

- 6 (a) A network of three resistors of resistances R_1 , R_2 and R_3 is shown in Fig. 6.1.

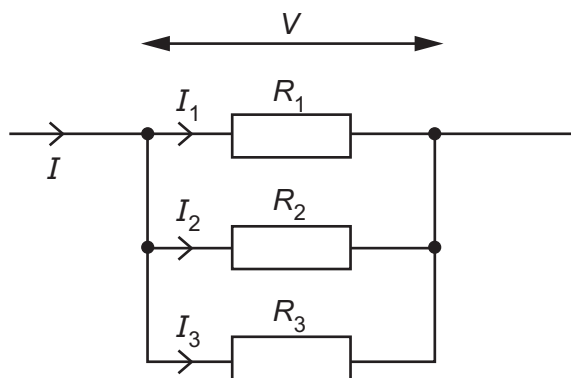


Fig. 6.1

The individual currents in the resistors are I_1 , I_2 and I_3 . The total current in the combination of resistors is I and the potential difference across the combination is V .

Show that the combined resistance R of the network is given by

$$\frac{1}{R} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3}.$$

[2]

- (b) A battery of electromotive force (e.m.f.) 8.0V and internal resistance r is connected to three resistors X, Y and Z, as shown in Fig. 6.2.

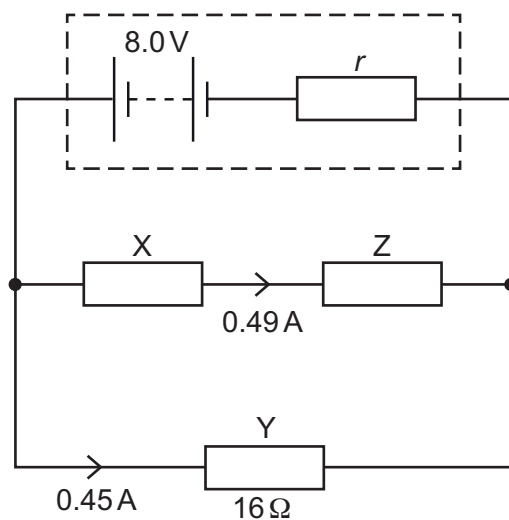


Fig. 6.2

Resistor Y has a resistance of $16\,\Omega$. The current in resistor X is 0.49A and the current in resistor Y is 0.45A .

Calculate:

- (i) the current in the battery

current = A [1]

- (ii) the internal resistance r of the battery.

$r =$ Ω [2]

- (c) Resistors X and Y in Fig. 6.2 are made from wires of the same material and cross-sectional area. The average drift speed of the free electrons in X is $2.1 \times 10^{-4}\text{ms}^{-1}$.

Calculate the average drift speed v of the free electrons in Y.

$v =$ ms^{-1} [2]

- (d) Resistor Z in Fig. 6.2 is replaced by a new resistor of smaller resistance.

State and explain the effect, if any, on the terminal potential difference of the battery.

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..... [2]

[Total: 9]