

Resistance



S1-3-12 Describe resistance in terms of the particle model of electricity.

Resistance...

In a Circuit:

- Electrons are MOVING.
- As they move through the CONDUCTOR, they are BUMPING into the ATOMS in the CONDUCTOR (wire, light bulb, motor, etc.)
- When the electrons bump into the ATOMS, they are SLOWED down, and give up some of their ENERGY as HEAT, LIGHT, MOTION, etc.

Examples:

Light bulbs, stove tops, toasters, students leaving class

We call the OPPOSITION to the flow of electrons RESISTANCE. Think of moving a heavy crate across a carpet, as opposed to a tile floor → DIFFERENT CONDUCTORS HAVE DIFFERENT RESISTANCES.

Water analogy for Resistance...

Think of water flowing down a river...the water flows at a specific rate.



→ The Colorado River before construction of the Hoover Dam

- Water is able to **FLOW** as **FAST** as **POSSIBLE**

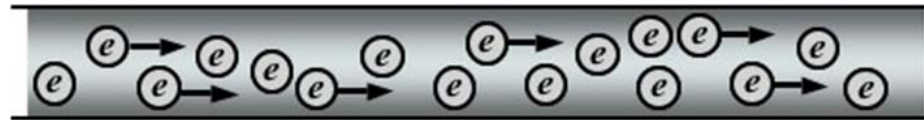
→ The same river after construction

- Water can only flow as fast as the dam allows
- The dam provides **RESISTANCE**



Water analogy for Resistance...

We can extend this to current electricity...

