

Review 34-35

1. A 100 W light bulb is 20% efficient. That means 20% of the electric energy is converted to light energy.

a. How many joules does the light bulb convert into light each minute it is in operation?

$$P = \frac{q}{t} \quad (20W)(60s) = q$$

$$q = 1.20 \times 10^3 \text{ J}$$

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

$$(80W)(60s) = q$$

$$q = 4.80 \times 10^3 \text{ J}$$

2. The resistance of an electric stove element at operating temperature is 11 ohms

a. 220 V are applied across it. What is the current through the stove element?

$$R = \frac{V}{I} \quad I = \frac{220V}{11\Omega}$$

$$I = 20 \text{ AMP}$$

b. How much energy does the element convert to thermal energy in 30 s?

$$P = V \cdot I$$

$$= 220V \cdot 20A = 4,400 \text{ W}$$

$$P = \frac{q}{t} \quad q = (4,400 \text{ W}) \cdot 30 \text{ s}$$

$$q = 1.32 \times 10^5 \text{ J}$$

c. The element is being used to heat a kettle containing 1.2 kg of water. Assume that 70% of the heat is absorbed by the water. What is its increase in temperature during the 30 s?

$$q = m \cdot c \cdot \Delta T$$

$$1.32 \times 10^5 = (1200 \text{ g})(4.18) \Delta T$$

$$\Delta T = 26.32^\circ \text{C}$$

3. A 15 ohm electric heater operates on a 120 V outlet.

a. What is the current through the heater?

$$R = \frac{V}{I} \quad I = \frac{V}{R} = \frac{120V}{15\Omega}$$

$$I = 8 \text{ AMP}$$

b. How much energy is used by the heater in 30 s?

$$P = V \cdot I$$

$$= 120V \cdot 8A = 960 \text{ W}$$

$$P = \frac{q}{t} \quad q = 960 \cdot 30 = 2.88 \times 10^4 \text{ J}$$

c. How much thermal energy is liberated by the heater in this time?

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4. A 30 ohm resistor is connected across a 60 V battery.

a. What is the current in the circuit?

$$R = \frac{V}{I} \quad I = \frac{60V}{30\Omega}$$

$$I = 2 \text{ AMP}$$

b. How much energy is used by the resistor in 5 min?

$$P = V \cdot I$$

$$= 60V \cdot 2 \text{ AMP}$$

$$= 120 \text{ W}$$

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2. The resistance of an electric stove element at operating temperature is 11 ohms

a. 220 V are applied across it. What is the current through the stove element? $R = \frac{V}{I}$ $I = \frac{220V}{11\Omega} = 20 \text{ AMP}$

b. How much energy does the element convert to thermal energy in 30 s?

$$P = V \times I$$

$$= 220V \times 20A = 4.40 \times 10^3 \text{ W}$$

$$P = \frac{q}{t} \quad q = (4.40 \times 10^3) 30s$$

c. The element is being used to heat a kettle containing 1.2 kg of water. Assume that 70% of the heat is absorbed by the water. What is its increase in temperature during the 30 s?

$$q = m C \Delta t$$

$$1.32 \times 10^5 = (1200 \text{ kg})(4.18) \Delta t$$

$$\Delta t = 26.32^\circ \text{C}$$

3. A 15 ohm electric heater operates on a 120 V outlet.

a. What is the current through the heater?

$$R = \frac{V}{I} \quad I = \frac{V}{R} = \frac{120V}{15\Omega} = 8 \text{ AMP}$$

b. How much energy is used by the heater in 30 s?

$$P = V \times I$$

$$= 120V \times 8A = 960W$$

$$P = \frac{q}{t} \quad q = 960 \times 30 = 2.88 \times 10^4 \text{ J}$$

c. How much thermal energy is liberated by the heater in this time?

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4. A 30 ohm resistor is connected across a 60 V battery.

a. What is the current in the circuit?

$$R = \frac{V}{I} \quad I = \frac{60V}{30\Omega} = 2 \text{ AMP}$$

b. How much energy is used by the resistor in 5 min?

$$P = V \times I$$

$$= 60V \times 2 \text{ AMP}$$

$$= 120W$$