Power and the Power Triangle

We’ve talked about Ohm’s law.

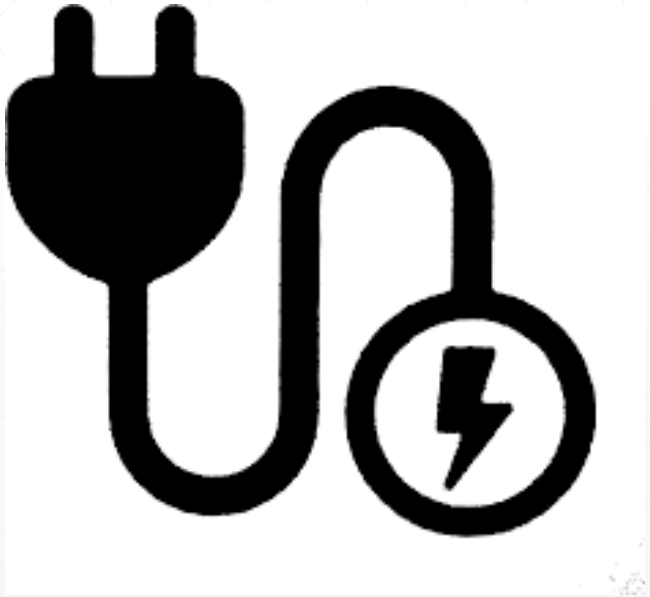
Now let’s talk about power.

So far we’ve used “power” loosely in describing it as what electricity is used for.

Now we’ll define it – power is related to energy where ENERGY is the ability to do work.

POWER is the rate that energy is used, or how much energy is used in an amount of time.

- The units of power are WATTS.
- We define ENERGY CONSUMPTION by the amount of power used over a given amount of time.



If power is defined by:

Power = Energy / Time

then energy consumption is defined by multiplying both sides of this equation by time to get:

Energy = Power x Time

This is an important relationship in telling us another way to express energy.

Energy is often expressed in kilowatt-hours, the unit that electric companies use to designate our daily power consumption.

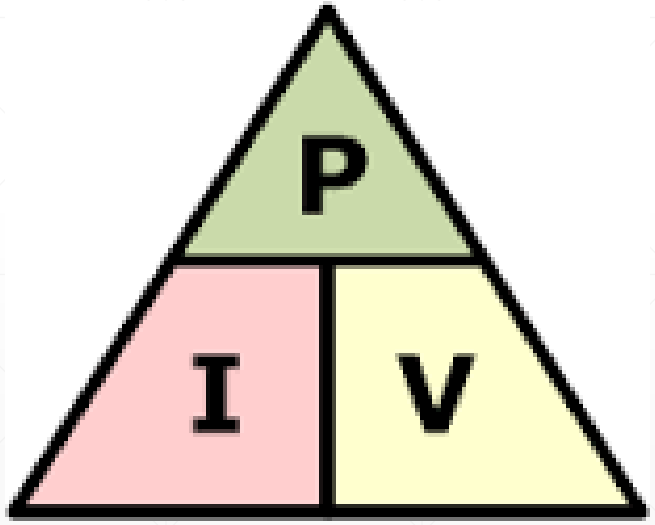
- One kilowatt-hour is the equivalent of using 1000 watts of power for 1 hour.
- If you took a 10 W light bulb (about what you get when you use CFL bulbs) and leave it on for 100 hours, you will have produced 1000 watt-hours, or 1 kilowatt-hour.

Power Formula

- Power consumption in circuit components can also be calculated if you know the current and voltage.
- It is done with the following relationship: $P = I \times V$

This relationship can also be formulated into a triangle for more convenient calculations.

The triangle follows the same steps as when using the Ohm’s law circle.

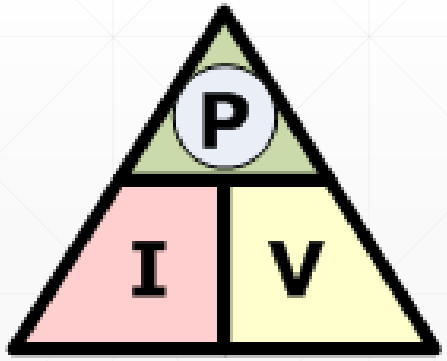


Some problems:

An electric heater works on 115 V and draws 3A of current. How much power does it use?

Solution: since you are finding for power, cover the P. Since I and V are side by side, multiply them for the answer.

115 V x 3 A = 345 W



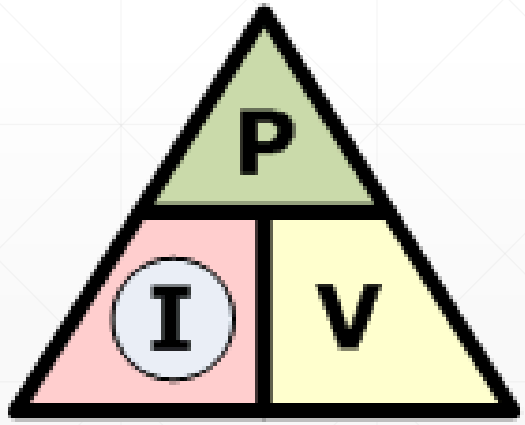
$P = I \times V$

Here’s another one:

What is the current flow through a 7500 W heat strip when connected to a 230 V power supply?

Solution: Cover the I, as we are finding for current. As the P is over the V, divide power by voltage.

7500W / 230 V = 32.6 A



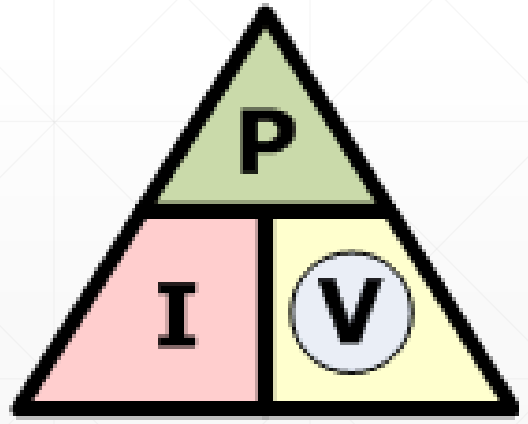
$$I = \frac{P}{V}$$

Last example:

How much voltage is needed to run a 1000 W hair dryer that draws 9A of current?

Solution: Cover the V. P is over the I, so divide power by current.

1000 W / 9 A = 111 V



$$V = \frac{P}{I}$$