

- 6 (a) State Kirchhoff's second law.

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.....
..... [2]

- (b) An electric heater containing two heating wires X and Y is connected to a power supply of electromotive force (e.m.f.) 9.0 V and negligible internal resistance, as shown in Fig. 6.1.

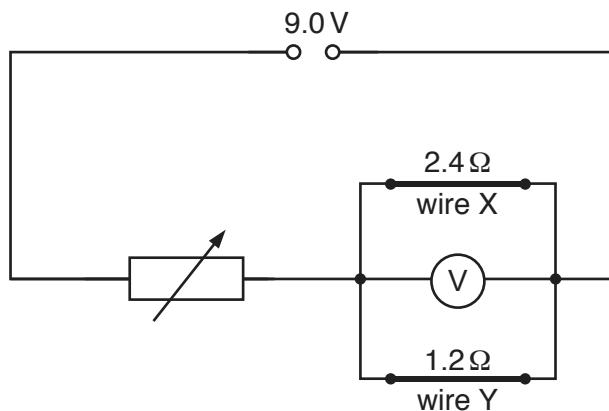


Fig. 6.1

Wire X has a resistance of 2.4Ω and wire Y has a resistance of 1.2Ω . A voltmeter is connected in parallel with the wires. A variable resistor is used to adjust the power dissipated in wires X and Y.

The variable resistor is adjusted so that the voltmeter reads 6.0 V.

- (i) Calculate the resistance of the variable resistor.

$$\text{resistance} = \dots \Omega [3]$$

- (ii) Calculate the power dissipated in wire X.

$$\text{power} = \dots \text{W} [2]$$

- (iii) The cross-sectional area of wire X is three times the cross-sectional area of wire Y. Assume that the resistivity and the number density of free electrons for the metal of both wires are the same.

Determine the ratio

1. $\frac{\text{length of wire X}}{\text{length of wire Y}}$,

ratio = [2]

2. $\frac{\text{average drift velocity of free electrons in wire X}}{\text{average drift velocity of free electrons in wire Y}}$.

ratio = [2]

[Total: 11]

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