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Practice Problems - Set D
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1. Describe the role of the battery in a circuit.
2. Describe what happens to the energy of the charge carriers in a circuit as they make one complete round trip through the circuit.
3. We have discussed the fact that the drift velocity of charge carriers in a conductor is very low. If this is the case, explain why you do not have to wait between the instant when you flip the switch and the instant when the incandescent light turns on.

4. Does the kinetic energy of the charge carriers change as they leave a resistor? Explain.
  
5. Describe the role of resistors in a circuit - is resistance always bad?
  
6. In a RC circuit, describe the function of the resistor in the circuit?
  
7. List the quantities that are the same for resistors connected in series. List the quantities that are the same for resistors connected in parallel. Explain why the listed quantities are the same in each situation.

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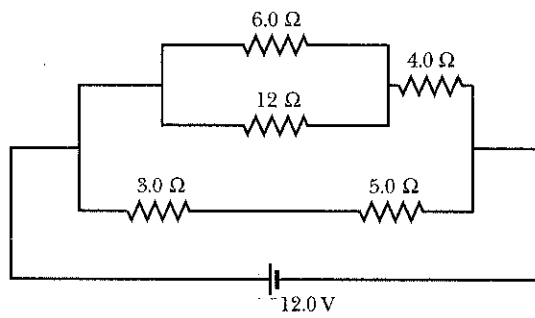
8. Compute the cost per day of operating a lamp that draws 1.7 A from a 110-V line if the cost of electrical energy is 6 cents per kWh.
9. An electric utility company supplies a customer's house from the main power lines (120 V) with two copper wires, each 50 m long and having a resistance of  $0.108 \Omega$  per 300 m. (A) Find the voltage at the customer's house for a load current of 110 A. For this load current, find (B) the power the customer is receiving and (C) the power dissipated in the copper wires?

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10. A block in the shape of a rectangular solid has a cross-sectional area of  $3.50 \text{ cm}^2$  across its width, a front-to-rear length of  $15.8 \text{ cm}$ , and a resistance of  $935 \Omega$ . The material of which the block is made has  $5.33 \times 10^{22}$  conduction electrons/ $\text{m}^3$ . A potential difference of  $35.8 \text{ V}$  is maintained between its front and rear. (A) What is the current in the block? (B) If the current density is uniform, what is its value? (C) What is the drift velocity of the conduction electrons? (D) What is the magnitude of the electric field in the block

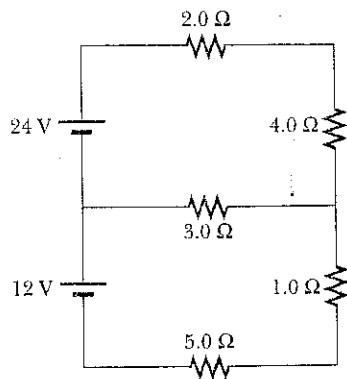
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11. The circuit shown below is connected to a 12.0 V battery. (A) Determine the equivalent resistance for the circuit. (B) Determine the power delivered to the circuit by the battery. (C) Determine the potential difference across the 5.0  $\Omega$  resistor.



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12. Calculate the power dissipated in each resistor in the circuit shown below.



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13. In an RC series circuit, the emf of the battery is 12.0 V, the resistor has a resistance of  $1.40\text{ M}\Omega$  and the capacitor has capacitance of  $1.80\text{ }\mu\text{F}$ . (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  $16.0\text{ }\mu\text{C}$  (starting with an uncharged capacitor at  $t = 0$ )? (D) How long does it take for the current in the circuit to fall to 1/10 of its initial value (starting with an uncharged capacitor at  $t = 0$ )?

