

OHM'S LAW AND ELECTRONIC CIRCUITS

ELECTRICAL CIRCUITS

All you need to be an inventor is a good imagination and a pile of junk.

-Thomas Edison

OHM'S LAW



Georg Simon **Ohm** (1787-1854)

$$I = V / R$$

I = Current (Amperes) (amps)

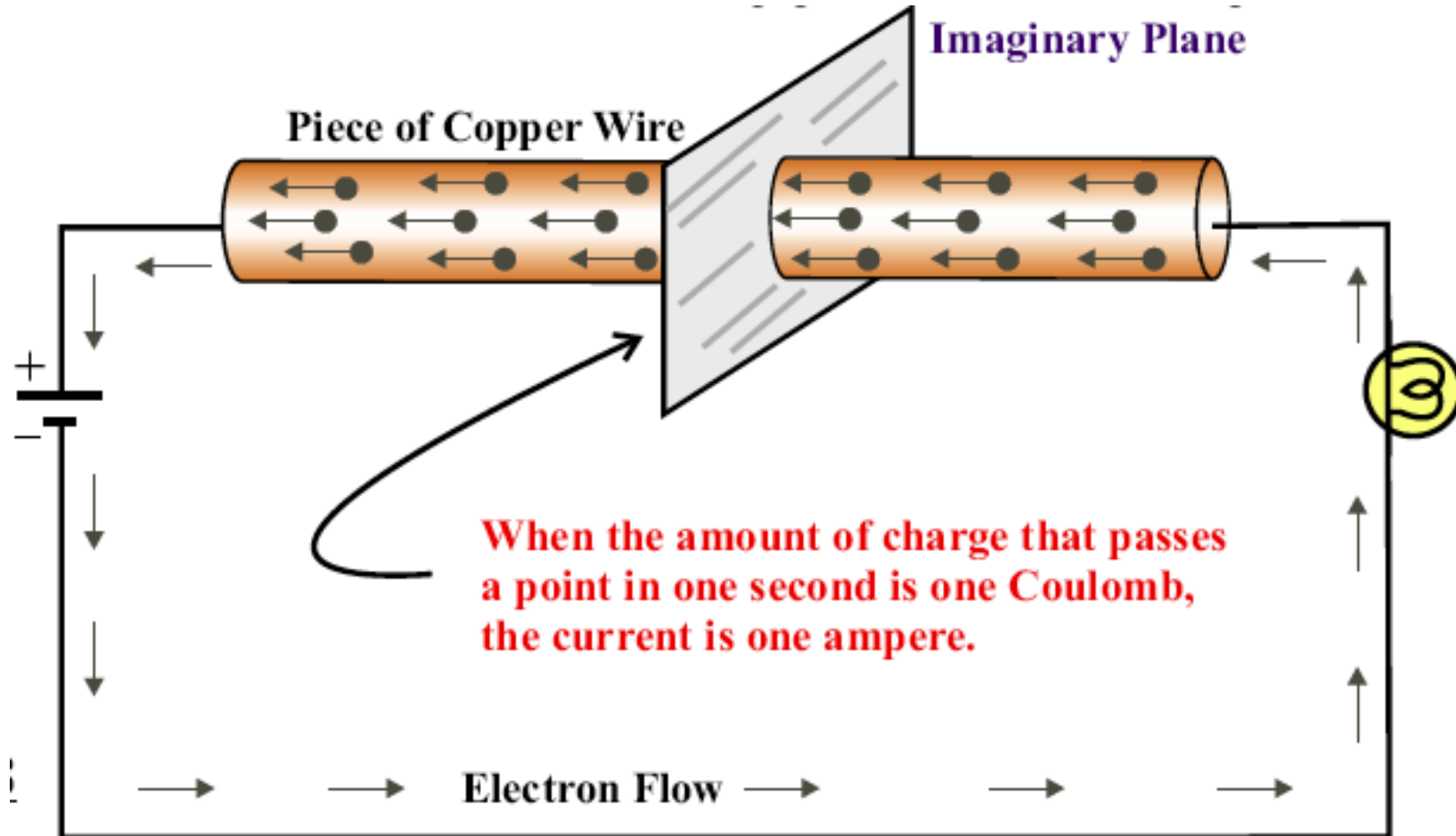
V = Voltage (Volts)

R = Resistance (ohms)

OHM'S LAW

- Ohm's Law explains the relationship between voltage (V or E), current (I) and resistance (R)
- The amount of current in a circuit is dependent on its resistance and the applied voltage. Specifically $I = V/R$
- If you know any two of the factors V, I, and R you can calculate the third.
- Current $I = V/R$
- Voltage $V = IR$
- Resistance $R = V/I$

1 ampere = 1 coulomb per second



CHART

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

VOLTAGE (V)

- It is the push or pressure behind current flow through a circuit, and is measured in (V) volts.



