VOLTAGE, CURRENT & RESISTANCE

What kind of car does an electrician drive?

VOLTAGE, CURRENT & RESISTANCE

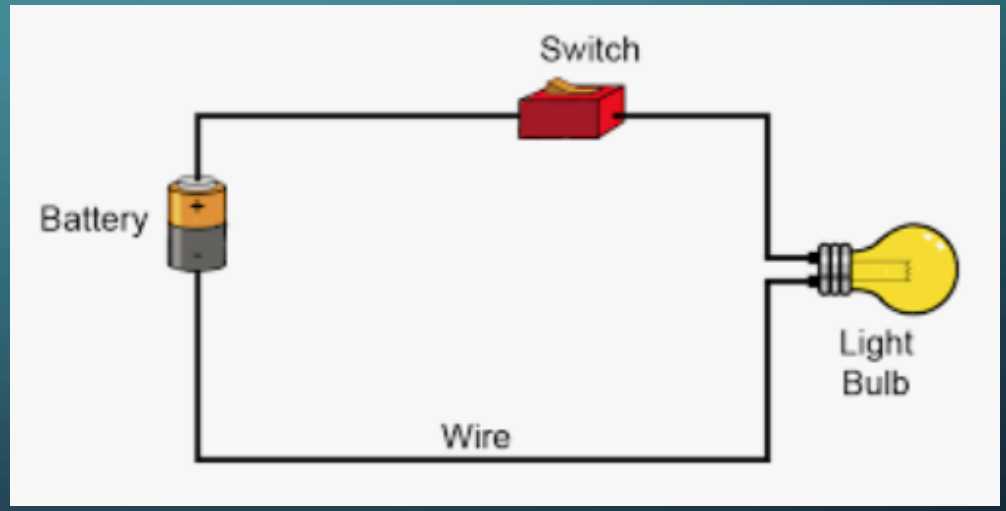
A Volts-wagon!

VOLTAGE, CURRENT, RESISTANCE

An electrical circuit is a pathway that allows electrons to flow.

Within a circuit, we can describe quantities such as:

- **Voltage**
- **Current**
- **Resistance**



WHAT IS VOLTAGE?

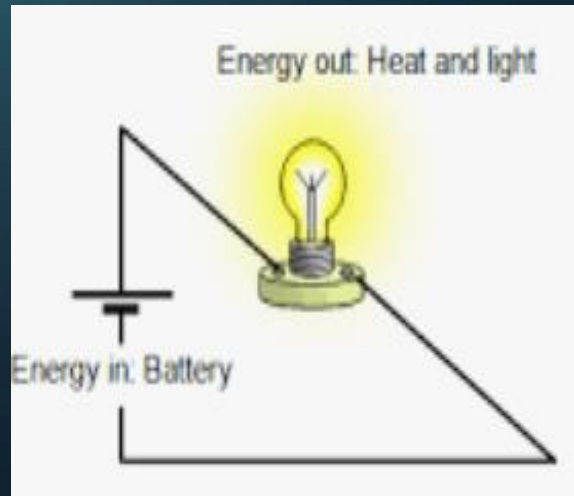
Voltage (also known as an electrical potential difference) is the amount of potential energy between two points of a cell.

It is the difference in charge between two points.

A unit of charge (called a coulomb) is able to gain voltage when it passes through a source.

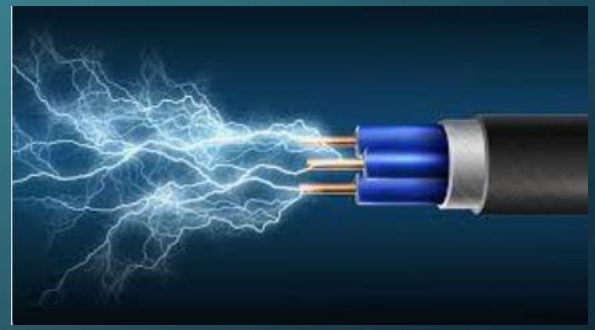
We can measure the amount of voltage in **volts (V).**

The symbol to represent voltage is **V**.



WHAT IS CURRENT?

Electric current is the rate where electric charge flows past a certain point in an electric circuit.



It can be described as the movement of electrons through a wire.

We can measure the amount of current in **amperes (A)**.

The symbol to represent current is **I**.

WHAT IS RESISTANCE?

Resistance is the degree to which the flow of current is hindered by a **load**.

- A load is an object that is able to resist the flow of current.

- Loads are able to convert electrical energy into another form of energy.

