

Name of the Student: _____

Max. Marks : 19 Marks

Time : 19 Minutes

Mark Schemes

Q1.

Question number	Answer	Mark
(i)	either power = (current) ² × resistance OR $P = I^2 \times R$	(1)

Question number	Answer	Additional guidance	Mark
(ii)	substitution into $P = I^2 \times R$ (1) $55 = 4.4^2 \times R$ rearrangement (1) $R = P \div I^2$ evaluation (1) 2.8 (Ω)	Substitution and re-arrangement in either order $R = 55 \div 4.4^2$ for 2 marks allow answers that round to 2.8 award full marks for correct answer without working allow alternative route $V = P \div I = 55 \div 4.4$ then $R = V \div I = 12.5 \div 4.4$	(3)

Question Number:	Answer	Additional Guidance	Mark
	an explanation linking: relevant calculation (1) $R \text{ (between P and Q)} = \frac{6}{1.2} = 5\Omega$ reasoning / interpretation of result (1) this is less than {a single resistor / two resistors in series} conclusion (1) resistors must be connected <u>in parallel</u>	allow alternative arguments such as if resistors had been in series, then... $I = \frac{6}{20} = 0.3A$ $V \text{ (between P and Q)} = 1.2 \times 10 = 12V$ current is more (than 0.3A) total p.d. is less than 12 V	(3) AO 3 2a AO 3 2b

Q3.

	Answer	Acceptable answers	Mark
(a)	transformer	Step-up transformer Step-down transformer	(1)
(b)	A suggestion to include any 2 of the following • (LED) turns on and off • as voltage/current changes direction/from +ve to -ve/ twice each second (1) • (LED) on for (+ve) part of cycle (1) • (LED) off for (-ve) part of cycle (1)	Flash(es) / flicker(s) (on and off) current changes every 0.25 s /4 times each second Turns on twice each second = 2 marks Only on when voltage/current is +ve gains both marks	(2)
(c)	substitute (1) $3 = I \times 12$ transformation (1) $I = 3 \div 12$ evaluation (1) 0.25 (A) Ignore any unit given by candidate	Subst. and transform. either order 1 mark only can be scored for correct substitution after incorrect transposition. Accept any number of sig. figs. that rounds to 0.25 (A) 250 <u>mA</u> gains 3 marks give full marks for correct answer, no working $2.5 \times$ any other power of ten = 2 marks eg 25 (A) gains 2 marks	(3)

		Indicative Content	Mark
QWC	*(d)	A discussion including some of the following points • improved lighting levels for LEDs • energy savings per year for LEDs or calculation of payback time • calculation of energy savings over lifetime of LEDs or calculation of	(6)

		monetary savings by using LEDs per year - link to savings in fossil fuels for LEDs or link to reduced CO₂ produced for LEDs and reduced global warming - comparison of lifetimes and maintenance cost	
Level	0	No rewardable content	
1	1 - 2	- a limited discussion of benefits using some pieces of the information provided, e.g. LEDs last 40 000 hours longer and the lighting levels are 200% brighter. - 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 discussion of benefits using some pieces of the information and processing one of them OR 2 processed pieces of information. e.g. LEDs save 3000 kW h of energy each year and are much brighter. The money they save each year compared to fluorescents is £420. OR The payback time for the LEDs is about 5 years and in that time they would have to pay for the fluorescent lights to be replaced 5 times. - 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 discussion of benefits using processed information covering more than half of the data points in the table e.g. LEDs use less energy each year and this means that fossil fuel reserves are not used up as quickly. The LEDs save £420 each year and have a payback time of about 5 years. - the answer communicates ideas clearly and coherently uses a range of scientific terminology accurately - spelling, punctuation and grammar are used with few errors	