

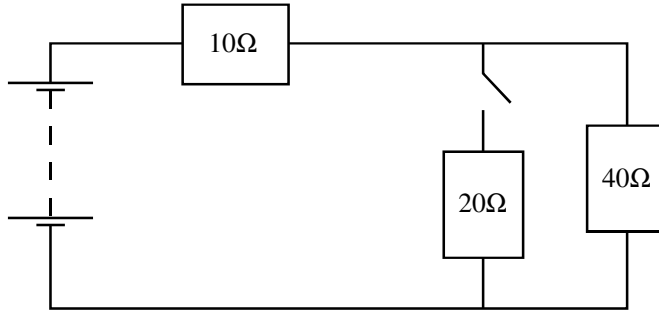
HW One - Electric Circuits

40 min
40 marks

1. Three identical resistors are connected across a potential difference V so that one of them is in parallel with the other two which are connected in series. The power dissipated through the first one, compared to the power dissipated by each of the other two, is approximately
- A the same
 - B half as much
 - C twice as much
 - D four times as much

(Total 1 mark)

2. A circuit is set up as shown in the diagram.

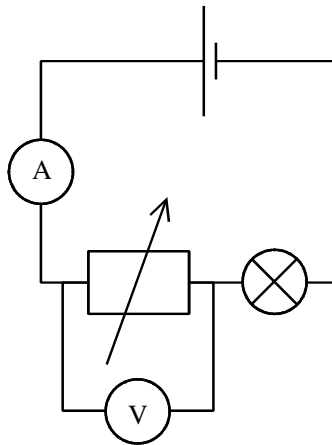


When the switch is closed, the potential difference across the $20\ \Omega$ resistor would

- A equal the potential difference across the $10\ \Omega$ resistor
- B be twice the potential difference across the $10\ \Omega$ resistor
- C equal the potential difference across the $40\ \Omega$ resistor
- D be half the potential difference across the $40\ \Omega$ resistor

(Total 1 mark)

3. A student sets up the following circuit to measure the internal resistance of a cell.



(a) What is wrong with his circuit diagram?

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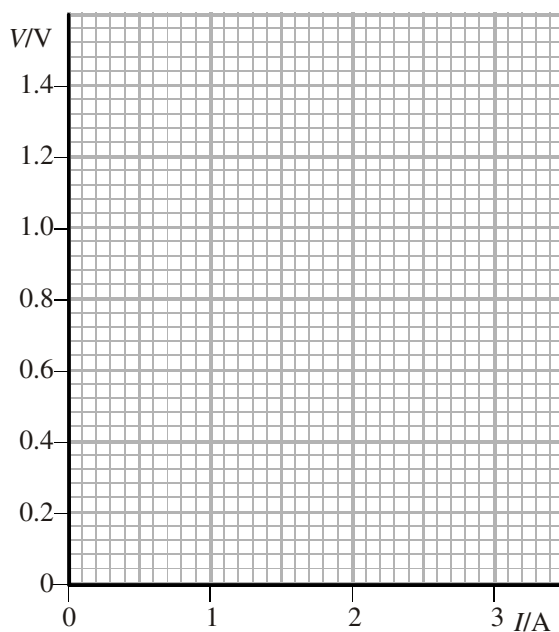
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(1)

(b) Using the correct circuit the student obtains the following results.

Current in the cell I/A	Terminal potential difference across the cell V/V
0.5	1.2
0.9	1.0
1.5	0.8
1.9	0.6
2.5	0.4
2.9	0.2

(i) On the grid below, plot these results and draw the line of best fit through your points.



(3)

(ii) Use your graph to determine the e.m.f. of the cell.

e.m.f. =

(1)

(iii) Use your graph to determine the internal resistance of the cell.

Internal resistance = (2)

(c) The experiment is repeated with two such cells connected in series. How does the graph differ?

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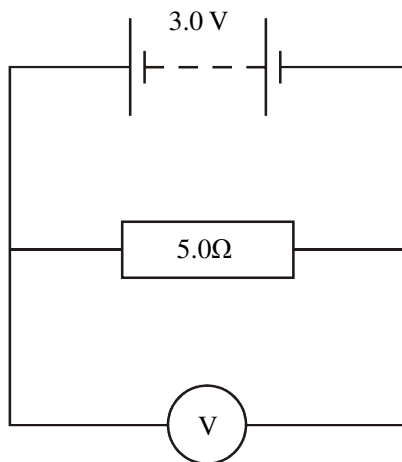
(2)
(Total 9 marks)

4. (a) Define the term electromotive force (e.m.f.).

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.....
.....

(2)

- (b) A battery of e.m.f. 3.0 V is connected to a 5.0 Ω resistor with a very high resistance voltmeter placed across the resistor.



- (i) The very high resistance voltmeter gives a reading of 2.8 V. Show that the internal resistance of the battery is about 0.4 Ω .

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(3)

- (ii) A voltmeter with a resistance of 10 Ω is used instead of the original one. Calculate the combined resistance of this voltmeter and the 5.0 Ω resistor.

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Combined resistance =

(2)

(iii) Calculate the reading on this voltmeter.

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Voltmeter reading =

(3)

(c) State and explain what the resistance of an ideal voltmeter should be.

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(2)

(Total 12 marks)

5. A portable games console has the option of using a rechargeable battery unit which is recharged by connecting it to a mains adaptor. The adaptor has an input power of 2.5W at a voltage of 230 V.

(a) Calculate the adaptor's input current when it is in use.

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.....

Current =

(2)

(b) The adaptor's output is marked as: 3 V 0.2 A 0.6 VA

(i) Explain why V A is a unit of power.

.....
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(1)

(ii) Calculate the efficiency of the adaptor.

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.....
.....

Efficiency =

(2)

(iii) Suggest and explain a reason for the efficiency being less than 100%.

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(2)

(c) (i) The battery unit takes a time of 6 hours to charge fully. Assuming the adaptor's output current remains constant, calculate the amount of charge which flows from the adaptor.

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Charge =

(2)

(ii) Calculate the work done by the adaptor.

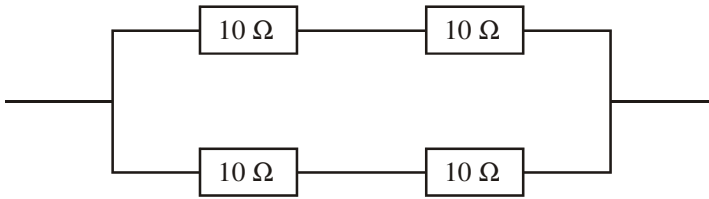
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Work done =

(3)

(Total 12 marks)

6. Four $10\ \Omega$ resistors are connected as shown in the diagram.



Calculate the total resistance of the combination.

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Total resistance =

(3)

Comment on your answer and suggest why such a combination of resistors might be used.

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(2)

(Total 5 marks)