CURRENT

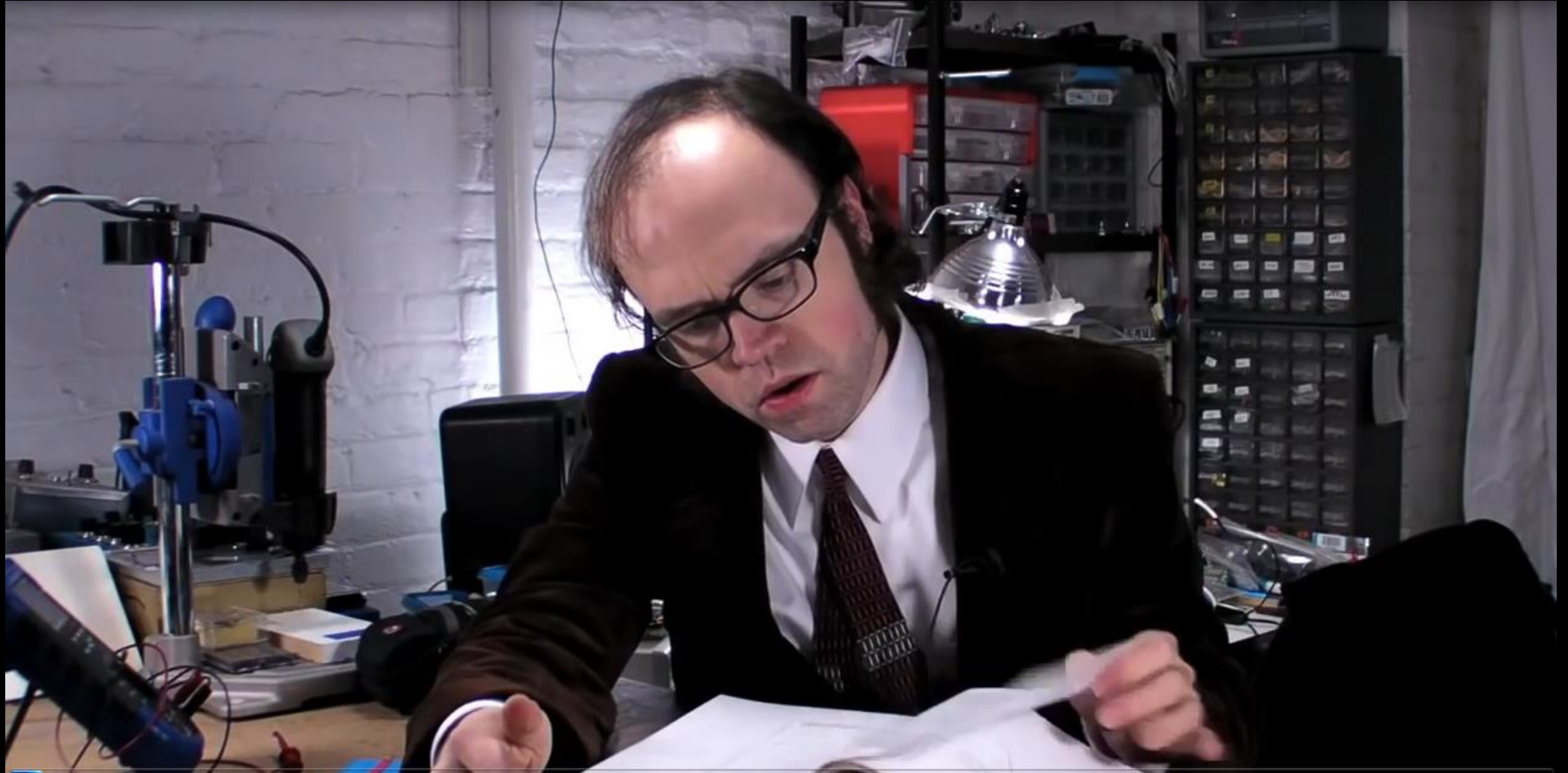
- Current refers to the quantity/volume of electrical flow. Measured in Amps (A)
- The symbol for current is I (for intensity) and is measured in **amperes**



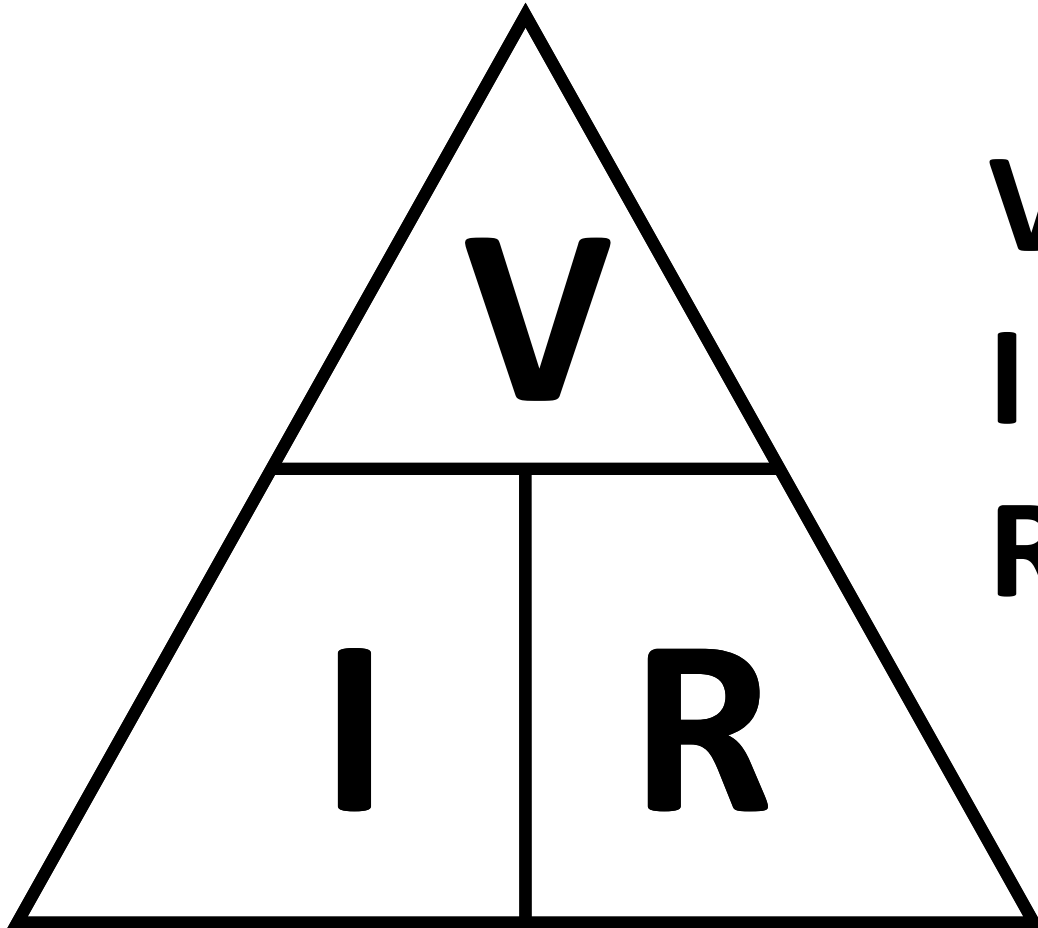
RESISTANCE

- Resistance to the flow of the current. Measured in Ohms Ω
- Opposition to the flow of current is termed resistance.
- The fact that a wire can become hot from the flow of current is evidence of resistance.
- Conductors have very little resistance.
- Insulators have large amounts of resistance.





