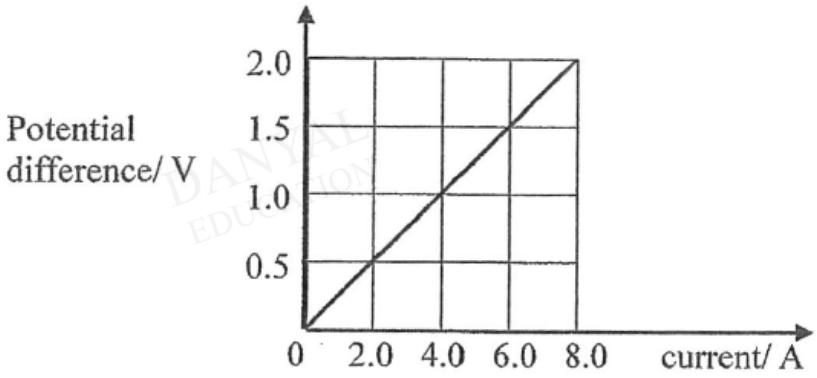
O Level Combined Physics Structured

Current and DC Circuits Test 2.0

Q1

The graph shows the potential difference-current characteristics of a conductor.



If the potential difference across the conductor is 1.5 V,

(a) how much charges flow through the conductor for 5.0 minutes?

charge = ... C [2]

(b) How much work is done in bringing the charge through the conductor in 5.0 minutes?

work = ... J [2]

Q2

Fig. 12.1 shows how the current in the filament of a lamp depends on the potential difference across it.

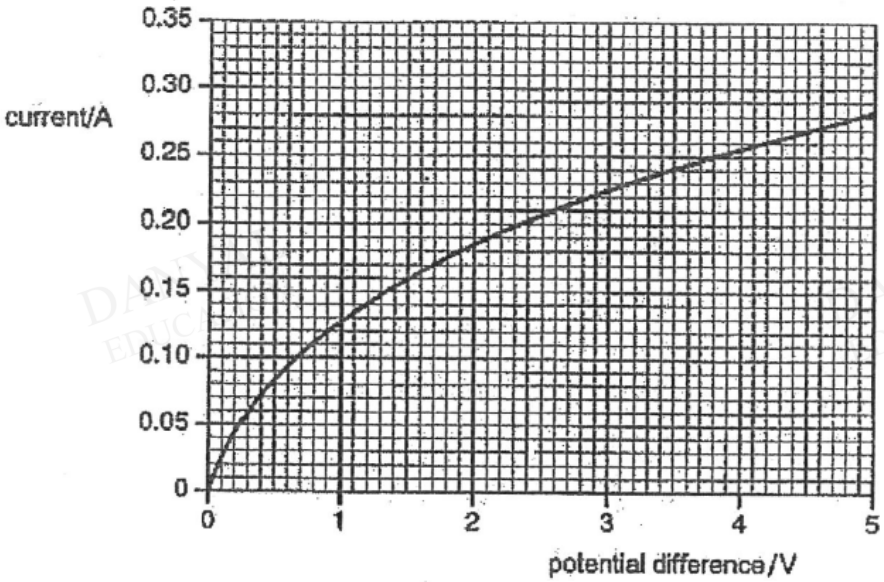


Fig. 12.1

(a) Calculate the resistance of the filament when the current is 0.25 A.

Resistance = ... [2]

(b) Explain how Fig. 12.1 shows that the resistance of the filament increases with temperature rise.

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..... [2]

(c) The lamp in Fig. 12.1 is connected in a circuit shown in Fig. 12.2.

