
PHYSICS VCE UNITS 1&2 DIAGNOSTIC TOPIC TESTS 2016

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

TOTAL 45 MARKS (45 MINUTES)

Student's Name: _____ Teacher's Name: _____

Directions to students

Write your name and your teacher's name in the spaces provided above.
Answer all questions in the spaces provided.

Question 1 (4 marks)

A simple circuit is set up using a 12 V battery and a resistor, as shown in Figure 1. A current of 2.0 A flows through the resistor for a period of 2 minutes.

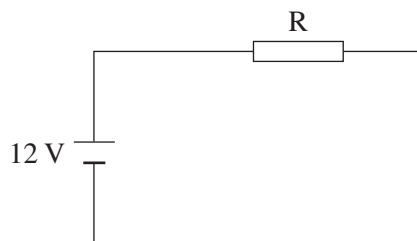


Figure 1

- a. Calculate the total number of coulombs that flow through the resistor during the 2 minutes. 1 mark

C

- b. Determine the resistance of the resistor. 1 mark

Ω

c. Determine the power dissipated in the resistor.

2 marks

Question 2 (12 marks)

The current in a lightning bolt is measured as 200 kA, the voltage is measured as 1.2 MV and the duration of the pulse of lightning is 10 ms.

- a. How many coulombs per second are there in this lightning bolt? 2 marks

- b. Calculate the amount of charge in coulomb contained within this lightning bolt. 2 marks

- c. How many joules per coulomb are there in this lightning bolt? 2 marks

- d.** Calculate the total number of joules carried by this lightning bolt. 2 marks

J

- e.** Calculate the total power of this lightning bolt. 2 marks

kW

- f.** Explain why this form of electrical energy has not been used to power the electricity needs of domestic houses. 2 marks

Question 3 (13 marks)

Figure 2 shows two different circuits (A and B). Each circuit contains three light globes and a 12 V battery. All the light globes are identical and each light globe has a resistance of 4.0Ω .

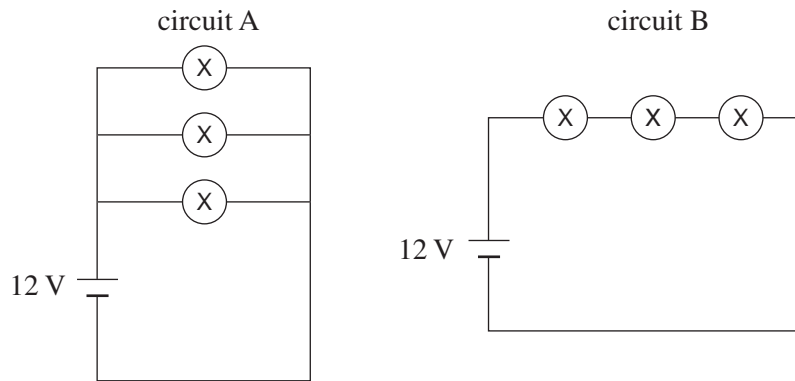


Figure 2

- a. Which of the circuits shows the lights in a series arrangement? 1 mark

- b. Calculate the potential difference across each light globe in circuit A. 2 marks

- c. Calculate the potential difference across each light globe in circuit B. 2 marks

- d. Calculate the current through one of the light globes in circuit A. 2 marks

- e. Calculate the current through one of the light globes in circuit B. 2 marks

A

- f. Calculate the power dissipated by a single globe in circuit B. 2 marks

W

- g. In which circuit would the globes shine brighter? Explain your answer? 2 marks

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Question 4 (6 marks)

Figure 3 shows a voltage-current graph for a particular electrical device.

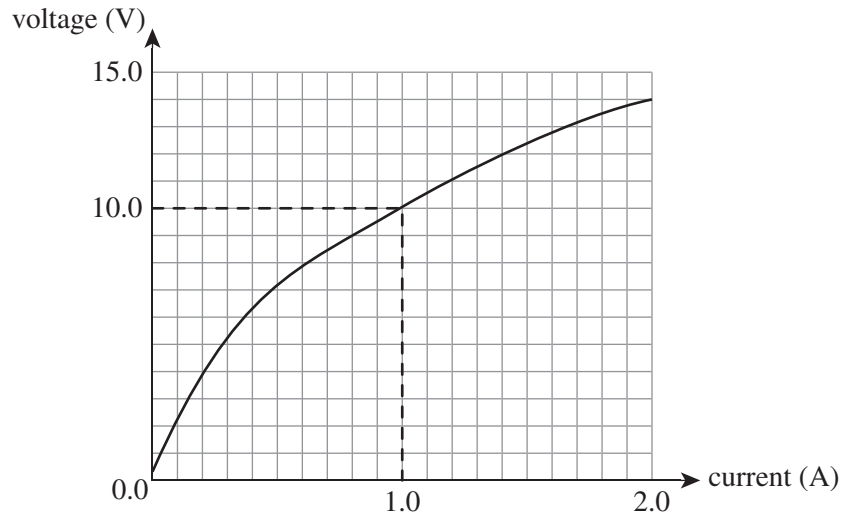


Figure 3

- a. Is the device whose graph is shown in Figure 3 ohmic or non-ohmic? Explain your answer. 2 marks

- b. Which one of the following statements is true about the device whose graph is shown in Figure 3? 2 marks

- A. Its resistance is constant.
- B. Its resistance increases as the current increases.
- C. Its resistance decreases as the current increases.
- D. Not enough information is given to determine how the resistance varies.

- c. Calculate the power the electrical device uses when the current is 1.0 A. 2 marks

Question 5 (10 marks)

Photovoltaic solar cells are being installed in houses throughout Australia to generate electricity. A typical system creates 960 W of electrical power in full sunshine. The photovoltaic cells generate DC electricity which is converted (using an inverter) to AC electricity for household purposes. In one set of photovoltaic solar cells, each cell generates 1.2 V DC of output voltage. These cells are then organised into a module that provides a 12 V DC output with a current of 2.0 A. A number of these modules are then organised into a parallel grid arrangement that provides 12 V DC to the inverter.

- a. Are the photovoltaic solar cells that make up a module arranged in series or parallel?
Explain your answer. 2 marks

- b. Calculate the total current produced by all the modules when the photovoltaic solar cells are producing 960 W at 12 V DC. 2 marks

A

- c. Determine the number of modules that are arranged in parallel to produce 960 W of electrical output. 2 marks

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- d. Calculate the maximum current available to the household when the 12 V DC is inverted into 240 V AC. 2 marks

A

On one particular day the Sun shines for 4 hours. Assume the photovoltaic solar cells work at their maximum efficiency of 960 W for the whole time.

- e. Calculate the total kW h produced by the photovoltaic solar cells during the 4 hours. 2 marks

kW h