TRICK TO REMEMBER OHM'S LAW



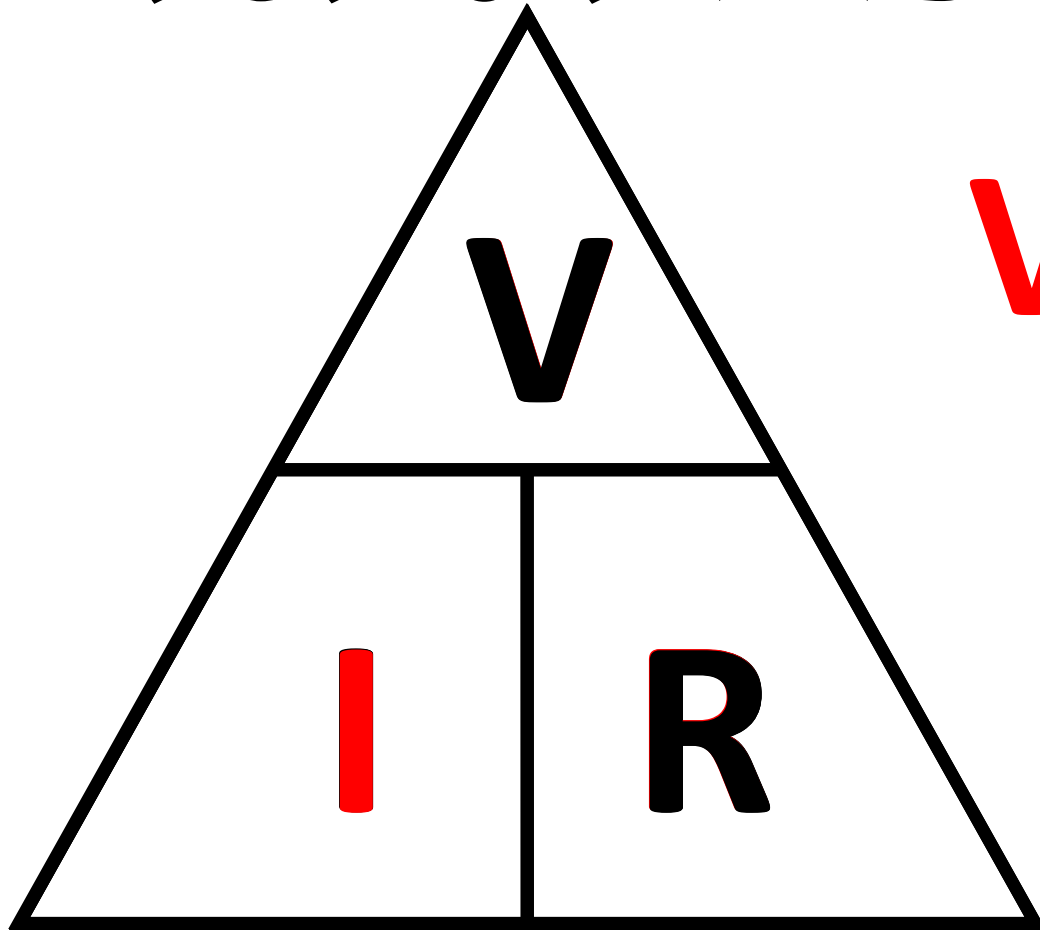
V = Voltage = Volts

I = Amperes = Amps

R = Resistance = Ohms

Ω

TRICK TO REMEMBER OHM'S LAW



$$V = I * R$$

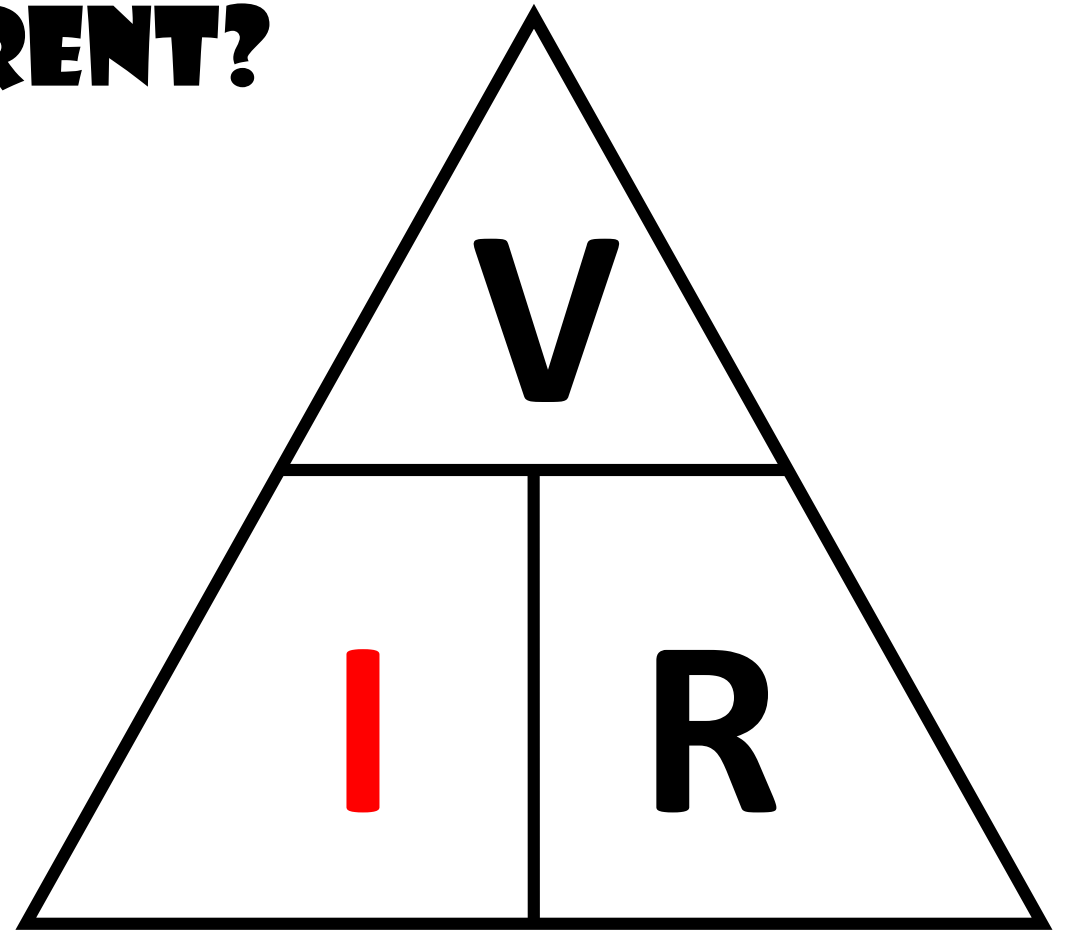
$$I = \frac{V}{R}$$

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

HOW DO CALCULATE CURRENT?

