, such as those in the indicative content, showing some reasoning. The answer addresses the question with some omissions. The candidate uses mainly appropriate scientific terminology and some accurate spelling, punctuation and grammar. **1 – 2 marks** The candidate makes some relevant points, such as those in the indicative content, showing limited reasoning. The answer addresses the question with significant omissions. The candidate uses limited scientific terminology and inaccuracies in spelling, punctuation and grammar. **0 marks** The candidate does not make any attempt or give a relevant answer worthy of credit.	6
				Question total	**[12]**

7.

Question			Marking details	Mark
2.			Any 1 correct - 1 mark Any 2 correct – 2 marks Any 3 or all four correct – 3 marks	3
			Question total	**[3]**

8.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			2	320 [MJ] (1) 150 [MJ] (1)			
(b)	(i)		1	chemical [energy]			
	(ii)		1	electrical [energy]	electricity		
(c)	(i)		1	coal	C		
	(ii)		2	Wasted as heat (thermal) energy (1) Since turbines, pipes etc become hot / water cools (1) **Alternative:** Wasted as sound energy (1) Because of the noise [released by the machines] (1) **The 2nd mark can only be awarded if it is linked to the 1st mark.**	Cooling towers/chimney/ Transformers / friction in moving parts Steam	Other types of named energies References to CO_2	Friction only Smoke
(d)			2	$efficiency = \dfrac{useful\ power\ transfer}{total\ power\ input} \times 100$ $efficiency = \dfrac{170}{500} \times 100$ Selection of 170 anywhere (1) Efficiency = 34 (1)	Answer alone gains both marks $\dfrac{500}{170} = 34$ gets 1 mark only Answer only of 0.34 gets 1 mark		170 on the answer line
(e)			3	**Oil:** causes [increased] greenhouse effect / global warming / climate change (1) **Nuclear:** must be stored safely for a long time / problems linked to storage or leaks (1) **Coal:** causes acid rain (1)		Global warming when referring to problems with SO_2	Leaves nuclear waste / ozone layer / harmful to humans or wildlife

9.

Question			Marking details	Marks
5.	(a)	(i)	1 000	1
		(ii)	1 000(**ecf**) × 0.7 (1 − subs) = 700 [km^2] (1-answer)	2
		(iii)	$\frac{60}{20}$ (1)x 1000(**ecf**) = 3 000[1 − answer] Answer of 3 **award 1 mark**	2
	(b)		Wind doesn't always blow / nuclear runs all of the time / takes less ground space / fewer habitats destroyed / total commissioning cost is less / longer lifetime. **Accept** more reliable / bigger power [output] / bigger energy [output] / more electricity.	1
			Question total	**[6]**