Eduqas Physics GCSE
Topic 1.3: Energy transfers
Mark Schemes for Questions by topic

1.

Question			Marking details	Marks
3.		(i)	Electricity is transmitted at high (increases the) voltages (1) to reduce the current (1). This reduces energy losses due to heat (1). **Either the 2nd mark must be linked to the 1st mark or the 3rd mark must be linked to the 2nd mark.** If reference to power increasing is made the maximum mark that can be awarded is 2. **Don't accept** any reference to stopping energy losses	3
		(ii)	$3950 \times \left(\frac{92}{100}\right)$ (1 - substitution) = 3 634 [MW] (1)	2
		(iii)	**EITHER**: 230 × 80 = 18 400 [W] (1) Then pair of values with consistent units e.g $\frac{3634}{0.0184}$ or $\frac{3634000}{18.4}$ or $\frac{3634000000}{18400}$ (1) = 197 500 (1) (allow **ecf** from (ii) and on 18 400) **OR**: current = $\frac{3634000000(1)}{230(1)}$, $\frac{15800000}{80}$ = 197 500 (1) N.B. mark after 230 moves to after the 2nd division **Award 2 marks** for an answer of 214 674	3
			Question total	**[8]**

2.

Sub-section			Mark	Answer	Accept	Neutral answer	Do not accept
(a)			2	Increases or steps up the voltage / reduces the current (1) to reduce energy / heat losses [in the cables] (1) **The 2nd mark can only be awarded if it is linked to the 1st mark.**		Improves efficiency (given)	Reduces the power No heat loss
(b)	(i)		1	950 000 000 [W]	950×10^6		950 MW
	(ii)		2	$I = \frac{P}{V}$ $I = \frac{950\,000\,000}{475\,000}$ (manip & subst- 1) **ecf** from (b)(i) I = 2 000 [A] (1) **Alternative:** Calculations with matching units e.g. mega or kilo	An answer of 2×10^n [A] other than 2×10^3 award 1 mark only unless **ecf** rule applies		$\frac{475\,000}{950\,000\,000}$ = 2 [A]
(c)			2	Reduce the voltage (1) to a safer value [for use in the home] / because high voltages are more dangerous (1) **The 2nd mark can only be awarded if it is linked to the 1st mark.**	Step-down the voltage	Increase the current	
(d)			6	**Indicative content:** Some types of power station continue working for 24 hours a day and for 365 days a year. These include nuclear, coal and oil powered stations which take a long time to shut down and to start up again. Through the day, however, demand changes, the demand being small at night while most of the population is sleeping but during the daytime there are peaks of demand, notably at breakfast time and again in early evening. To meet this demand some power stations are needed which can be brought on stream at very short notice. This is where hydroelectric power stations are very useful because they can start up within seconds by just opening a valve to let the water flow. They, along with reserve oil and gas powered stations can also be used to maintain supply during maintenance or breakdown times of other stations. **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 (d) **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.			
Total Mark			13				

3.

Question			Marking details	Marks
6.	(a)		It provides power (electricity) to consumers / users (1) (**accept** 2 named consumers e.g. schools, hospitals, factories, houses) and maintains a reliable supply / is capable of responding to fluctuating demand / caters for a power station breakdown (1) **Don't accept** reference to efficiency	2
	(b)	(i)	Energy = $P \times t = \frac{5400(1)}{60(1)} \times 0.95$ (1) = 85.5 [MWh] **Award 2 marks** for an answer of 5 130 [MWh] **Award 2 marks** for an answer of 90	3
		(ii)	**EITHER:** 85.5 MWh **(ecf)** = 85 500 kWh (1) Cost = 85 500 × [£]0.05 (1) = [£]4 275(1) $\frac{650000}{4275}$ = 152 [weeks] (1) **OR:** 85.5 MWh **(ecf)** = 85 500 kWh (1) Cost = 85 500 × 5 [p] = 427 500 [p] (1) 65 000 000 (1) ÷ 427 500 = 152 [weeks] (1) **OR:** (650 000 ÷ 0.05) (1) = 13 000 000 [kWh] (1) 13 000 000 ÷ 85 500(1-conversion) = 152 [weeks] (1) **Accept** an answer of 153 [weeks] if correct workings shown	4

Question			Marking details	Marks
	(c)		**Indicative content:** The number of wind turbines required to meet the demand is $\frac{40000}{0.95}$ = 42 106. This compares with 16 nuclear power stations. The area of land or sea required for this number of turbines would be extremely large. Is there sufficient area available? Wind turbines can only operate between certain wind speeds. They will not produce a consistent power supply. However, wind turbines do not use any fuel so will not produce any waste. Running wind turbines will not produce greenhouse gases so will not contribute to global warming or acid rain. Some people consider wind turbines to be a source of visual and noise pollution. **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. **Question total**	6 **[15]**
			HIGHER TIER PAPER TOTAL	**[60]**

4.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	power output increases (to meet demand) due to people returning home from work / school	accept many electrical appliances are switched on (which increases demand) accept other sensible suggestions	1	AO3/1a 4.1.3
03.2	00.00	accept midnight allow answers between 00.00 and 04.00	1	AO3/1a 4.1.3 WS3
03.3	any **two** from: • conserves fuel reserves • spare capacity to compensate for unreliable renewable resources • provides spare capacity in case of power station emergency shut-down • so as to not make unnecessary environmental impact		2	AO2/1 4.1.3
Total			**4**	

5.

(a) (i) transformer 1

(ii) current 1

(iii) transformer 1

(b) (i) One mark is awarded for a correct relevant statement – the second mark can only be awarded if the candidate correctly and coherently links a second relevant statement to the first, e.g.[Smaller current in C means] less heat produced [or equiv.] (1) resulting in energy loss in **C** [or in the grid or equiv.] (1)
Alternative answer: Smaller current in C allows for thinner conductors (1) which require less material / are cheaper [or easier to support, or other sensible answer] 2

(ii) Lower voltage at D for safety reasons however expressed 1

Total marks for question 6

6.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	230 V		1	AO1/1 6.2.3.1
01.2	Earth Neutral	must be in the correct order	1 1	AO1/1 6.2.3.2
01.3	It is easy to identify each wire.		1	AO3/1a 6.2.3.2
01.4	current shock	must be in the correct order	1 1	AO1/1 6.2.3.2
01.5	50 Hz		1	AO1/1 6.2.3.1