PQ 13 Electricity

Q and A

Q1

- The current through a globe connected across the terminals of a 125-V outlet is 0.50 A. At what rate does the bulb convert electric energy to light?

$$P = IV = (0.50\ \text{A})(125\ \text{V}) = 63\ \text{J/s} = 63\ \text{W}$$

Q2

- A van battery causes a current of 2.0 A through a lamp and produces 12 V across it. What is the power used by the lamp?

$$P = IV = (2.0\ \text{A})(12\ \text{V}) = 24\ \text{W}$$

Q3

- What is the current through a 75-W globe that is connected to a 125-V outlet?

$$P = IV$$

$$I = \frac{P}{V} = \frac{75\ \text{W}}{125\ \text{V}} = 0.60\ \text{A}$$

Q4

- The current through the starter motor of a van is 210 A. If the battery maintains 12 V across the motor, how much electric energy is delivered to the starter in 10.0 s?

$P = IV$ and $E = Pt$

Thus, $E = IVt = (210\text{ A})(12\text{ V})(10.0\text{ s})$

$= 2.5\times10^4\text{ J}$

Q5

- A torch bulb is rated at 0.90 W. If the light bulb drops 3.0 V, how much current goes through it?

$$P = IV$$

$$I = \frac{P}{V} = \frac{0.90\ \text{W}}{3.0\ \text{V}} = 0.30\ \text{A}$$

Q6

- An automobile panel lamp with a resistance of 33 ohmn’s is placed across a 12-V battery. What is the current through the circuit?

$$I = \frac{V}{R} = \frac{12\ \text{V}}{33\ \Omega} = 0.36\ \text{A}$$

Q7

- A lamp draws a current of 0.50 A when it is connected to a 120-V source.
- **a.** What is the resistance of the lamp?

$$R = \frac{V}{I} = \frac{120\ \text{V}}{0.50\ \text{A}} = 2.4\times10^{2}\ \Omega$$

- **b.** What is the power consumption of the lamp?

$$P = IV = (0.50\ \text{A})(120\ \text{V}) = 6.0\times10^{1}\ \text{W}$$

Q8

- A 75-W lamp is connected to 125 V.
- **a.** What is the current through the lamp?

$$I = \frac{P}{V} = \frac{75\ \text{W}}{125\ \text{V}} = 0.60\ \text{A}$$

- **b.** What is the resistance of the lamp?

$$R = \frac{V}{I} = \frac{125\ \text{V}}{0.60\ \text{A}} = 2.1\times10^{2}\ \Omega$$

Q9

- A resistor is added to the lamp in the previous problem to reduce the current to half of its original value.
- **a.** What is the potential difference across the lamp?

The new value of the current is

$$\frac{0.60\ \text{A}}{2} = 0.30\ \text{A}$$

$$V = IR = (0.30\ \text{A})(2.1\times10^{2}\ \Omega)$$

$$= 6.3\times10^{1}\ \text{V}$$

Q9 continued

- **b.** How much resistance was added to the circuit?

The total resistance of the circuit is now

$$R_{total} = \frac{V}{I} = \frac{125\ \text{V}}{0.30\ \text{A}} = 4.2\times10^2\ \Omega$$

Therefore,

$$R_{res} = R_{total} - R_{lamp}$$

$$= 4.2\times10^2\ \Omega - 2.1\times10^2\ \Omega$$

$$= 2.1\times10^2\ \Omega$$

- **c.** How much power is now dissipated in the lamp?

$$P = IV = (0.30\ \text{A})(6.3\times10^1\ \text{V}) = 19\ \text{W}$$

Q10

- A 100W light bulb is 22 percent efficient.
- **a.** How many joules does the light bulb convert into light each minute it is in operation?

$$E = Pt$$
$$= (0.22)(100.0\ \text{J/s})(1.0\ \text{min})(60\ \text{s/min})$$
$$= 1.3\times10^{3}\ \text{J}$$

- **b.** How many joules of thermal energy does the light bulb produce each minute?

$$E = Pt$$
$$= (0.78)(100.0\ \text{J/s})(1.0\ \text{min})(60.0\ \text{s/min})$$
$$= 4.7\times10^{3}\ \text{J}$$