- Voltage is 5V
- Resistance is 220 Ω
- Current = Amp ?

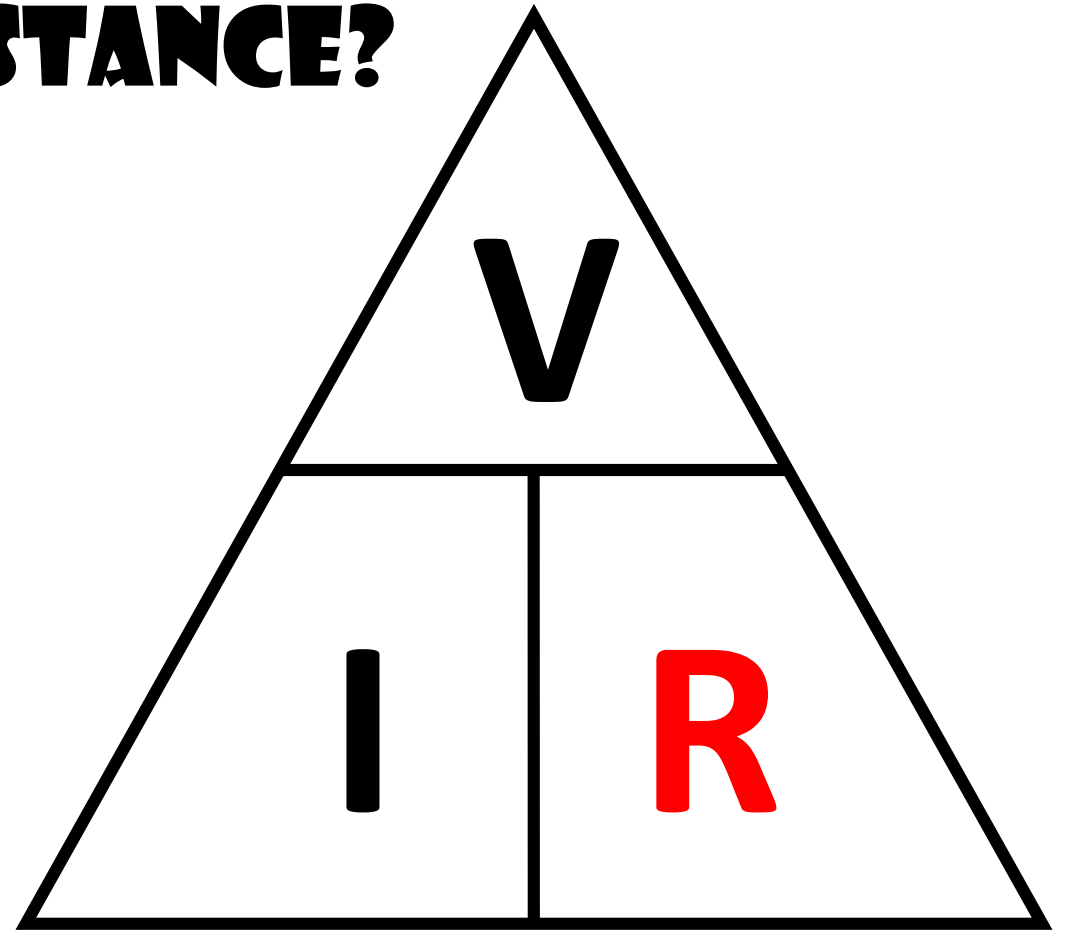
$$I = \frac{V}{R} \quad I = \frac{5}{220}$$



$$I = 22.7 \text{ mA}$$

HOW DO CALCULATE RESISTANCE?

- Voltage is 5V
- Current is 10mA
- Resistance = Ohm?