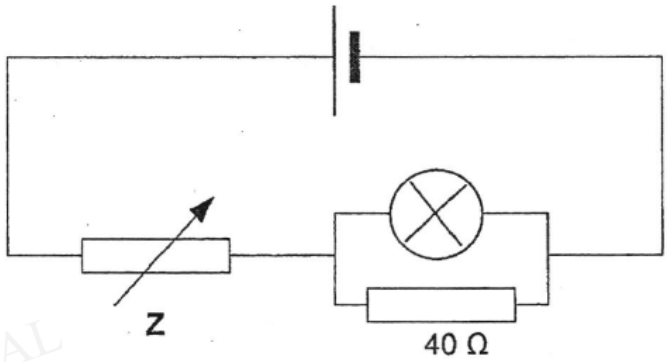

Fig. 12.2

The current in the lamp is maintained at 0.25 A. Determine

(i) the potential difference across the 40 Ω resistor,

Potential difference = ... [1]

(ii) the current in the 40 Ω resistor,

Current = ... A [2]

(iii) the current in the variable resistor, **Z**.

current = ... A [1]

(d) If the lamp blows (spoilt), explain how will the current flowing through the circuit change.

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.....

..... [2]

Q3

Fig. 12.1 shows 3 identical resistors R_1, R_2 and R_3. The resistance of each resistor is 20 Ω. The resistance of the lamp is 10 Ω.

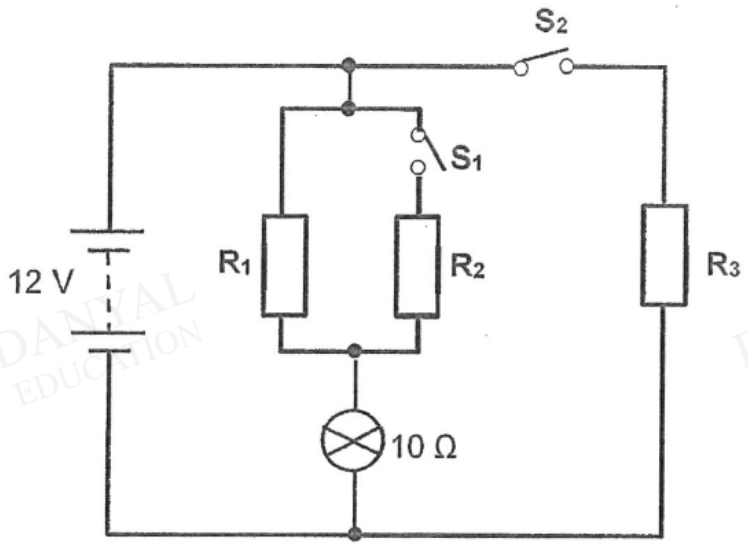

Fig. 12.1

(a) When both switches are left open, the current flows through R_1 and the lamp only.

(i) Calculate the current through the resistor R_1 and the lamp.

current = ... A [2]

(ii) Calculate the power of the lamp.

power = ... W [2]

(b) When switch S_1 is closed, R_1 and R_2 are connected in parallel

(i) Calculate the effective resistance of R_1 and R_2.

effective resistance = ... Ω [2]

(ii) State how the brightness of the lamp is affected. Explain your answer.

.....

.....

.....

.....

..... [2]

(c) State whether the brightness of the lamp is further affected if the switch S_2 is closed as well. Explain your answer.

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..... [2]

Q4

Fig. 9.1 shows an electric circuit.

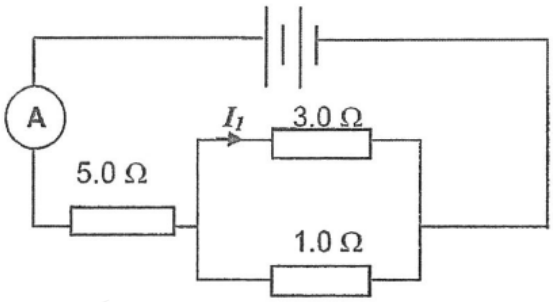


Fig. 9.1

(a) Calculate the effective resistance of the circuit.

effective resistance = ...Ω [1]

(b) Given that current I_1 is 0.50 A, find the reading in the ammeter.

ammeter reading = ...A [2]

(c) Calculate the e.m.f. of the battery.

e.m.f. = ...V [2]

Q5

(a) Clifton has a metallic conductor. He would like to do an experiment to find out the relationship between the potential difference across it and the current flowing through it.