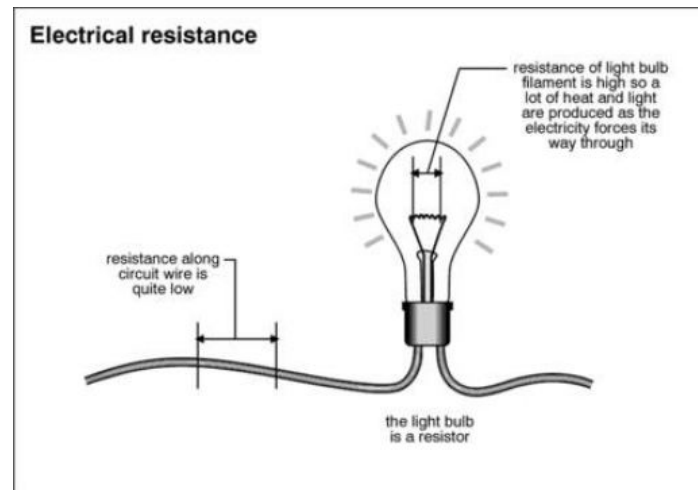


electrons (electricity) traveling in a wire

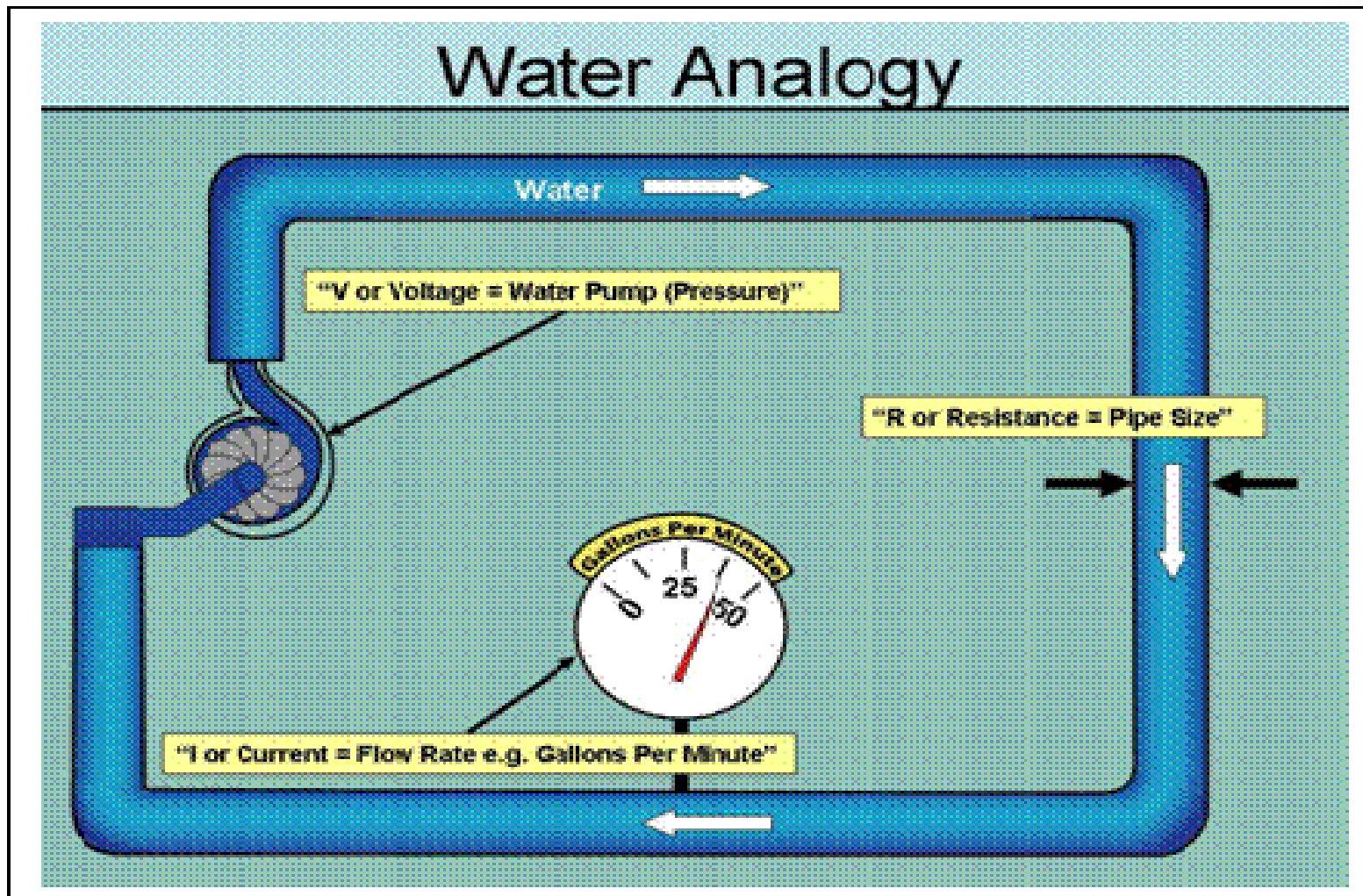
The current in this wire may be slowed down, how?

→ By adding something that will resist the flow of electrons!

Example: A light bulb



Water analogy for Resistance...



Ohms Law...

George Simon Ohm (1789-1854) said that we can relate the RESISTANCE of a conductor/load to the POTENTIAL DIFFERENCE (V) across the load, and the CURRENT through the load.

