Daily (formative) Quiz

- Compare current and voltage using a water hose as an analogy
- Does our classroom have a fuse box or a circuit breaker box? How do you know?
- Why did the microwave and Keurig lose power when they were both on?
- Why don’t birds get electrocuted when they sit on power lines?

2.1 CONTROLLING THE FLOW OF ELECTRICAL CURRENT

RESISTANCE	measure of how **difficult** it is for electrons to flow through a substance
RESISTOR	device that provides resistance to the **flow of electrons**; often used to **control** electrical current

Resistance

- Resistance in electricity is like the size of the water pipe in the water analogy.

Unit & Abbreviation: Ohm (Ω)

Mathematical Notation: R

Resistors

- Electrons in a current always flow towards the positive end of the voltage source.
- Resistors decrease the amount of current flowing past them
- Examples:

Tungsten filament of a light bulb

"Neon" signs

Electric stove/ cooktop

Loads Act as Resistors

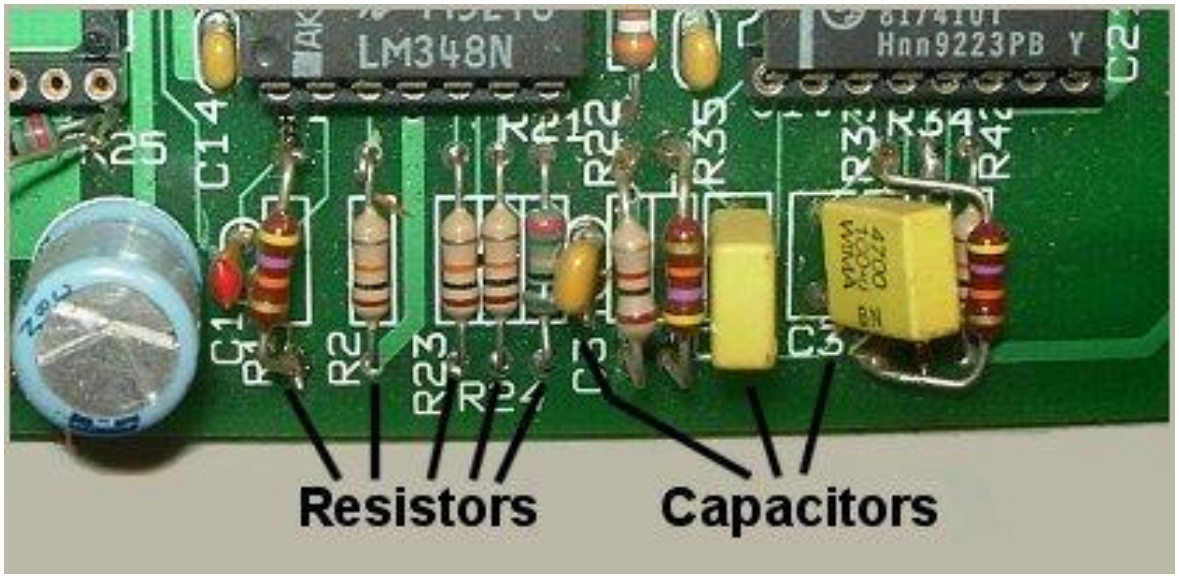
- The more resistance a material has, the more energy it gains from each passing electron
- This energy is often released as heat or light

