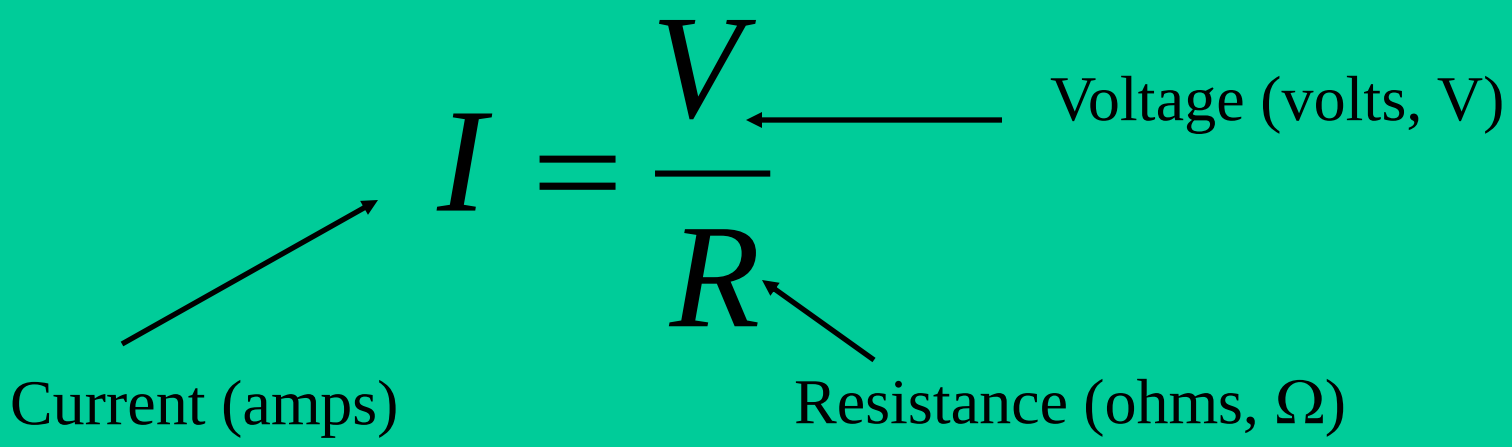
Chp 8

Ohm’s Law

Energy and Power

Ohm's Law

- Ohm's Law is a relationship between voltage, current, and resistance



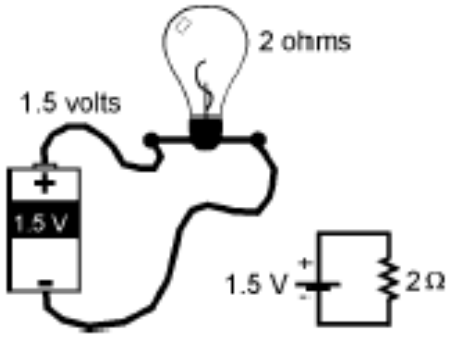
Electrical Quantities

- Amps = Current is what flows in a circuit. Current is the rate of charge flow.
- Volts = Voltage measures the potential energy differences between two places in the circuit. Voltage differences make current flow
- Ohms = Resistance measures the ability to resist the flow of current

Equation	Gives you...	If you know...
I = V/R	current (I)	voltage and resistance
V = IR	voltage (V)	current and resistance
R = V/I	resistance (R)	voltage and current

Ohm's Law can be used to calculate any of the three variables given the other two.

Example A light bulb with a resistance of 2 ohms is connected to a 1.5 volt battery as shown. Calculate the current that will flow.



Solution:

(1) We are asked for the current, I.

(2) We know V and R.

(3) Use the formula V = I ÷ R.

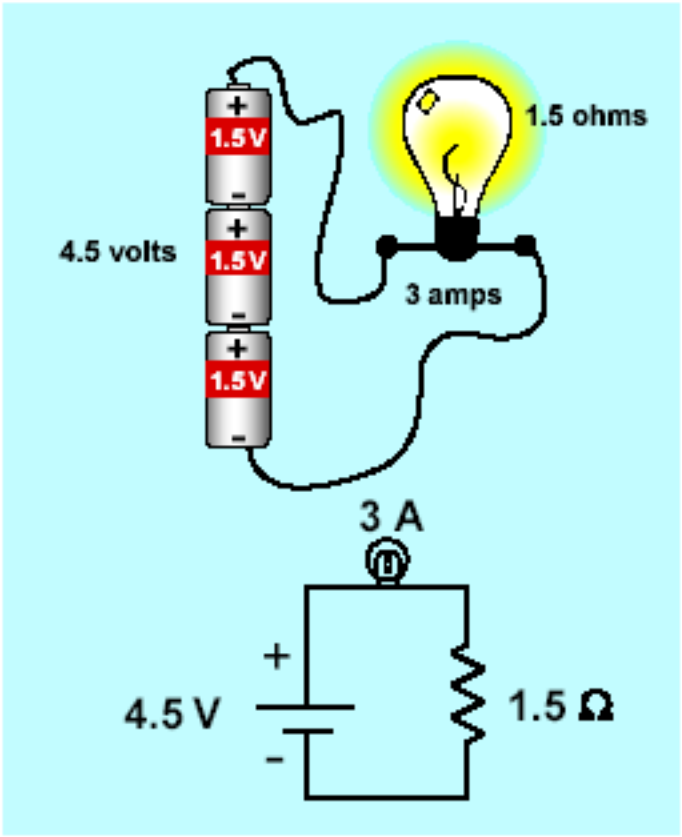
(4) Plug in numbers.
I = 1.5 V ÷ 2 Ω = 0.75 A

Answer: 0.75 amps will flow in the circuit.