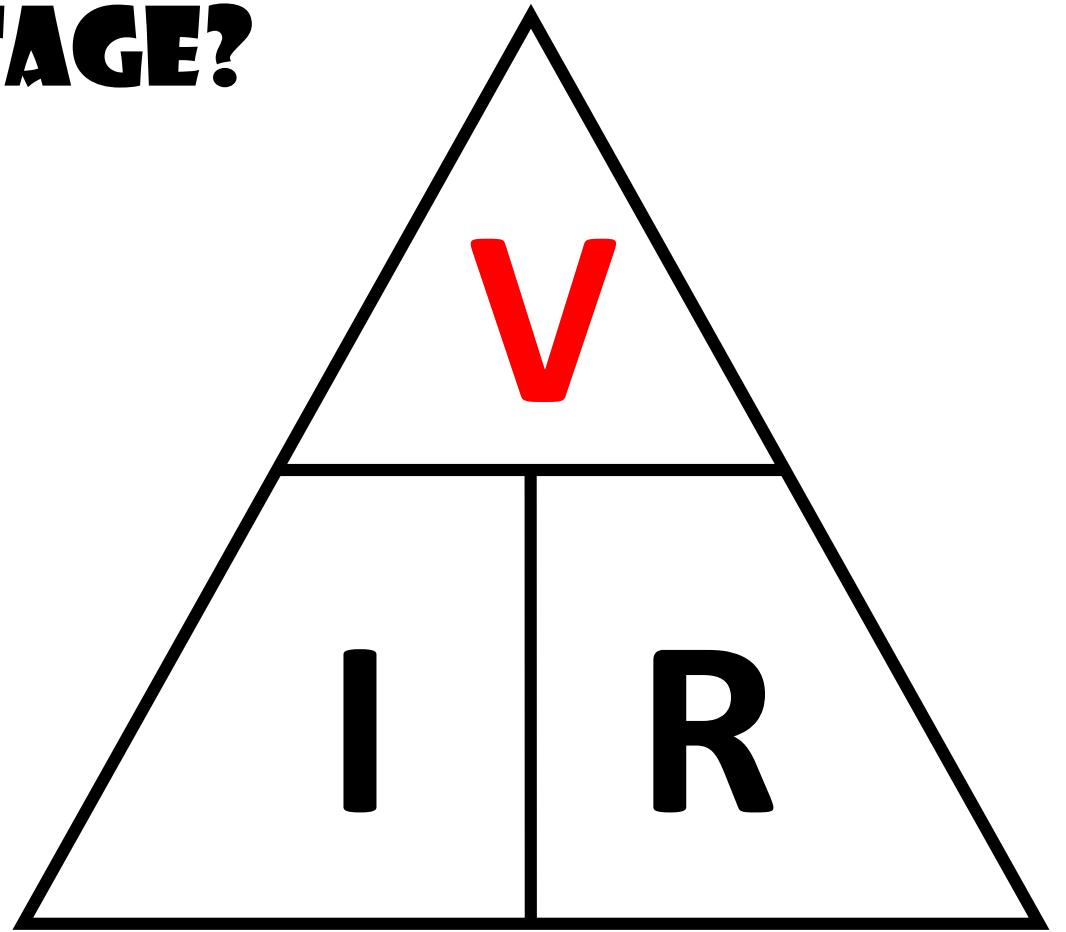
$$R = \frac{V}{I}$$

$$R = \frac{5}{.010\text{amp}}$$

$$R = 500 \Omega$$

HOW DO CALCULATE VOLTAGE?

- Resistance is $1\text{K}\Omega$
- Current is 200 mA
- Voltage = V ?



$$V = I * R$$

$$V = .2 * 1\text{K}\Omega$$

$$V = 200\text{v}$$

WOULD THIS WORK?



WOULD THIS WORK?



WOULD THIS WORK?

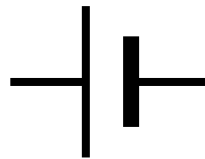
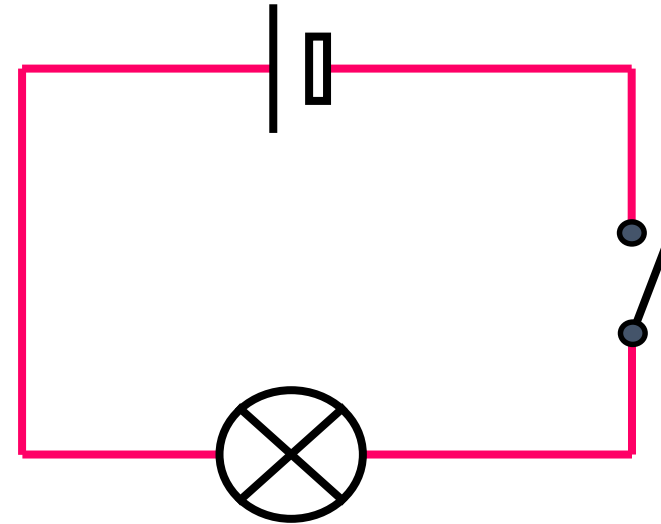
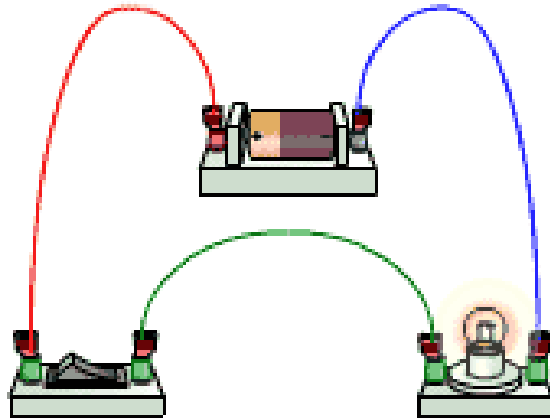


THE CENTRAL CONCEPT: CLOSED CIRCUIT



CIRCUIT DIAGRAM

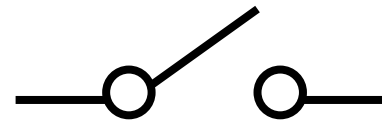
Scientists usually draw electric circuits using symbols;