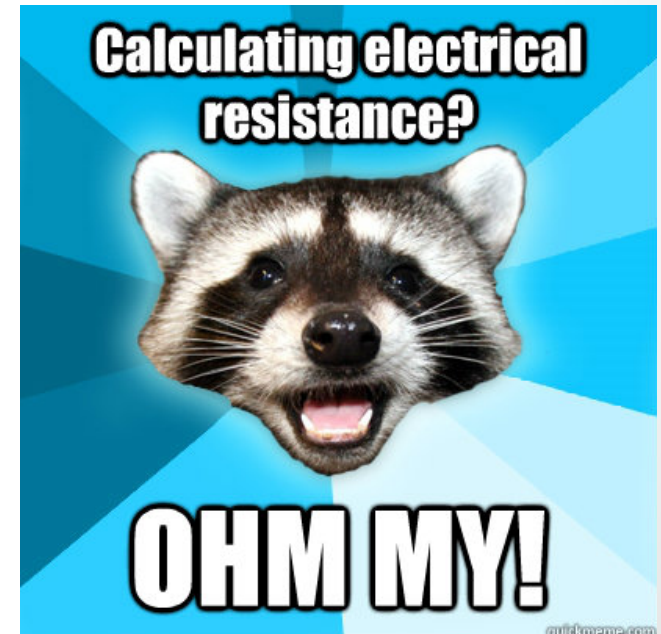
$$V = IR$$

Where:

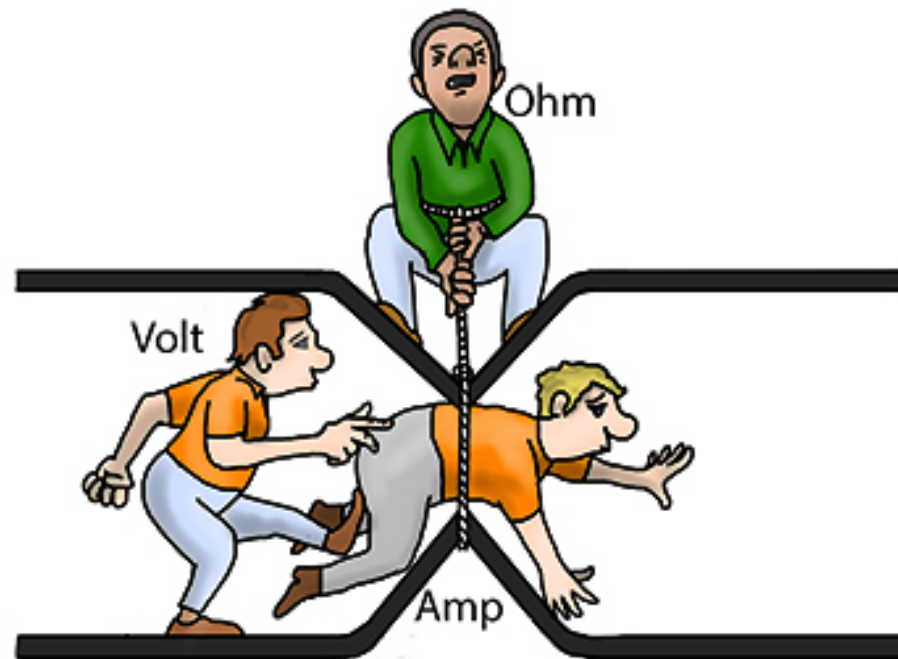
V = POTENTIAL DIFFERENCE, measured in VOLTS (V)

I = CURRENT, measured in AMPS (A)

R = RESISTANCE, measured in OHMS (Ω)



Putting it together...



Quantity	Symbol	Unit of Measurement	Unit Abbreviation
Current	I	Ampere (Amp)	A
Voltage	V or E	Volt	V
Resistance	R	Ohm	Ω

$$V = IR$$

Ohms Law Examples...

1. You make a circuit that has 0.4A of current and 24 Ω resistance. What is the potential difference?
2. A light operates on a 110V circuit and uses 0.8A of current. What is the resistance of the light?

Ohms Law Examples...

$$V = IR$$

3. A light bulb is rated for 120V and has a resistance of 5 Ohms. How much current is able to flow?
4. If one dry cell is 1.5V, how many do you need to make 1.4A flow in a circuit with a resistance of 62Ω ?

$$V = IR$$

Try These ones...

1. What voltage is required for a stove if it has a resistance of 5.5 Ohms and needs a current of 40 Amps?
2. A toaster uses 8.8A in a 110V circuit. What is the resistance of the toaster?
3. Eight dry cells are used in series to operate an electric motor with a resistance of 40Ω . Find the current.