Ohm's Law

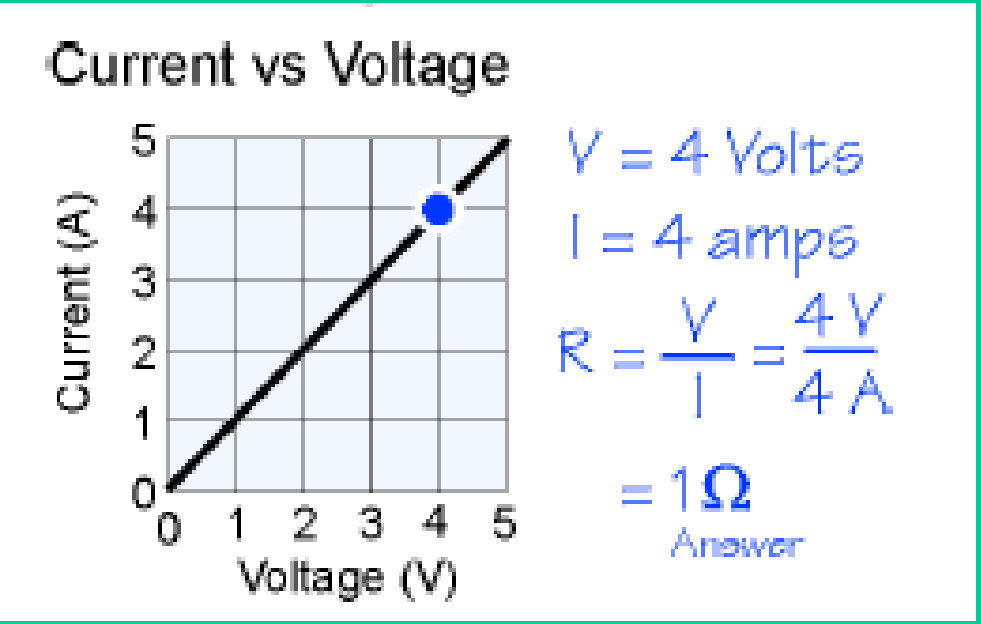
Example: A light bulb requires 3 amps to produce light. The resistance of the bulb is 1.5 ohms. How many batteries do you need if each battery is 1.5 volts?

1. We are asked for the number of batteries, which means we need to know the voltage. Each battery is 1.5 volts.
2. We know current and resistance.
3. Use the formula: V = IR
4. Plug in the numbers.
   V = 3 A x 1.5 = 4.5 V
5. Each battery can produce 1.5 volts so we need three batteries to get the required 4.5 volts.



Graphing

- The slope of a current vs. voltage graph shows the resistance of a circuit
- If the graph goes through the point (0,0) then you can calculate the resistance using R=V/I form of Ohm's Law



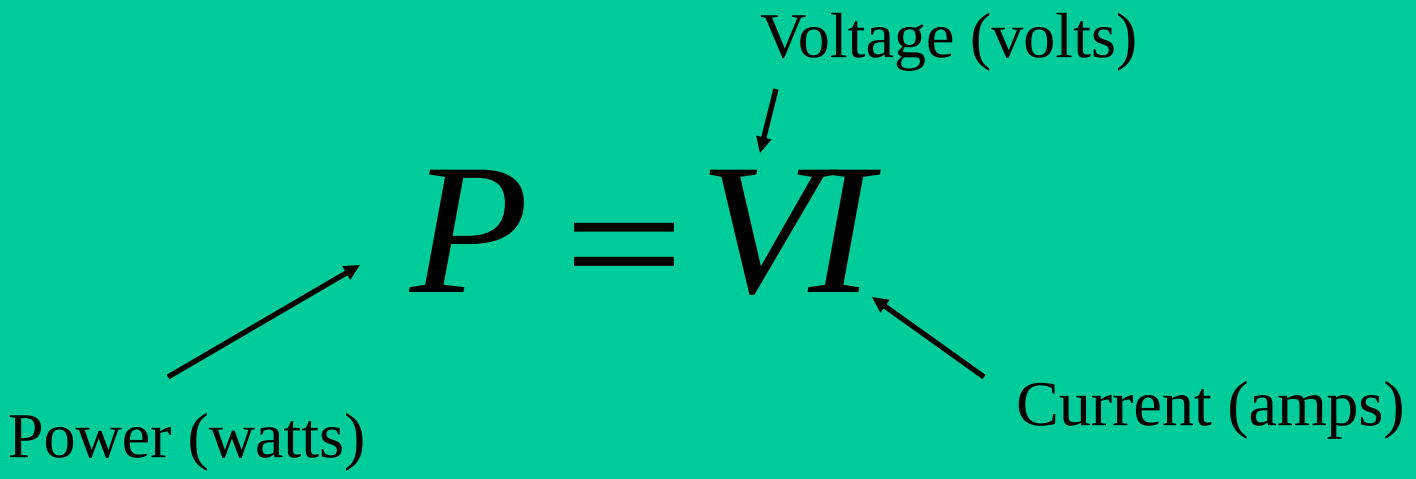
Electrical Power

- Power is the rate at which energy is flowing.
- The unit of power is the watt (W)
- Electric companies charge for the energy you use, which depends on how many watts each appliance consumes in a given month

Where does the power go?

