Question Number	Answer	Acceptable answers	Mark
1(a)(i)	Substitution (1) 2900 = 230 × current Transposition (1) $\frac{2900}{230}$ Evaluation (1) 13 (A)	Award full marks for correct answer with no working Allow substitution and transposition in either order Ignore powers of ten errors until evaluation Allow numbers which round up to 13	**(3)**

Question Number	Answer	Acceptable answers	Mark
1(a)(ii)	Substitution (1) 97 = 2.9 × time × 17 Transposition (1) $\frac{97}{2.9 \times 17}$ OR $\frac{97}{49.3}$ Evaluation (1) 2.0 (h)	Award full marks for correct answer with no working Allow substitution and transposition in either order Ignore powers of ten errors until evaluation Allow $\frac{97}{17}$ = 5.7 for 1 mark Allow numbers which round up to 2.0	**(3)**

Question Number		Indicative Content	Mark
QWC	***1(b)**	An explanation including some of the following points • a current/voltage/emf is induced when there is relative movement between a magnet and a coil of wire • the current is bigger when the movement is faster • the current is alternating/regularly changing direction • the current is zero when the magnet is not moving • points P and R on the graph correspond to the fastest movement of the magnet • the magnet is changing direction at points O, Q, S on the graph (quoting positive and negative current values from graph is sufficient to indicate a change in direction of current on graph) • the magnet is at the top/bottom of its movement at points O, Q, S on the graph • the magnet is not moving at points O, Q, S on the graph IGNORE references to number of turns or stronger magnet	**(6)**

Level	0	No rewardable content
1	1 - 2	• a limited explanation linking induced current to idea of movement of magnet OR limited reference linking graph to type of current with no link to model e.g. magnet moving in coil (induces a current) / (magnetic) field lines cut coil OR (the graph shows) an alternating current • spelling, punctuation and grammar are used with limited accuracy • the answer communicates ideas using simple language and uses limited scientific terminology
2	3 - 4	• a simple explanation linking the motion of the magnet to the size/direction of the induced current OR {a limited explanation linking induced current to idea of movement of magnet AND limited reference linking graph to type of current with no link to model} e.g. Magnet moving in the coil induces a current. The faster it moves the bigger the induced current. OR Magnet moving in the coil induces a current. When the magnet changes direction, the current changes direction. OR Magnet moving in the coil induces a current. The graphs shows an alternating current. OR Magnet moving in the coil induces a current. The current is positive at P and negative at R. • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately
3	5 - 6	• a detailed explanation linking the motion of the magnet to the size/direction of the induced current AND reference to graph for one factor e.g. Magnet moving in the coil induces a current. The faster it moves the bigger the induced current. The magnet is moving fastest at point P on the graph. OR Magnet moving in the coil induces a current. When the magnet changes direction the current changes direction. At P and R the magnet is moving in opposite directions. OR Magnet moving in the coil induces a current. The current is positive at P and negative at R. The magnet is moving up at P and down at R. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors

Total for Question 6 = 12 marks

Question Number	Answer	Acceptable answers	Mark
2(a)	☒ **B** charge		**(1)**

Question Number	Answer	Acceptable answers	Mark
2(b)	Substitution 12 x 230 (1) evaluation 2800 (W) (1)	2760 (W) give full marks for correct answer, no working Power of 10 error max. 1 mark.	**(2)**

Question Number	Answer	Acceptable answers	Mark
2(c)	Conversion 0.4 (kW) (1) Substitution 0.4 x 10 x 15 (p) (1) or 0.4 x 10 x 0.15 (£) Evaluation 60(p) or £0.6 (1)	give marks for correct answer, no working 60(p) or £0.6 (3) 60,000(p) or £600 (2) 6 to any other power of 10 (1) (400/40/4) x 10 x (15/0.15) gains one mark if no mark can be awarded for evaluation.	**(3)**

Question Number		Indicative Content	Mark
QWC	*)	A discussion including some of the following points	**(6)**

Energy saving lamp	**Filament lamp**
Advantages • Saves energy / uses energy more efficiently • Cost efficient • Lasts longer • Lower power (needed) • Less fossil fuels burnt • Cool to touch • Efficiency 20% • Lasts 9000 hours longer • Lasts 10 times longer • Produces 4 times as much light energy for every 100J of electrical energy supplied. • More readily available **Disadvantages** • Higher initial cost • May contain harmful gases • Takes longer to reach maximum brightness • Not such a bright light • Costs 5 times as much • Costs £1.20 more	**Disadvantages** • Wastes more energy • Less efficient • Shorter lifetime • Higher power (needed) • More fossil fuels burnt • Gets very hot • Only 5% efficient • Wastes 95% of energy supplied • Uses 4 times as much power • Less readily available **Advantages** • Costs less to buy • Do not contain harmful gases • Lights immediately • Bright light

