

**Electric Power**

$P = IV$

- Unit: \_\_\_\_\_ (W)
- Other \_\_\_\_\_ for electrical \_\_\_\_\_

$P = I^2R$

$P = \frac{V^2}{R}$

Let's say an electric heater has a resistance of 1430 Ω and operates at 120V. What is the power rating of the heater? How much electrical energy does it use in 24 hours?

**Kilowatt hours**

- Electrical \_\_\_\_\_ you for the amount of electrical \_\_\_\_\_ you use
- Measured in \_\_\_\_\_ (kWh)

If electricity costs \$0.15 per kWh how much does it cost to operate the previous heater (P = 10.1 W) for one month?

**Alternating Current**

- Charge flow \_\_\_\_\_ direction \_\_\_\_\_
- Due to way that \_\_\_\_\_ plants \_\_\_\_\_ power
- Simple circuit
- Periodicity
  - \_\_\_\_\_, \_\_\_\_\_, and \_\_\_\_\_ with time
  - So we usually talk about the \_\_\_\_\_

Average Power

- DC
- AC

$P = IV$

$P_{ave} = \frac{1}{2} I_0 V_0$

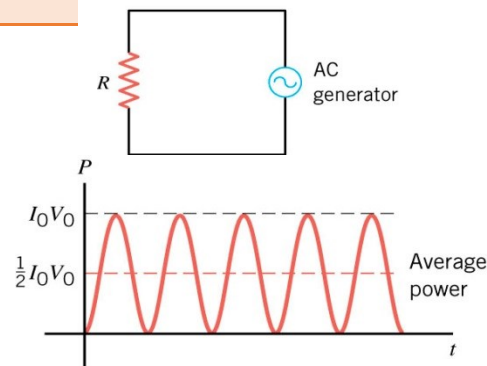
- Often P is used to represent \_\_\_\_\_ power in \_\_\_\_\_ AC circuits.

Root Mean Square (rms)

$P_{ave} = \frac{1}{2} I_0 V_0 = \left(\frac{I_0}{\sqrt{2}}\right) \left(\frac{V_0}{\sqrt{2}}\right) = I_{rms} V_{rms}$

- $I_{rms}$  and  $V_{rms}$  are called \_\_\_\_\_ current and voltage
- Found by dividing the \_\_\_\_\_ by \_\_\_\_\_

$I_{rms} = \frac{I_0}{\sqrt{2}} \quad V_{rms} = \frac{V_0}{\sqrt{2}}$



**Convention in USA**

- $V_0 = 170 \text{ V}$ ,  $V_{\text{rms}} = \text{_____ V}$
- \_\_\_\_\_ electronics specify 120 V, so they really mean \_\_\_\_\_
- We will always (unless noted) use \_\_\_\_\_, and root mean square \_\_\_\_\_ and \_\_\_\_\_
- Thus all \_\_\_\_\_ learned equations \_\_\_\_\_!

A 60 W light bulb operates on a peak voltage of 156 V. Find the  $V_{\text{rms}}$ ,  $I_{\text{rms}}$ , and resistance of the light bulb.

Why are you not supposed to use extension cords for devices that use a lot of power like electric heaters?

**Practice Work**

1. Give an example of a use of AC power other than in the household. Similarly, give an example of a use of DC power other than that supplied by batteries.
2. Why do voltage, current, and power go through zero 120 times per second for 60-Hz AC electricity?
3. You are riding in a train, gazing into the distance through its window. As close objects streak by, you notice that the nearby LED christmas lights make dashed streaks. Explain.
4. What is the power of a  $1.00 \times 10^2 \text{ MV}$  lightning bolt having a current of  $2.00 \times 10^4 \text{ A}$ ? (OpenStax 20.40)  **$2.00 \times 10^{12} \text{ W}$**
5. What power is supplied to the starter motor of a large truck that draws 250 A of current from a 24.0-V battery hookup? (OpenStax 20.41) **6.00 kW**
6. A charge of 4.00 C of charge passes through a pocket calculator's solar cells in 4.00 h. What is the power output, given the calculator's voltage output is 3.00 V? (OpenStax 20.42)  **$8.33 \times 10^{-4} \text{ W}$**
7. How many watts does a flashlight that has  $6.00 \times 10^2 \text{ C}$  pass through it in 0.500 h use if its voltage is 3.00 V? (OpenStax 20.43) **1.00 W**
8. Find the power dissipated in each of these extension cords: (a) an extension cord having a 0.0600- $\Omega$  resistance and through which 5.00 A is flowing; (b) a cheaper cord utilizing thinner wire and with a resistance of 0.300  $\Omega$ . (OpenStax 20.44) **1.50 W, 7.50 W**
9. An electric water heater consumes 5.00 kW for 2.00 h per day. What is the cost of running it for one year if electricity costs 12.0 cents/kW·h? (OpenStax 20.50) **\$438/y**
10. With a 1200-W toaster, how much electrical energy is needed to make a slice of toast (cooking time = 1 minute)? At 9.0 cents/kW·h, how much does this cost? (OpenStax 20.51) **0.02 kWh, 0.18 cents**
11. What is the hot resistance of a 25-W light bulb that runs on 120-V AC? (OpenStax 20.72) **580  $\Omega$**
12. Certain heavy industrial equipment uses AC power that has a peak voltage of 679 V. What is the rms voltage? (OpenStax 20.73) **480 V**
13. A certain circuit breaker trips when the rms current is 15.0 A. What is the corresponding peak current? (OpenStax 20.74) **21.2 A**
14. What is the peak power consumption of a 120-V AC microwave oven that draws 10.0 A? (OpenStax 20.79) **2.40 kW**
15. What is the peak current through a 500-W room heater that operates on 120-V AC power? (OpenStax 20.80) **5.89 A**