PRACTICE PROBLEMS

1. A 75-W light bulb draws a current of 0.80 A. If the light bulb stays on for 3.0 hours (a) how much charge flows through the light bulb? (b) How many electrons have passed through the bulb?

$3 \cdot 60^2 = 10800\,s$

a) $I = \frac{Q}{t} = .8\frac{C}{s} \cdot 10800\,s = 8640\,C$ (a)

b) $8640\,C \cdot \frac{1\ electron}{1.6 \cdot 10^{-19}\,C} = 5.4 \cdot 10^{22}\ electrons$ (b)

2. A certain material used for a wire is 25 m long and has a diameter of 3.0 mm. The wire carries a 2.5 A current when a 12-V potential difference is applied between its ends. What is the resistivity of the wire?

resistance

$V = I \cdot R$

$12 = 2.5R$

$R = 4.8\,\Omega$

3. At what temperature would the resistance of a silver conductor be double its resistance at 20.0 °C? Take the temperature coefficient of resistivity for silver to be $3.80 \times 10^{-3}\ (C°)^{-1}$.

4. A wire whose resistance is 12.0 Ω is melted down. From the melted material a new wire is made that is 1/4 the diameter of the original wire. What is the resistance of the new wire?

5. An electric alarm clock uses a 5.0-W motor and runs all day, every day. If electricity costs $0.10 per kWh, determine the yearly cost of running the clock.

24 hr → 86400 s

.005 kW · 24 hr

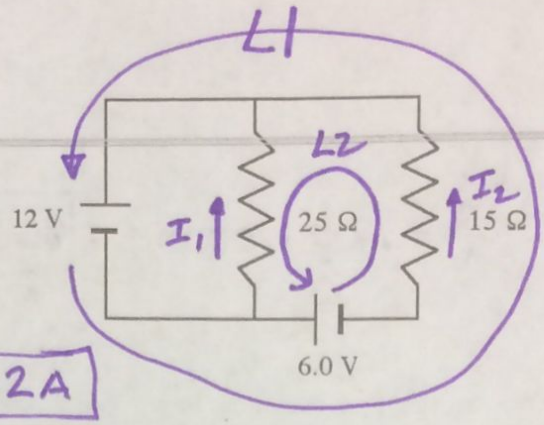
$P \cdot t = E = .12\ kWh \cdot \frac{\$.1}{kWh} = \$.012$ (or 1.2¢) for an hour...

$4.38 for a year

6. An ac generator produces a voltage given by V = 283 sin 188t, where V is in volts and t in seconds. (a) What is the peak voltage produced by the generator? (b) What is its frequency? (c) If the voltage supplied by the generator produces an rms current of 2.0 A in a device in the circuit, what is the resistance of this device?

7. A device is rated at 750 watts when used with a 120-V ac line. (a) What peak current flows through it? (b) What peak current would flow through it if connected to a 240-V ac line? (c) In which case is more power utilized? (Assume the resistance of the device is constant).

13. Apply Kirchhoff's rules to find the currents in the circuit shown.



L1:

$12 + 6 - 15I_2 = 0$

$18 - 15I_2 = 0$

$I_2 = 1.2\text{A}$

L2:

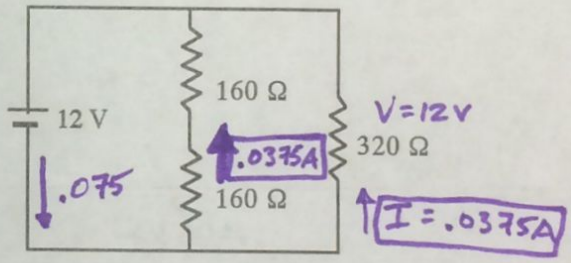
$6 - 15I_2 + 25I_1 = 0$

$6 - 18 + 25I_1 = 0$

$25I_1 = 12$

$I_1 = .48\text{A}$

14. Find the current through each of the resistors in the diagram shown. Also, find the current delivered by the battery.