cell



lamp



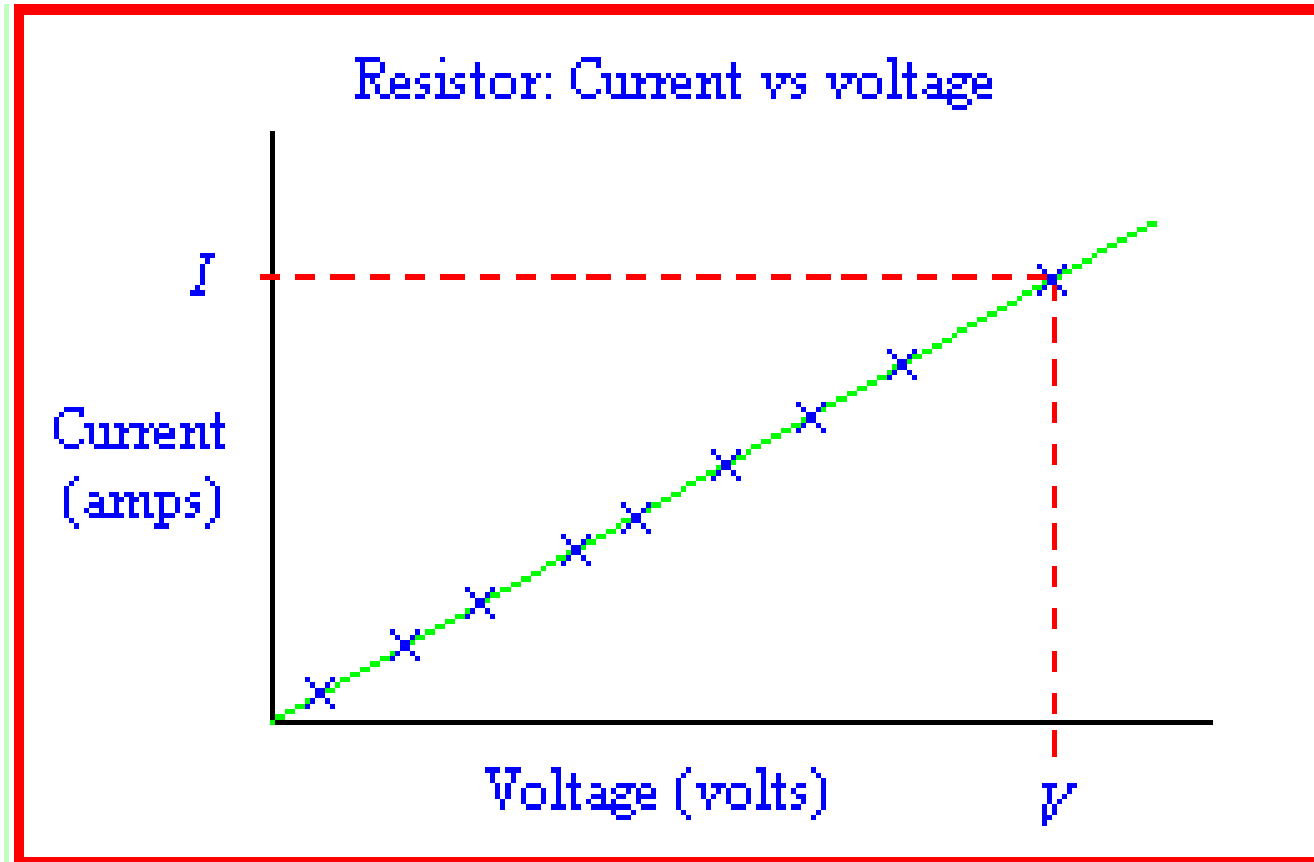
switch



wires

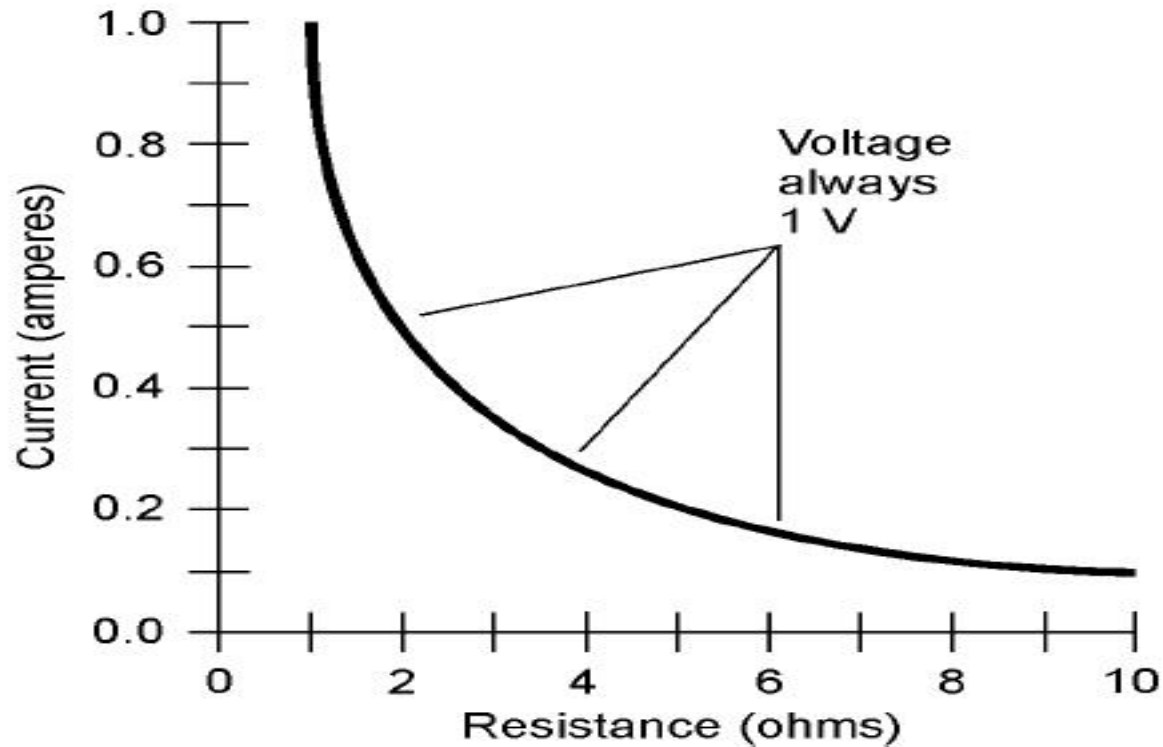
Current is Directly Proportional to Voltage for a Constant Resistance

OHM'S LAW



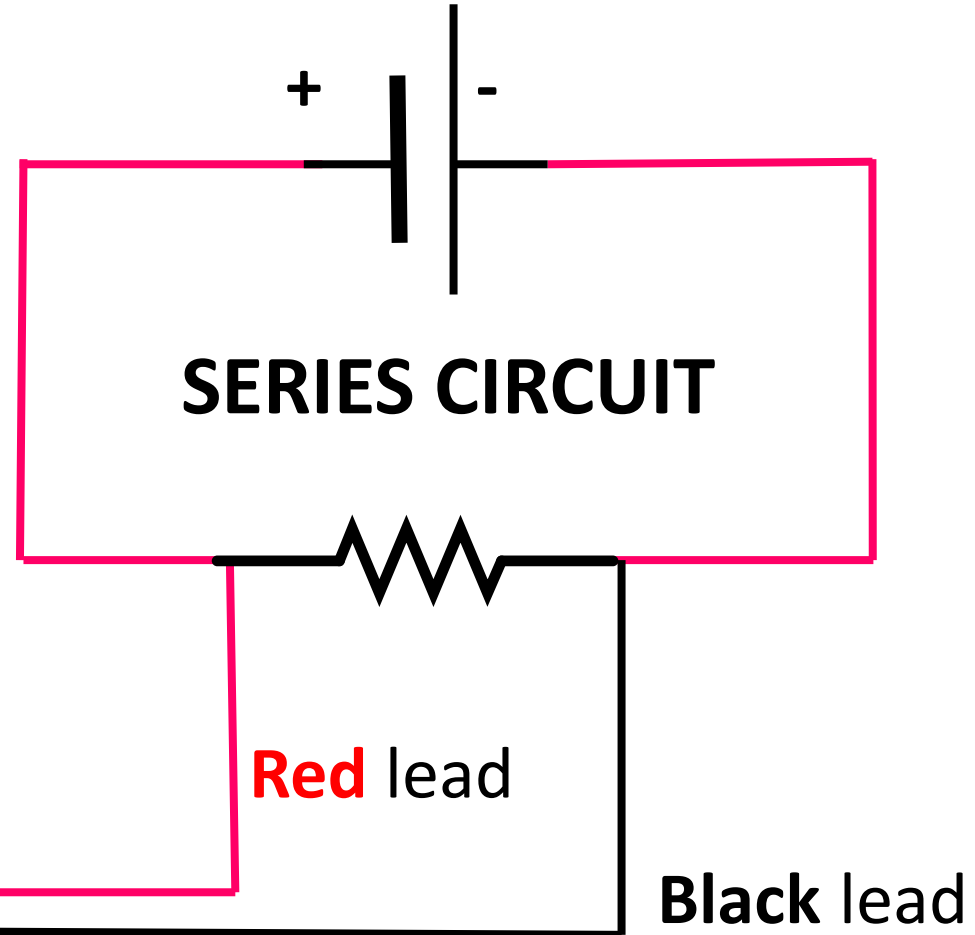
Current is Inversely Proportional to Resistance for a Constant Voltage