Table of information given in the question

Energy saving lamp	Filament lamp
power =15 W	power =60W
Cost = £1.50	Cost = £0.30
Lifetime = 10 000 hours	Lifetime = 1000 hours
Produces 20J of light energy for every 100J of electrical energy supplied	Produces 5J of light energy for every 100J of electrical energy supplied

Level	**0**	No rewardable content	
1	**1 - 2**	• A limited description of one advantage or one disadvantage e.g. energy saving lamps last a long time/ filament lamps get very hot **OR** A correct value quoted from information with no comparison. • The answer communicates ideas using simple language and uses limited scientific terminology • Spelling, punctuation and grammar are used with limited accuracy	
2	**3 - 4**	• A simple description of two different advantages / disadvantages e.g. energy saving lamps cost more but last longer / filament lamps have a short life time and use more power **OR** Correct values quoted from table and used to provide two comparisons without calculations • The answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • Spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• A detailed description of two different advantages / disadvantages using a **quantitative** comparison. e.g. energy saving lamps cost 5 times more but last 10 times longer. / Energy saving lamps produce 4 times as much light energy for every 100J of electrical energy supplied and are much more efficient. / Energy saving lamps last 9,000 hours longer than and they use less power. • The answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • Spelling, punctuation and grammar are used with few errors	

Question Number	Answer		Mark
3(a)	C		**(1)**

Question Number	Answer	Acceptable answers	Mark
3(b)(i)	a description including the following • direct current (the flow of charge) is only in one direction (1) • alternating current (the flow of charge periodically) {changes / reverses} {direction / eq} (1)	d.c stays {positive/negative} only goes positive and negative	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(b)(ii)	any **one** of the following • transformers only change alternating {voltages / currents} • transformers will not work with direct current	It is {not alternating / direct} current	**(1)**

Question Number	Answer	Acceptable answers	Mark
3(c)	An explanation linking any **two** of the following • reduction of fossil fuels burnt (1) • less reliance on fossil fuels (1) • reduction of greenhouse gases / pollution/global warming (1) • increased use of renewable energy source (1) • less use of non-renewable energy source (1) • reduce need for additional power station building (1) • reduction of negative impact of specified type of power station (1)	conserving fossil fuel reserves reduction of correctly named pollutant / greenhouse gas solar energy is renewable fossil fuels are non-renewable	**(2)**

Question Number	Answer	Acceptable answers	Mark
3(d)	substitution (1) 800 x 0.4 / 800 x 40 evaluation of payment (1) (£)320 / 32000 (p) evaluation of payback time (1) 15 (years)	4800 / 0.4 = 12000 Kwh (to be sold) takes 12000 / 800 years substitution and transposition can be in either order allow power of 10 error in 15 for (2) give full marks for correct answer, no working	**(3)**

Question Number	Answer	Acceptable answers	Mark
4(a)(i)	60 (kW h/ units) (1) 60 x 20 (= 1200) (p) (1)	15459 - 15399 £12 ecf Award full marks for correct answer with no working £12 scores 2 Power of Ten error scores maximum 1 60 in answer space with no working scores 1	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(a)(ii)	60 / 15 (1) 4 (kW) (1)	Allow ecf from 6(a)(i) marking point 1 Award full marks for correct answer with no working	**(2)**

Question Number	Answer	Acceptable answers	Mark
4(b)	An explanation linking any two of: • increase voltage (1) • decrease current (1) • reduce {loss / waste} of {energy / heat} (1)	Increase efficiency (of energy transmission) Ignore "more efficient" by itself Accept power instead of energy Accept no energy loss	**(2)**

Question Number		Indicative content	Mark
QWC	***4(c)**	A description to include some of the following points • speed of movement • stronger / more powerful (ORA) magnet • more turns / coils (ORA) • iron core • reversing movement • turning the magnet round • effect of any / each change • more conducting / less resistant wire • allow stronger current • allow ammeter reading / recording / voltage for current • allow moving coil Correct ideas but using inaccurate scientific terminology • larger / bigger magnet • more / longer movement Ignore • irrelevant information • speeds up current or more electricity	**(6)**
Level	**0**	no rewardable material	
1	**1-2**	• a limited description of any one change e.g. use more coils **OR** a stronger magnet. • the answer communicates ideas using simple language and uses limited scientific terminology • spelling, punctuation and grammar are used with limited accuracy	
2	**3-4**	• a simple description of any two different changes **OR** one change and its effect e.g. use more coils and a weaker magnet **OR** more coils more current • the answer communicates ideas showing some evidence of clarity and organisation and uses scientific terminology appropriately • spelling, punctuation and grammar are used with some accuracy	
3	**5 - 6**	• a detailed description of a change linked to its effect and a second different change e.g. using more turns of wire makes a bigger current. Moving the magnet out. • the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately • spelling, punctuation and grammar are used with few errors	

(Total for Question 6 = 12 marks)