$$P = IV = I^2R = \frac{V^2}{R}$$ $$E = Pt = I^2Rt$$ → Thermal Energy (Heat) Specifically

Physics
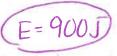**Power & Energy in a Circuit**

Name __Key__
Date _____

1. A 6.0-V battery delivers a 0.50-A current to an electric motor that is connected across its terminals.
   a) What is the power consumed by the motor?

   $P = 0.5A \cdot 6V = $ $\boxed{P = 3W}$

   b) If the motor runs for 5.0 minutes, how much electrical energy is delivered?

   $\frac{5 \, min}{1} \times \frac{60s}{1 \, min} = 300 \, s$ $E = 3W \cdot 300s$ $\boxed{E = 900 J}$

#1 A heater has a resistance of 10.0 Ω. It operates of 120.0V
   a) What is the current through the resistance?

   $120V = I \cdot 10\Omega$ $\boxed{I = 12 A}$

   b) What is the thermal energy supplied by the heater in 10.0s?

   $E = I^2Rt = (12^2)(10\Omega)(10s) = \boxed{14,400 \, J}$

#2 What is the current through a 75-W lightbulb connected to a 120-V outlet?

   $75W = I \cdot 120V$ $\boxed{I = 0.625A}$

#3 A 30.0-Ω resistor is connected across a 60-V battery.
   a) What is the current in the circuit?

   $60V = I \cdot 30\Omega$ $\boxed{I = 2 A}$

   b) How much energy is used by the resistor in 5.0 minutes? $\frac{5 \, min}{1} \times \frac{60s}{1 \, min} = 300 \, s$

   $E = (2A^2)(30\Omega)(300s) = \boxed{36,000 J}$

#5 The current through the starter motor of a car is 210 A. If the battery keeps 12 V across the motor, what electrical energy is delivered to the starter in 10.0 s?

   $P = 210 A \cdot 12V$ $E = 2520 \, W \cdot 10s$ $\boxed{E = 25,200 J}$
   $P = 2520 W$

#7 The current through a toaster connected to a 120-V source is 8.0 A. What power is given off by the toaster?

   $P = 8.0 A \cdot 120V$ $\boxed{P = 960 W}$

7. The resistance of an electric stove element at operating temperature is 11 Ω.
   a) If 220 V are applied across it, what is the current through the stove element?

$$220V = I \cdot 11\Omega \qquad \boxed{I = 20 A}$$

   b) How much energy does the element convert to thermal energy in 30.0 s?

$$E = (20 A^2)(11\Omega)(30.0s) = \boxed{132,000 \quad J}$$

9. A lamp draws 0.50 A from a 120-V generator.
   a) How much power is delivered?

$$P = 0.5A \cdot 120V \qquad \boxed{P = 60W}$$

   b) How much energy does the lamp convert in 5.0 minutes?

$$E = 60W \cdot 300s \qquad \boxed{E = 18,000J}$$

10. A 4000-W clothes dryer is connected to a 220-V circuit. How much

$$4000W = I \cdot 220V \qquad \boxed{I = 18.2}$$

11. A lamp is labeled 6.0 V and 12 W.
    a) What is the current through the lamp when it is operating?

$$12 W = I \cdot 6V \qquad \boxed{I = 2A}$$

    b) How much energy is supplied to the lamp in 100 seconds?

$$E = 12 W \cdot 100s \qquad \boxed{E = 1,200 J}$$

11. A 110-V electric iron draws 3.0A of current.
    a) How much power is delivered?

$$P = IV$$
$$= 3.0A \cdot 110V \qquad \boxed{P = 330 W}$$

    b) How much thermal energy is developed each (hour)?

$$E = Pt$$
$$E = (330W)(3600s)$$
$$E = 1,188,000 J$$

Additional Problems

④ a) E = 0.66 kWh
   b) $0.06

⑥ a) P = 1800 w (1.8 kW)
   b) E_{day} = 9 kWh
      $E_{30 days}$ = 270 kWh
   c) $29.70 for 30 days

⑧ a) I = 20 A
   b) P = 4400 W
      E = 132,000 J

⑫ a) P = 170 w (0.170 kW)
      V = 120 V
      t = 8 hr
      E = 1.36 kWh
   b) $0.16