#24)

| **Strategy** | **Calculations** |
| --- | --- |
| Apply Ohm's law. | $V = IR$ |
| | Substitute first |
| | $12\ \text{V} = I(5.8\ \Omega)$ |
| | $12\ \text{V}\cdot\frac{1}{5.8\ \Omega} = (5.8\ \text{A})\frac{I}{12\ \Omega}$ |
| | $I = \frac{12\ \text{V}}{5.8\ \Omega}$ |
| | $I = 2.07\ \text{A}$ |
| Use the expression for the electric current to solve for the charge and use the fact that A·s is equivalent to C. | $I = \frac{Q}{\Delta t}$ |
| | Substitute first |
| | $(2.07\ \text{A})(480\ \text{s}) = \frac{Q}{480\ \text{s}}(480\ \text{s})$ |
| | $Q = (2.07\ \text{A})(480\ \text{s})$ |
| | $Q = 990\ \text{C}$ |

#25)

| **Strategy** | **Calculations** |
| --- | --- |
| Use the expression for the potential difference. | $V = \frac{\Delta E_Q}{Q}$ |
| The amount of work done is equal to the potential energy. | $W = \Delta E_Q$ <br> $W = 3.35 \times 10^5\ \text{J}$ |
| Solve for the charge. | Substitute first |
| | $(120\ \text{V})Q = \frac{3.35 \times 10^5\ \text{J}}{\cancel{Q}}\cancel{Q}$ |
| | $\frac{(120\ \text{V})Q}{120\ \text{V}} = \frac{3.35 \times 10^5\ \text{J}}{120\ \text{V}}$ |
| | $Q = \frac{3.35 \times 10^5\ \text{J}}{120\ \text{V}}$ |
| | Solve for $Q$ first |
| | $VQ = \frac{\Delta E_Q}{\cancel{Q}}\cancel{Q}$ |
| | $\frac{\cancel{V}Q}{\cancel{V}} = \frac{\Delta E_Q}{V}$ |
| | $Q = \frac{3.35 \times 10^5\ \text{J}}{120\ \text{V}}$ |
| $1\ \frac{\text{J}}{\text{V}}$ is equivalent to 1 C, thus | $Q = 2.80 \times 10^3\ \text{C}$ |

#25)-continued

Use the expression for the electric current to solve for the current.

$$I = \frac{Q}{\Delta t}$$

Substitute and divide.

$$I = \frac{2.80 \times 10^3\ \text{C}}{270\ \text{s}}$$

1 $\frac{\text{C}}{\text{s}}$ is equivalent to 1 A, thus

$$I = 10.3\ \text{A}$$

Apply Ohm's law.

$$V = IR$$

Substitute first

$$120\ \text{V} = (10.3\ \text{A})R$$

$$120\ \text{V} \cdot \frac{1}{10.3\ \text{A}} = (10.3\ \text{A})\frac{R}{10.3\ \text{A}}$$

$$R = \frac{120\ \text{V}}{10.3\ \text{A}}$$

$$R = 11.6\ \Omega$$

Solve for $R$ first

$$V = IR$$

$$V \cdot \frac{1}{I} = \cancel{I}\frac{R}{\cancel{I}}$$

$$R = \frac{120\ \text{V}}{10.3\ \text{A}}$$

$$R = 11.6\ \Omega$$

The resistance is 11.6 Ω.

#26)

| **Strategy** | **Calculations** |
|---|---|
| Use the expression for the potential difference. | $V = \frac{\Delta E_Q}{Q}$ |
| The amount of work done is equal to the potential energy. | $W = \Delta E_Q$ <br> $\Delta E_Q = 4.32 \times 10^5\ \text{J}$ |
| Solve for the charge. | Substitute first <br> $(240\ \text{V})Q = \frac{4.32 \times 10^5\ \text{J}}{\cancel{Q}}\cancel{Q}$ <br> $\frac{(240\ \text{V})Q}{240\ \text{V}} = \frac{4.32 \times 10^5\ \text{J}}{240\ \text{V}}$ <br> $Q = \frac{4.32 \times 10^5\ \text{J}}{120\ \text{V}}$ |
| $\frac{\text{J}}{\text{V}}$ is equivalent to 1 C, thus | $Q = 1800\ \text{C}$ |
| Apply Ohm's law. | $V = \frac{I}{R}$ <br> Substitute first <br> $240\ \text{V} = I(60.0\ \Omega)$ <br> $240\ \text{V} \cdot \frac{1}{60.0\ \Omega} = (60.0\ \text{A})\frac{I}{12\ \Omega}$ <br> $I = \frac{240\ \text{V}}{60.0\ \Omega}$ <br> $I = 4.00\ \text{A}$ |

#26)-continued

Use the expression for the electric current to obtain the time.

$I = \frac{Q}{\Delta t}$

Substitute first

$(4.00\ \text{A})\Delta t = \frac{1800\ \text{C}}{\Delta t}\Delta t$

$\Delta t = \frac{1800\ \text{C}}{4.00\ \text{A}}$

$1\ \frac{\text{C}}{\text{A}}$ is equivalent to 1 s.

$\Delta t = 450\ \text{s}$

It would take 450 s or $450\ \text{s}\ \frac{1\ \text{min}}{60\ \text{s}} = 7.50\ \text{min}$ for the battery to do the amount of work.