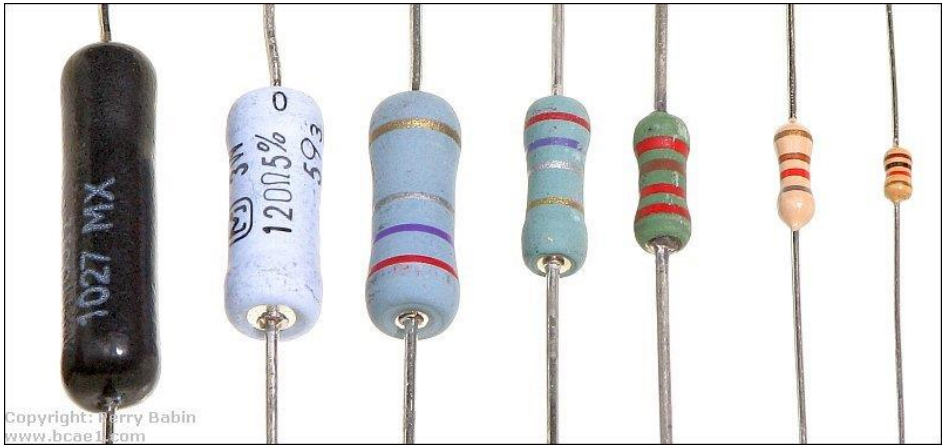
Tungsten filament of a light bulb

"Neon" signs

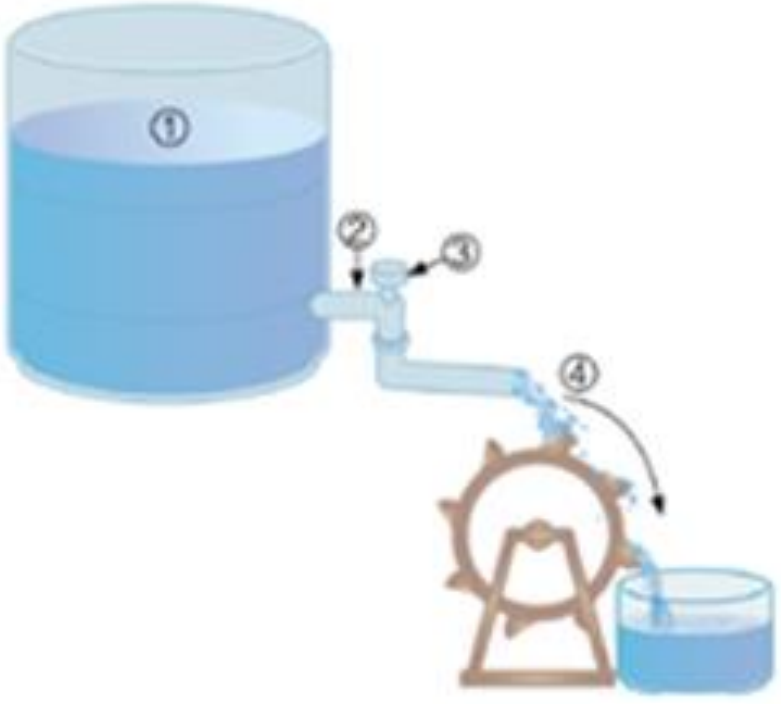
Electric stove/ cooktop

Other Resistors



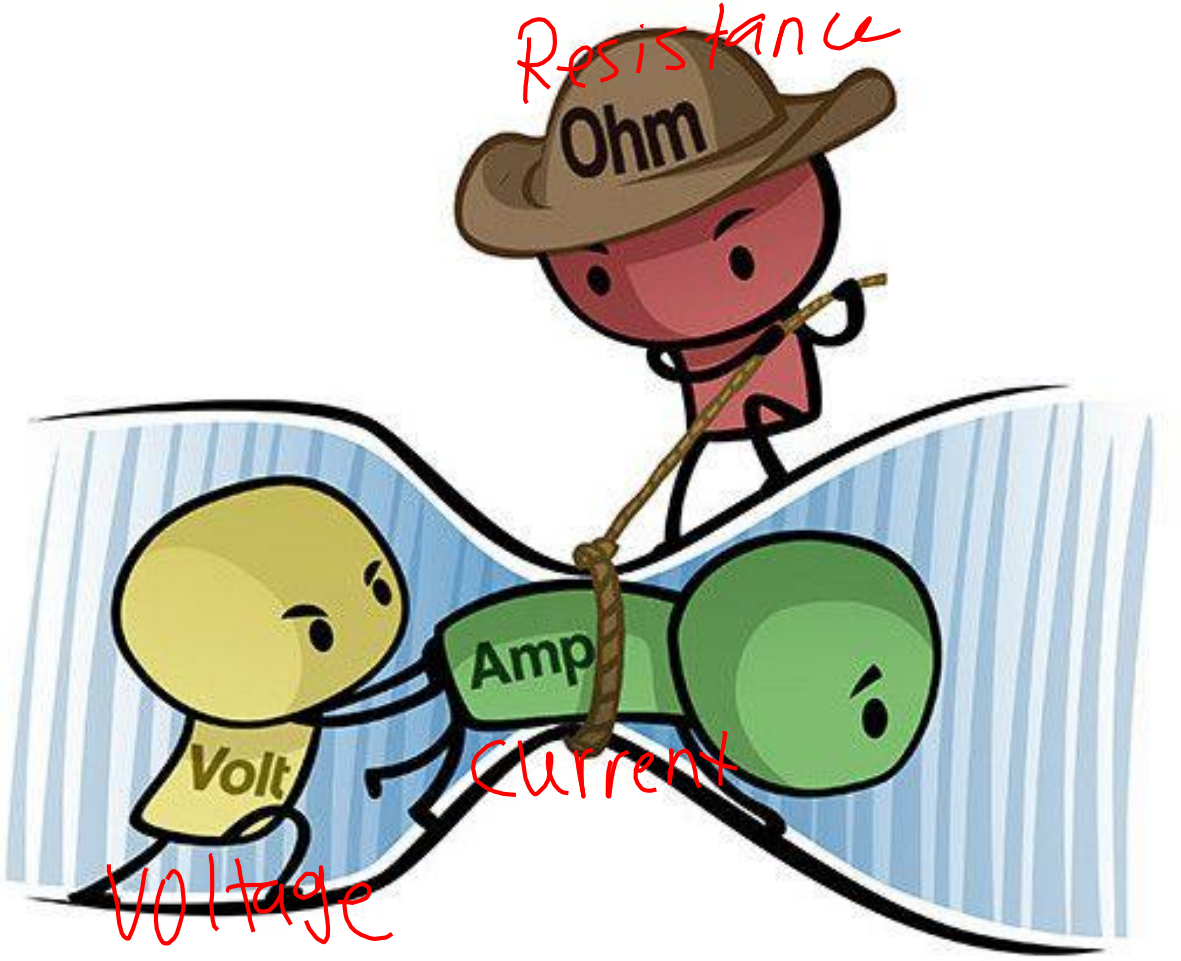


Their only purpose in life is to **reduce current**



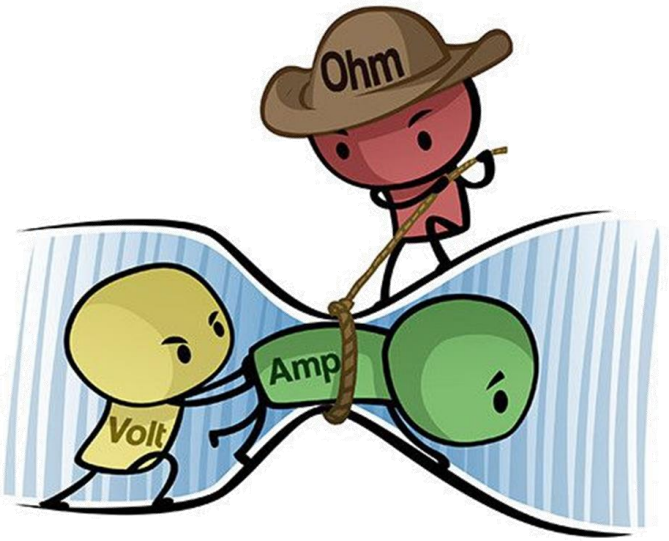
2.2 MODELLING AND MEASURING ELECTRICITY

How are Current, Voltage, and Resistance Related to Each Other?



Ohm's Law

- States that as long as temperature stays the same
  - if you increase the voltage in a circuit, the current also increases
  - if voltage stays the same but resistance increases, then current decreases



Ohm's Law

$V = I \times R$

where, V =

I = current (A)

R = Resistance (Ω)

Voltage, Current, and Resistance

Quantity	Unit & abbreviation	Mathematical Notation
Voltage	Volts (v)	V
Current	Amps (A)	I
Resistance	Ohms (Ω)	R

Using Ohm's Law Formula

1. Identify known quantities
2. Identify unknown quantities
3. Use the appropriate formula
4. Solve the problem

Example 1

$V = I \times R$

What is the potential difference (voltage) across a 1500 Ω resistor carrying a current of 0.075 A?

$R = 1500\ \Omega$

$I = 0.075\ A$

$V = ?$

$V = 0.075\ A \times 1500\ \Omega$

$V = 112.5\ V$

Answer = 112.5 V

Example 2

$V = I \times R$

An electric stove is connected to a 240 V outlet. The current through the stove is 20 A. Calculate the resistance in Ohms.

$V = 240\ V$

$I = 20\ A$

$R = ?$

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

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

$$R = \frac{V}{I} = \frac{240\ V}{20\ A} = 12.0\ \Omega$$

Answer = 12.0 Ω

Example 3

A 30 V battery creates a current through a 15 Ω resistor. What is the battery's current?

$V = 30\,V$

$R = 15\,\Omega$

$I = ?$

$V = IR$

$\frac{V}{R} = \frac{IR}{R}$

$I = \frac{V}{R} = \frac{30\,V}{15\,\Omega} = 2.0\,A$

2.0 A

Example 4

A toaster with a resistance of 145 Ω is connected to a 120 V wall outlet. What current will flow through the toaster?

0.83 A