OHM'S LAW



MEASURING VOLTAGE

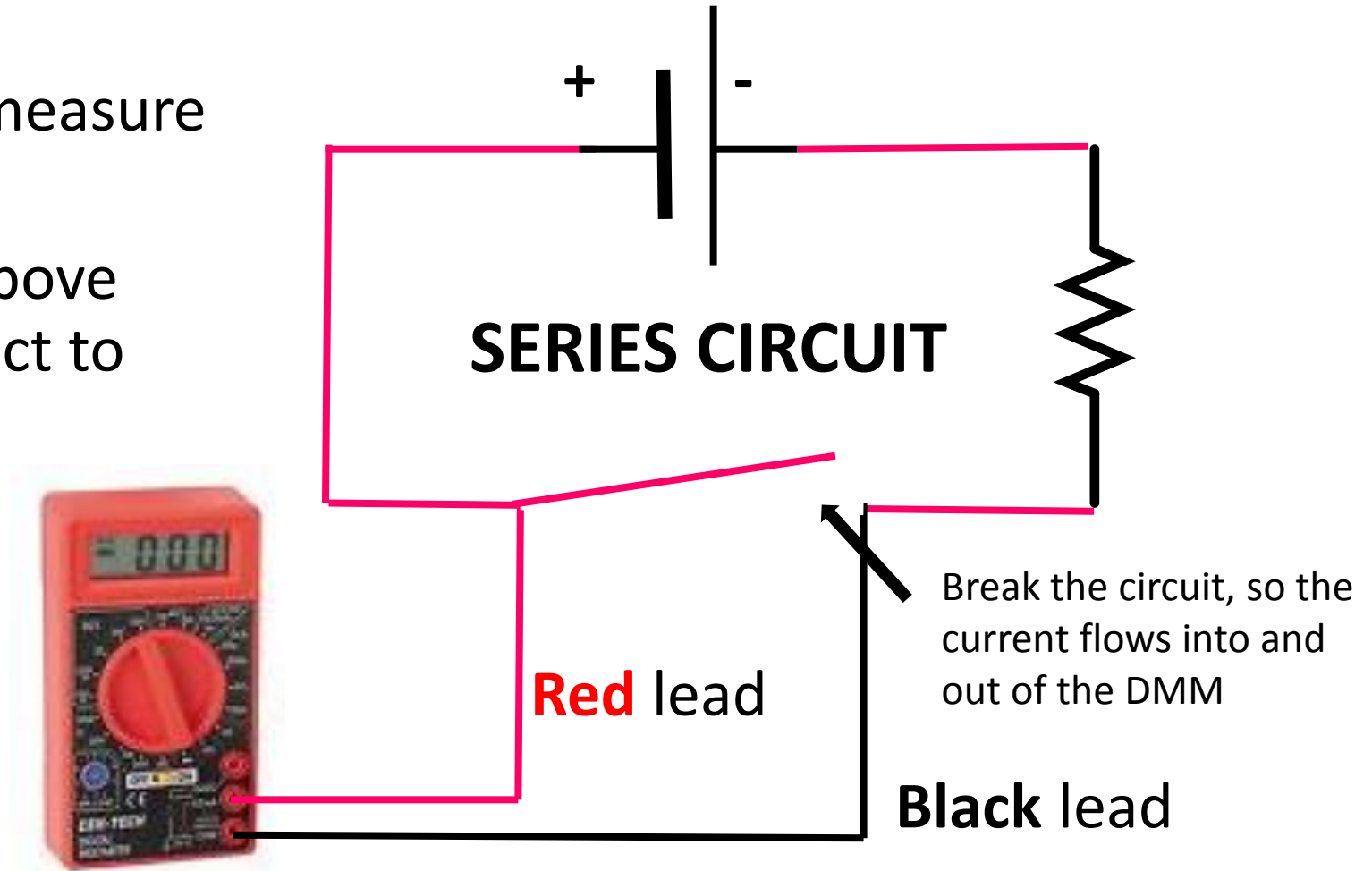
- Set the DMM to Ω (to measure Resistance)
- Set it to the closest value above the target resistor you are measuring



This is how we measure volts in a circuit

MEASURING CURRENT

- Set the DMM to Amps (to measure Current)
- Set it to the closest value above the target current you expect to measure



This is how we measure Amps in a circuit

GENERAL RULE.