<u>Examples</u>:

A lightbulb = a load that converts electrical energy into light and thermal energy

A radio = a load that converts electrical energy into sound energy

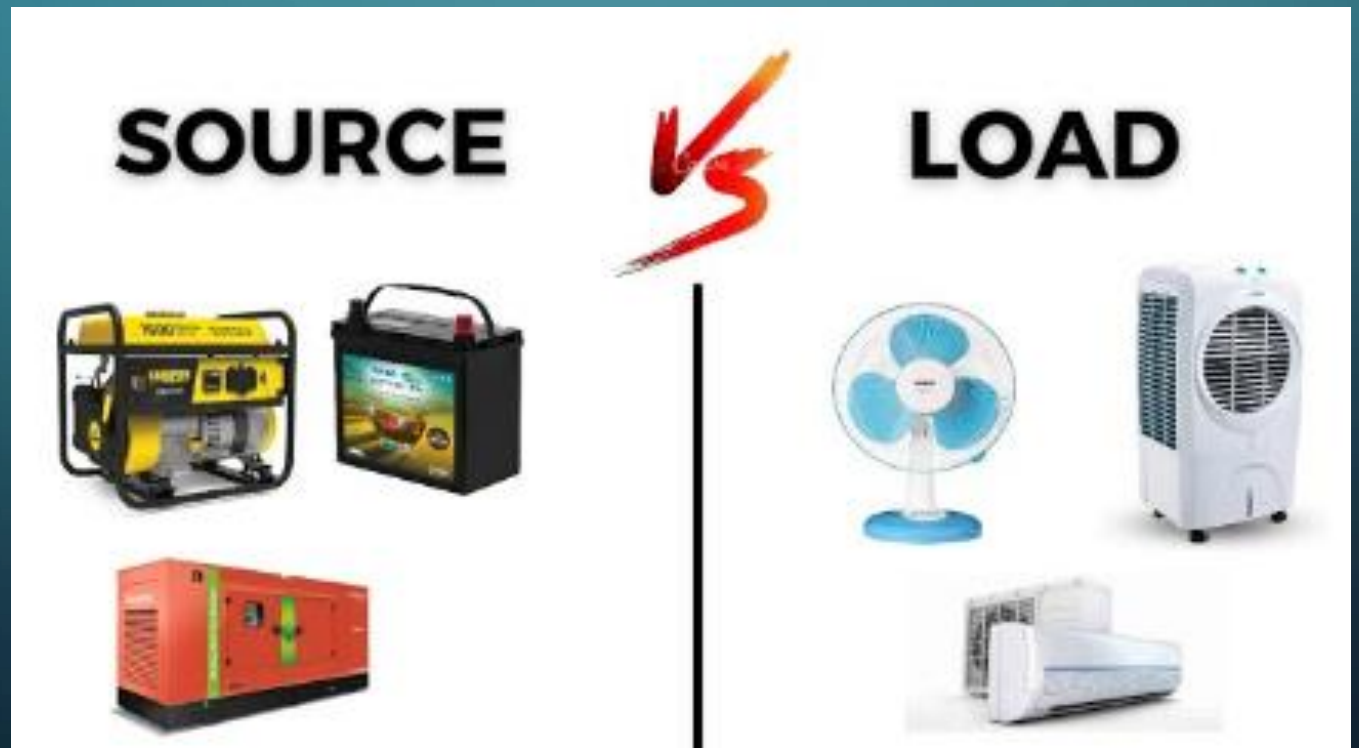
We can measure the amount of resistance in **ohms (Ω)**.

The symbol to represent resistance is **R**.

SOURCE VS. LOAD?

A **source** is a device <u>delivering energy</u> into a system

A **load** is a device <u>extracting energy</u> from a system



An **incandescent light bulb** typically consists of a glass enclosure containing a tungsten filament.

They convert electricity into light by heating the filament, using electric current, until it emits electromagnetic radiation.

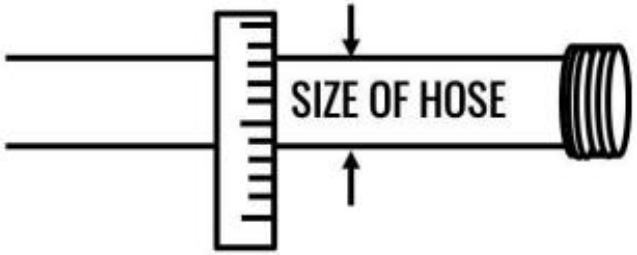
As current passes through the filament, its **high resistance** causes its **temperature to rise** until **it glows**.

A typical incandescent light bulb. The filament is the thin wire stretched between the vertical contact wires and held up by two other support wires.