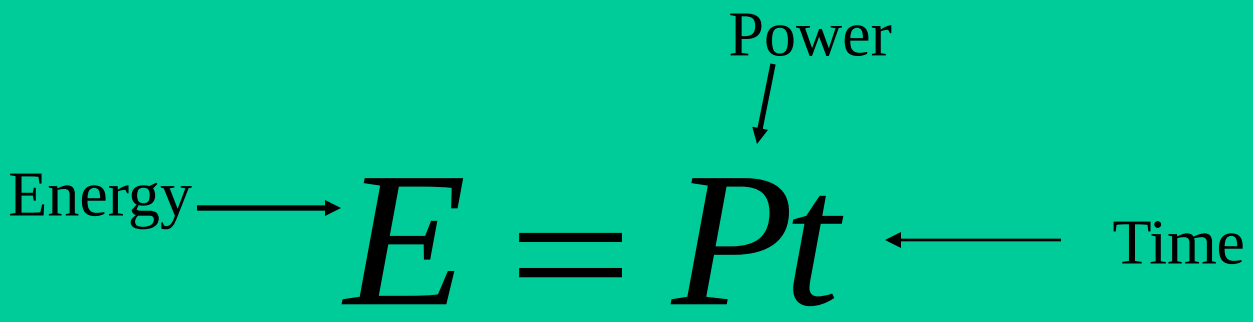
- Electrical power is easily transformed into many different forms.
- An electric motor takes electrical power and makes mechanical power
- A light bulb turns electrical power into light
- A toaster oven turns the power into heat.

Power



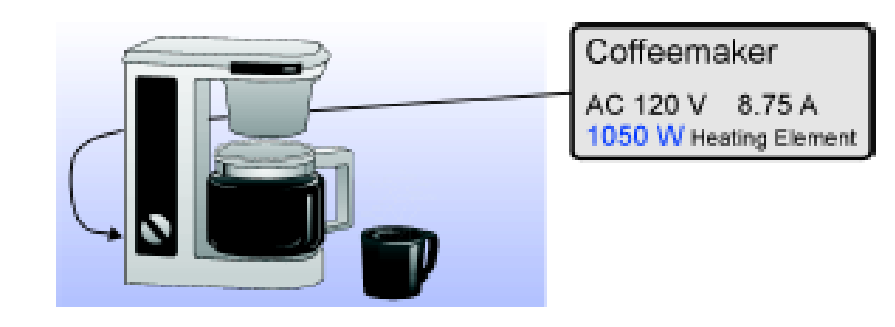
- Sometimes a larger unit of power is needed. A kilowatt (kW) is equal to 1000 watts

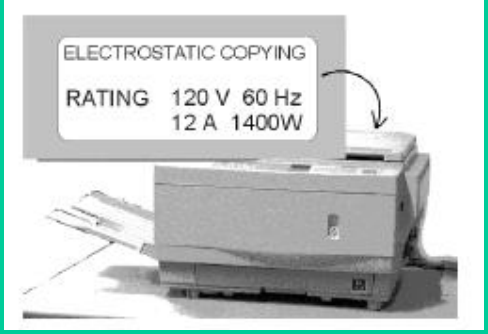
Energy



- Utility companies charge customers in kilowatt-hour (kWh)
- 1 kilowatt-hour means that 1 kilowatt of power has been used for one hour

- Different appliances have different power ratings
- On the back of most appliances is a listing of the power rating of the appliance
- From this information you can estimate the cost of running an appliance for a period of time





Typical power ratings

Appliance	Power (watts)
Electric stove	5,000
Electric heater	1,500
Hair dryer	1,200
Iron	800
Washing machine	750
Light	100
Small fan	50
Clock radio	10

Example: Your electric company charges 14 cents per kilowatt-hour. Your coffeemaker has a power rating of 1,050 watts. The coffeemaker is on for about 1 hour each day. What does this cost you each month in electricity?

Solution: Find the number of kilowatts of power that the coffeemaker uses.
1,050 W × 1 kW/1,000 W = 1.05 kW

Find the kilowatt-hours used by the coffeemaker each day.
1.05 kW × 1 hr/day = 1.05 kWh per day

Find the kilowatt-hours of electricity used by the coffeemaker each month. Assume there are 30 days in a month.
1.05 kWh/day × 30 days/month = 31.5 kWh per month

Find the cost of using the coffeemaker for one month.
31.5 kWh/month × $0.14/kWh = $4.41 per month