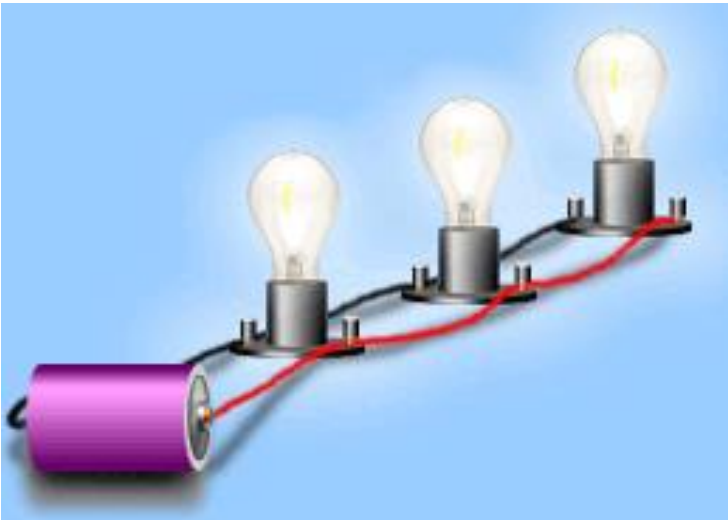
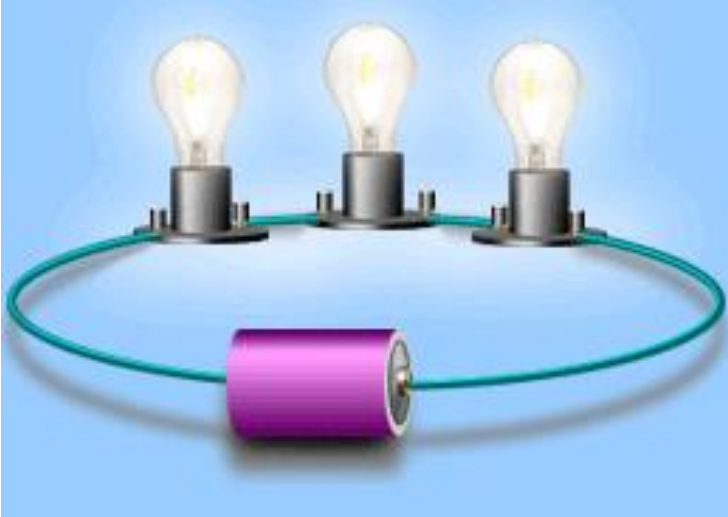
1. Assuming the resistance does not change:
 - As voltage increases, current increases.
 - as voltage decreases, current decreases.

2. Assuming the voltage does not change:
 - As resistance increases, current decreases.
 - As resistance decreases, current increases.

RECAP!!

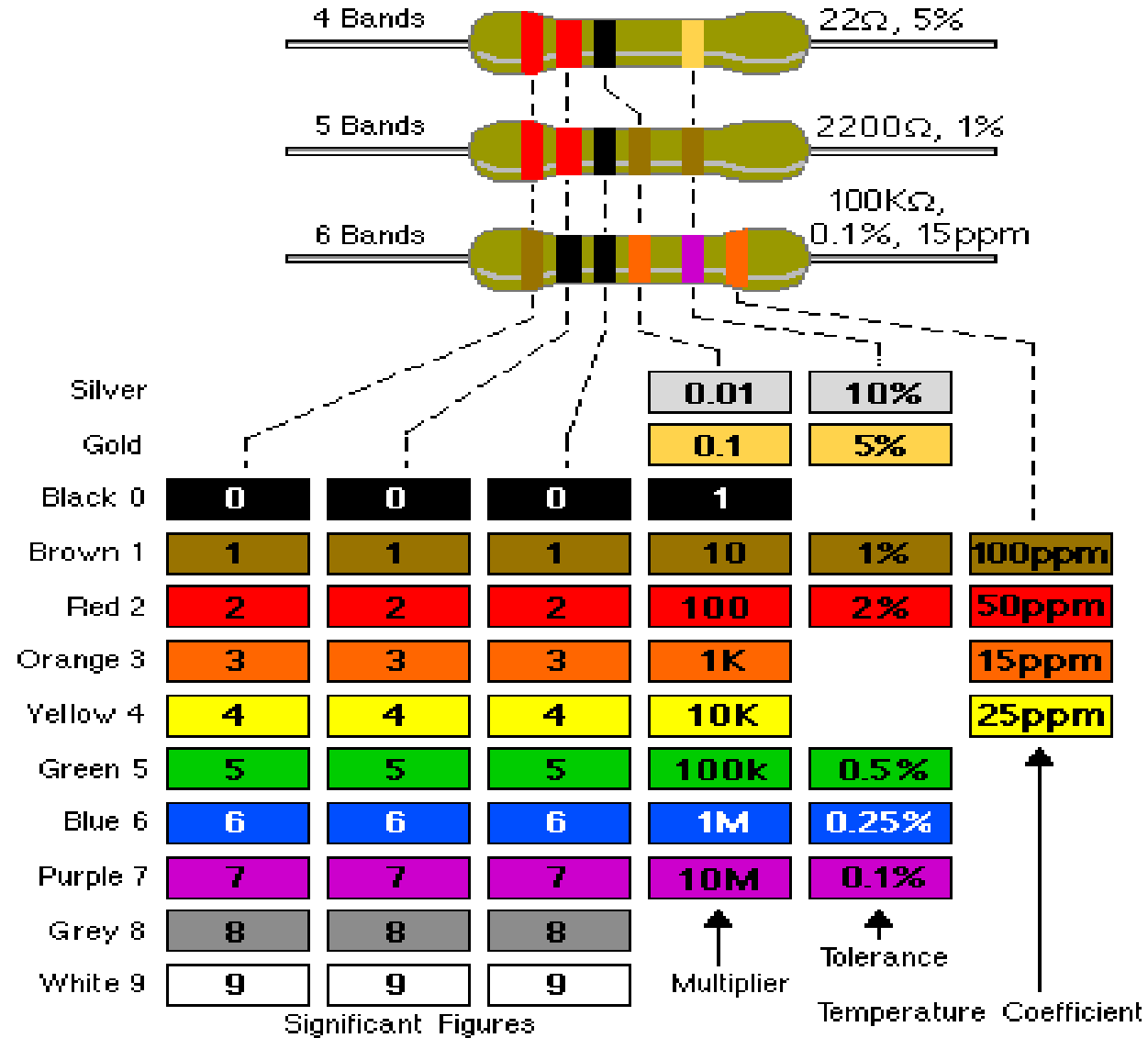
- What is Voltage?
- What is Current?
- What is Resistance?

SIMPLE CIRCUITS



- Series circuit
 - All in a row
 - 1 path for electricity
 - 1 light goes out and the circuit is broken
- Parallel circuit
 - Many paths for electricity
 - 1 light goes out and the others stay on

RESISTOR COLOR CHART



Resistor Color Code System

LAB TIME