

ELECTRICITY, MAGNETISM & OPTICS

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CH05: CURRENT, RESISTANCE AND ELECTROMOTIVE FORCES

1. A long thin wire made of aluminium with diameter 3.0 mm carries current 2.40 A. The free electron density in the wire is 2.1×10^{29} per cubic meter. Calculate the current density and drift speed of the free electrons.
2. The same wire in question 1 is used to supply 2.40 A current to a 500 W heater.
 - (i) Calculate the magnitude of electric field in the wire.
 - (ii) Find the voltage between two points in the wire 120 cm apart.
 - (iii) Determine the resistance of the wire with length 120 cm.
3. The resistance of a copper wire with diameter 0.5 mm is 0.35Ω at 20°C .
 - (i) Find the length of the copper wire.
 - (ii) Calculate the resistance of the wire at 0°C and 100°C , given the temperature coefficient of resistance for copper is $0.00393 (\text{C}^\circ)^{-1}$.
4. A 12 V battery with 2Ω internal resistance is connected to a 4Ω resistor, an ammeter and a voltmeter as shown in figure 5.1. Calculate the readings on the ammeter and voltmeter.

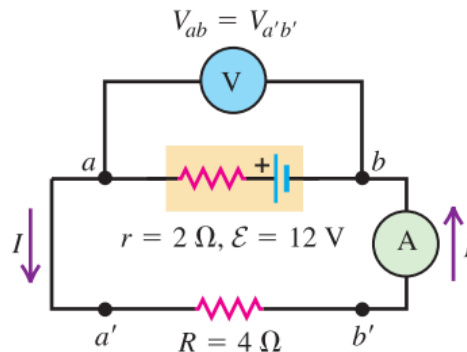


Figure 5.1

5. Find the rates of energy conversion (chemical to electrical) and energy dissipation in the battery, the rate of energy dissipation in the 4Ω resistor and the battery's net power output of figure 5.1.