25 SSM 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?

Fig. 27-36 Problem 24.

31 SSM In Fig. 27-42, the ideal batteries have emfs \( \varepsilon_1 = 5.0 \text{ V} \) and \( \varepsilon_2 = 12 \text{ V} \), the resistances are each 2.0 \( \Omega \), and the potential is defined to be zero at the grounded point of the circuit. What are potentials (a) \( V_1 \) and (b) \( V_2 \) at the indicated points?

Fig. 27-42

35 In Fig. 27-46, \( \varepsilon = 12.0 \text{ V} \), \( R_1 = 2000 \ \Omega \), \( R_2 = 3000 \ \Omega \), and \( R_3 = 4000 \ \Omega \). What are the potential differences (a) \( V_A - V_B \), (b) \( V_B - V_C \), (c) \( V_C - V_D \), and (d) \( V_A - V_C \)?

Fig. 27-46 Problem 35.
56 In Fig. 27-62, a voltmeter of resistance $R_V = 300 \, \Omega$ and an ammeter of resistance $R_A = 3.00 \, \Omega$ are being used to measure a resistance $R$ in a circuit that also contains a resistance $R_0 = 100 \, \Omega$ and an ideal battery of emf $\mathcal{E} = 12.0 \, \text{V}$. Resistance $R$ is given by $R = V/i$, where $V$ is the voltmeter reading and $i$ is the current in resistance $R$. However, the ammeter reading is not $i$ but rather $i'$, which is $i$ plus the current through the voltmeter. Thus, the ratio of the two meter readings is not $R$ but only an apparent resistance $R' = V/i'$. If $R = 85.0 \, \Omega$, what are (a) the ammeter reading, (b) the voltmeter reading, and (c) $R'$? (d) If $R_V$ is increased, does the difference between $R'$ and $R$ increase, decrease, or remain the same?

58 In an $RC$ series circuit, emf $\mathcal{E} = 12.0 \, \text{V}$, resistance $R = 1.40 \, \text{M}\Omega$, and capacitance $C = 1.80 \, \mu\text{F}$. (a) Calculate the time constant. (b) Find the maximum charge that will appear on the capacitor during charging. (c) How long does it take for the charge to build up to $16.0 \, \mu\text{C}$?

64 A capacitor with an initial potential difference of 100 V is discharged through a resistor when a switch between them is closed at $t = 0$. At $t = 10.0 \, \text{s}$, the potential difference across the capacitor is 1.00 V. (a) What is the time constant of the circuit? (b) What is the potential difference across the capacitor at $t = 17.0 \, \text{s}$?