$I_T = \frac{V}{R} = \frac{12}{160} = .075\text{A}$

All have a current of 0.0375A

$R_T = 160!$

CHAPTER QUIZ

1. A wire carries a current of 5.0 A. How many electrons cross a given area of the wire each second?
   a. 5 b. 5.0×10^{6} c. 3.1×10^{19} d. 8.0×10^{19}

2. A battery charger delivers a current of 2.0 A for 6.0 hours to a 12-V battery. What is the total charge that passes through the battery?
   a. 12 C b. 4.3×10^{4} C c. 8.6×10^{4} C d. 5.2×10^{5} C

3. A 24-Ω resistor is connected to a 12-V battery. How much current flows through the resistor?
   a. 0.50 A b. 2.0 A c. 6.0 A d. 288 A

4. A 24-Ω resistor is connected to a 12-V battery. How much power is used by the resistor?
   a. 0.5 W b. 2.0 W c. 6.0 W d. 288 W

5. Consider two silver wires. One has twice the length and twice the cross-sectional area of the other. How do the resistances of the two wires compare?
   a. Both wires have the same resistance.
   b. The longer wire has twice the resistance of the shorter wire.
   c. The longer wire has four times the resistance of the shorter wire.
   d. The shorter wire has the greater resistance.

6. If the resistance in a constant voltage circuit is cut in half, the power dissipated by that circuit
   a. is cut in half. c. is quadrupled.
   b. is doubled. d. remains unchanged.

7. The resistance of a copper wire (resistivity $\rho = 1.7 \times 10^{-8}$ Ω m) is 25 Ω. If the wire's cross-sectional area is 3.4×10^{-6} m^2, what is the length of the wire?
   a. 2.0×10^{-4} m b. 8.0 m c. 2.0×10^{2} m d. 5.0×10^{3} m

8. The peak voltage delivered by an electric generator is 277 V. The rms voltage delivered is
   a. 196 V b. 277 V c. 392 V d. 554 V

9. The peak voltage delivered to a circuit is 220 V and the peak current which results is 3.0 A. The average power delivered to the circuit is
   a. 660 W b. 73 W c. 330 W d. 220 W

10. A generator delivers an ac voltage given by V = 120 sin 553t. The peak voltage of the generator is
    a. 120 V b. 553 V c. 88 V d. 4.4 V

11. A generator delivers an ac voltage given by V = 120 sin 553t. The frequency of the generator is
    a. 120 Hz b. 553 Hz c. 88 Hz d. 4.4 Hz

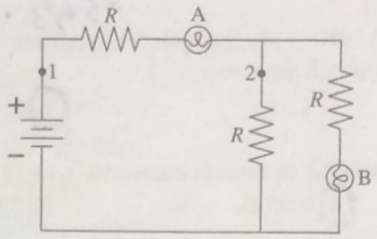
12. A generator delivers an ac voltage given by V = 120 sin 553t, producing an rms current of 2.0 A. The average power delivered to the circuit is
    a. 240 W b. 1100 W c. 60 W d. 170 W

13. Three resistors, 5.0 Ω, 255 Ω and 55 Ω, are connected in series with each other and in series with a 12 battery. How much current flows from the battery?
    a. 2.7 A b. 38 mA c. 47 mA d. 0.21 A

14. Two resistors, 4.0 Ω and 8.0 Ω are connected in series to a 9.0 V battery. How much power is dissipated in the 8.0 Ω resistor?
    a. 4.5 W b. 2.3 W c. 6.8 W d. 110 W

23.5 More Complex Circuits

13. Bulbs A and B are identical. Initially both are glowing.



a. Bulb A is removed from its socket. What happens to bulb B? Does it get brighter, stay the same, get dimmer, or go out? Explain.

Since there is no longer a circuit, bulb B will go out.

b. Bulb A is replaced. Bulb B is then removed from its socket. What happens to bulb A? Does it get brighter, stay the same, get dimmer, or go out? Explain.

The total resistance of the circuit increases since there is only one path. That means bulb A will become dimmer as the current decreases.

c. The circuit is restored to its initial condition. A wire is then connected between points 1 and 2. What happens to the brightness of each bulb?

Bulb A will go out, as it is now shorted out — all current will travel through the wire instead of bulb A.

14. Bulbs A and B are identical and initially both are glowing. Then the switch is closed. What happens to each bulb? Does its brightness increase, stay the same, decrease, or go out? Explain.