7. A fuse in an electric circuit is a wire that is designed to melt, and thereby open the circuit, if the current exceeds a predetermined value. Suppose that the material to be used in a fuse melts when the current density rises to 440 A/cm². What diameter of cylindrical wire should be used to make a fuse that will limit the current to 0.50 A?

25. Nine copper wires of length \( l \) and diameter \( d \) are connected in parallel to form a single composite conductor of resistance \( R \). What must be the diameter \( D \) of a single copper wire of length \( l \) if it is to have the same resistance?

43. An unknown resistor is connected between the terminals of a 3.00 V battery. Energy is dissipated in the resistor at the rate of 0.540 W. The same resistor is then connected between the terminals of a 1.50 V battery. At what rate is energy now dissipated?

3. A car battery with a 12 V emf and an internal resistance of 0.040 \( \Omega \) is being charged with a current of 50 A. What are (a) the potential difference \( V \) across the terminals, (b) the rate \( P_r \) of energy dissipation inside the battery, and (c) the rate \( P_{\text{emf}} \) of energy conversion to chemical form? When the battery is used to supply 50 A to the starter motor, what are (d) \( V \) and (e) \( P_r \)?

10. (a) In Fig. 27-28, what value must \( R \) have if the current in the circuit is to be 1.0 mA? Take \( \varepsilon_1 = 2.0 \) V, \( \varepsilon_2 = 3.0 \) V, and \( r_1 = r_2 = 3.0 \) \( \Omega \). (b) What is the rate at which thermal energy appears in \( R \)?
19. A total resistance of 3.00 Ω is to be produced by connecting an unknown resistance to a 12.0 Ω resistance. (a) What must be the value of the unknown resistance, and (b) should it be connected in series or in parallel?

29. In Fig. 27-40, \( R_1 = 6.00 \Omega \), \( R_2 = 18.0 \Omega \), and the ideal battery has emf \( \mathcal{E} = 12.0 \text{ V} \). What are the (a) size and (b) direction (left or right) of current \( i_1 \)? (c) How much energy is dissipated by all four resistors in 1.00 min?

---

**Fig. 27-40** Problem 29.