Neap.

PHYSICS VCE UNITS 1&2 DIAGNOSTIC TOPIC TESTS 2016

TEST 3: HOW DO ELECTRIC CIRCUITS WORK? (I)

SUGGESTED SOLUTIONS AND MARKING SCHEME

Question 1 (4 marks)

Q = It	
$= (2.0 \text{ A})(2 \times 60 \text{ s})$	
= 240 C	1 mark
V = IR	
$R = \frac{12}{2}$	
$= 6.0 \ \Omega$	1 mark
P = IV	
$= 2 \times 12$	1 mark
= 24 W	1 mark
	= $(2.0 \text{ A})(2 \times 60 \text{ s})$ = 240 C V = IR $R = \frac{12}{2}$ = 6.0Ω P = IV = 2×12

Question 2 (12 marks)

a. $2.0 \times 10^5 \text{ C s}^{-1}$ 2 marks The current in amperes is actually the number of coulombs per second, which in this case

is 200 kA, or 2.0×10^5 C s⁻¹.

b.	Q = It	
	$= (2.0 \times 10^5)(10 \times 10^{-3})$	1 mark
	= 2000 C	1 mark
		Note: Consequential on answer to Question 2a.

2 marks

c. $1.2 \times 10^6 \,\mathrm{J}\,\mathrm{C}^{-1}$

The voltage in volts is actually the number of joules per coulomb, which is 1.2 MJ (or 1.2 megajoule per coulomb).

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d.	U = VQ	
	$=(1.2 \times 10^{6})(2000)$	1 mark
	$= 2.4 \times 10^9 $ J	1 mark
		Note: Consequential on answer to Question 2b.

e.	P = IV	
	$= (2.0 \times 10^5)(1.2 \times 10^6)$	1 mark
	$= 2.4 \times 10^{11} $ W	
	$= 2.4 \times 10^8 \text{ kW}$	1 mark

f. Although there is a tremendous amount of electrical energy available in this lightning bolt (see part e.), there is no predicting when or where it will strike.
Also, we do not have any method of harnessing all this energy, which is discharged in

Question 3 (13 marks)

such a small time burst (10 milliseconds).

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a.	circuit B	1 mark
	The light globes are placed in series with each other and the battery.	
b.	12 V	2 marks
	Circuit A shows a parallel arrangement of the light globes, hence each light globe has the potential difference of the battery supply; that is, 12 V.	
c.	4 V	2 marks
	Circuit B is a series circuit. As each light globe is identical this is equivalent to three identical resistors placed in series with the battery. This means that the potential difference across each resistor will be 4 V.	
d.	$I = \frac{V}{R}$	
	$=\frac{12}{4}$	1 mark
	= 3 A	1 mark
e.	The total resistance of the three light globes in series is 12Ω .	
	V = IR	

, 11	
$I = \frac{12}{12}$	1 mark
= 1 A	1 mark

f. P = IV= 1 × 4 1 mark

1 mark

g.	circuit A	1 mark
	For each light globe in circuit A, the power is given by $P = IV = 3 \times 12 = 36$ W, whereas for each light globe in circuit B, the power is 4 W (see part e.). The amount of light is proportional to the output power of each globe.	1 mark
Que	estion 4 (6 marks)	
a.	non-ohmic	1 mark
	The graph of the electrical device does not follow a straight-line graph (straight-line graphs characterise ohmic devices).	1 mark
b.	С	2 marks
	The electrical device's resistance decreases as the current increases.	
c.	I = 1.0 A, V = 10 V	
	P = IV	
	$= 10 \times 1$	1 mark
	= 10 W	1 mark
Que	estion 5 (10 marks)	
a.	series	1 mark
	Each solar cell produces 1.2 V; by putting ten solar cells in series, a total potential difference of 12 V is obtained.	1 mark
b.	$I = \frac{P}{V}$	
	$=\frac{960}{12}$	1 mark
	12 = 80 A	1 mark
c.		2 marks
	Each module produces 2 A of current. Therefore, 40 modules will produce 80 A. <i>Note: Consequential on answer to Que</i>	estion 5h
d.	total power in = total power out	50000000
u.	P = IV	
	$I = \frac{960}{240}$	1 mark
	=4 A	1 mark
e.	energy produced in kW $h = Pt$	
	$= 0.96 \text{ kW} \times 4 \text{ h}$	1 mark

= $0.96 \text{ kW} \times 4 \text{ h}$ 1 mark = 3.84 kW h 1 mark