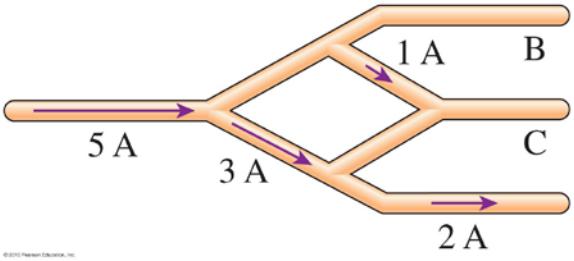
Chapter 22: Current & Resistance
Questions & Problems

$$I = \frac{\Delta Q}{\Delta t} \qquad R = \frac{\rho L}{A} \qquad I = \frac{\Delta V}{R} \qquad P_{emf} = I\mathcal{E} \qquad P_R = I_R \Delta V_R = I_R^2 R = \frac{\Delta V_R^2}{R}$$

Example 22.1
2.0×10^{13} electrons flow through a transistor in 1.0 ms. What is the current through the transistor?

Example 22.2
a. A car battery is rated at 90 A·hr, meaning that it can supply a 90 A current for 1 hr before being completely discharged. If you leave your headlights on until the battery is completely dead, how much charge leave the positive terminal of the battery?
b. The starter motor of a car engine draws a current of 150 A from the battery. The copper wire to the motor is 5.0 mm in diameter and 1.2 m long. The started runs for 0.80 s until the car engine starts. How much charge passes through the starter motor? How much work has been done on the charges that passed through the battery?

Example 22.3
The currents through several segments of a wire object are shown in the figure below. What are the magnitudes and directions of the currents I_B and I_C in segments B and C?



Example 22.4
How much work is done to move 1.0 uC of charge from the negative terminal to the positive terminal of a 1.5 V battery?

Example 22.5
Wires 1 and 2 are made of the same metal. Wire 2 has twice the length and twice the diameter of wire 1. What are the ratios (a) ρ_1 / ρ_2 of the resistivities and (b) R_1 / R_2 of the resistances of the two wires?

Example 22.6

a. A 1.0-mm-diameter, 20-cm-long copper wire carries a 3.0 A current. What is the potential difference between the ends of the wire? Hint: $\rho_{Cu} = 1.7 \times 10^{-8}\ \Omega\cdot m$
b. A motorcyclist is making an electric vest that, when connected to the motorcycle's 12 V battery, will warm her on cold rides. She is using 0.25-mm-diameter copper wire, and she wants a current of 4.0 A in the wire. What length wire must she use?

Example 22.7

A 3.0 V potential difference is applied between the ends of a 0.80-mm-diamter, 50-cm-long nichrome wire. What is the curent in the wire? Hint: $\rho_{nichrome} = 1.5 \times 10^{-6}\ \Omega\cdot m$

Example 22.8
A 60-cm-long heating wire is connected to a 120 V outlet. If the wire dissipates 45 W, what are (a) the current in and (b) the resistance of the wire?

Example 22.9
An electric eel develops a potential difference of 450 V, driving a current of 0.80 A for a 1.0 ms pulse. For this pulse, find (a) the power, (b) the total energy, and (c) the total charge that flows.