12.7 - Power and Efficiency

1. $P = 0.8\,kW$ $t = 0.5h$ $E = ?$

$E = P \cdot t$

$E = (0.8)(0.5)$

$E = 0.4\,kW \cdot h$

2. $P = 400W$ $t = 2500h$ $E = ?$

$E = P \cdot t$

$E = (400)(2500)$

$E = 1{,}000{,}000\,W \cdot h$ or $1000\,kW \cdot h$

3. $E = 392\,kW \cdot h$ $t = 70h$ $P = ?$

$P = \frac{E}{t} = \frac{392\,kW \cdot h}{70h}$

$P = 5.6kW$

4. $P = 1300W$ $E = 78\,kW \cdot h$ $t = ?$

convert $\longrightarrow$ $1300W \times \frac{1kW}{1000W}$

$P = 1.3kW$

$t = \frac{E}{P} = \frac{78\,kW \cdot h}{1.3kW} = 60h$

5. $P = 12kW$ $t = 300h$ price $= 0.11\ \frac{\$}{kW \cdot h}$ cost $= ?$

$E = P \cdot t$

$E = 12\,kW \cdot 300h$

$E = 3{,}600\,kW \cdot h$

cost = energy used × price of electricity

cost $= 3600\,kW \cdot h \times 0.11\ \frac{\$}{kW \cdot h}$

cost $= \$396$

6. $P = 1500W$ $t_{day} = 30\ \frac{min}{day}$ price $= 7.5\ \frac{¢}{kW \cdot h}$ cost $= ?$

$t_{month} = 30\ \frac{min}{day} \times 30\ \frac{day}{month}$

$= 900\ \frac{min}{month} \times \frac{1h}{60min}$

$= 15\ \frac{hours}{month}$

convert $P = 1500W \times \frac{1kW}{1000W}$

$= 1.5kW$

$E = P \cdot t$

$E = 1.5kW \cdot 15h$

$E = 22.5kW \cdot h$

cost = energy × price

cost $= 22.5kW \cdot h \times \frac{7.5¢}{kW \cdot h}$

$= 168.75¢$

or

$\$1.69$

7. $P = 175W$ price $= 5.7\ \frac{¢}{kW \cdot h}$ time $= 24\ \frac{h}{day} \times \frac{365\,days}{year} = 8{,}760\ \frac{h}{year}$ cost $= ?$

convert $\longrightarrow$ $175W \times \frac{1kW}{1000W} = 0.175kW$

$E = P \cdot t$

$E = (0.175kW)(8{,}760h)$

$E = 1{,}533\,kW \cdot h$

cost = energy × price

cost $= (1533\,kW \cdot h)(5.7\ \frac{¢}{kW \cdot h})$

cost $= 8{,}738.1¢$

8. $E_{in} = 100\,J$

$E_{out} = 35\,J$

$e = ?$

$$\text{efficiency} = \frac{E_{out}}{E_{in}} \times 100\%$$

$$e = \frac{35}{100} \times 100\%$$

$$e = 35\%$$

9. $E_{out} = 30\,J$

$E_{in} = 95\,J$

$e = ?$

$$e = \frac{E_{out}}{E_{in}} \times 100\%$$

$$e = \frac{30}{95} \times 100\%$$

$$e = 31.6\%$$

10. $E_{out} = 4500\,J$

$E_{in} = 6500\,J$

$e = ?$

$$e = \frac{E_{out}}{E_{in}} \times 100\%$$

$$e = \frac{4500}{6500} \times 100\%$$

$$e = 69.2\%$$