(i) In the space below, draw a circuit diagram that could be used to determine relationship between values of the potential difference across the metallic conductor and its corresponding values of current. [3]

(a) (ii) The following set of data is obtained from the experiment

potential difference, V / V	current, I / A
0.0	0.0
1.0	0.5
2.0	1.0
3.0	1.5
4.0	2.0

Describe how you could determine the resistance of the metallic conductor from a graph plotted using the data obtained.

.....

.....

.....[2]

Answers

Current and DC Circuits Test 2.0

Q1

(a)	Charge, Q = I x t = 6.0 x (5 x 60) = 1 800 C	[1] [1]
(b)	Work = V x Q = 1.5 x 1800 = 2 700 J	[1] [1]

Q2

2(a)	When current, I = 0.25 A, V = 3.7 V (from the graph) Therefore, Resistance, R = V / I = 3.7 / 0.25 = 14.8 Ω	[1] [1]
(b)	For each unit of current increase, the potential difference increases at a larger amount. Thus the resistance increases as current increases. Since higher current produces greater heat, resistance increases s temperature increases.	 [1] [1]
(c)(i)	Potential difference across 40 Ω resistor = potential difference across the lamp = 3.7 V (parallel connection)	[1]
(ii)	Current, I = V/R = 3.7 / 40 = 0.0925 A or 0.093 A	 [1] [1]
(iii)	Current through Z = 0.0925 + 0.25 = 0.363 A or 0.36 A	 [1]
(d)	When the lamp blows, the effective resistance of the circuit increases. The current in the circuit will thus reduce.	 [1] [1]

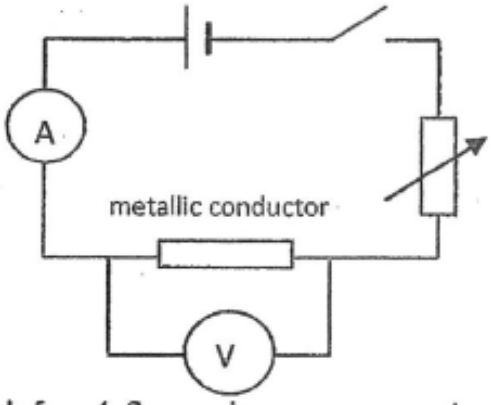
Q3

(a) (i) Current = V / R = 12 / (10 + 20) = 0.4 A (ii) P = Current^2 x R = 0.4^2 x 10 = 1.6 W	 1 1 1 1
(b) (i) R = (1/20 + 1/20)$^{-1}$ = 10 Ω (ii) The total resistance is (10 + 10) Ω which is lower. So, the current is increased The power is also increased. So, the brightness is increased.	1 1 1 1
(c) The current is unchanged. So, the power is unchanged and the brightness is unchanged.	1 1

Q4

(a)	Effective R = 5.0 + (1/3 + 1/1)$^{-1}$ = 5.75 Ω	[A1]
(b)	Current in 1 Ω resistor = 0.5 x 3 = 1.5 A Ammeter reading = total current in the circuit = 0.50 + 1.5 =2.0 A	 [M1] [A1]
(c)	V = I x R = 2.0 x 5.75 =11.5 V (allow ecf)	[M1] [A1]

Q5

(a)	 Deduct one mark for 1-2 mssing components Deduct two marks for 3-4 mising components Deduct one mark for wrong connection of voltmeter or ammeter	
(aii)	Plot a graph of Potential Difference against Current and draw a straight line joining the points plotted The gradient of the straight line graph is the resistance of the metallic conductor	[B1] [B1]