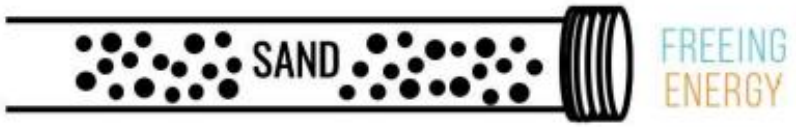
Electricity is like a water hose

Voltage — Volts (V)

Current — Amps (A or I)



Resistance — Ohms (R or Ω)

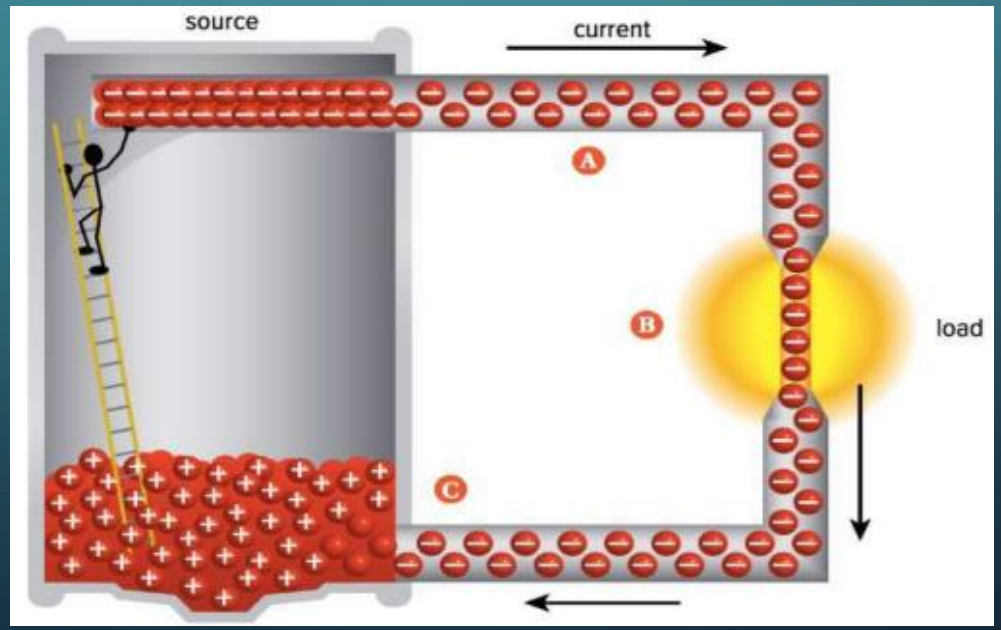


Variable	Symbol	Unit
Voltage	V	Volts (V)
Current	I	Amperes (A)
Resistance	R	Ohms (Ω)

CIRCUITS

An electrical circuit always contains a **source**, a **load**, and **wires** that are connected in a **closed loop**.

Electrical circuits allow current to flow through each component.



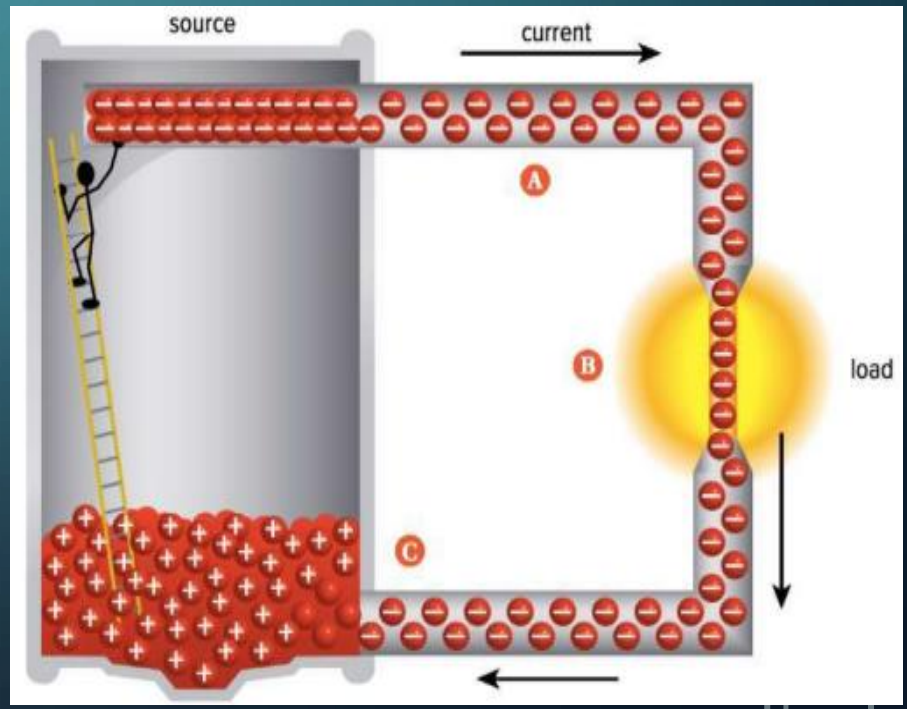
HOW DOES CURRENT FLOW THROUGH A CIRCUIT?

Electrons will leave the negative terminal (anode) of the electrochemical cell due to the repulsion between the charges and the attraction to the positive charges in the positive terminal (cathode).

The electrons leaving the electrochemical cell will carry voltage provided by the cell.

The electrons will pass through the load and transfer some of its energy to the load.

The electrons will leave the load and return to the cell.

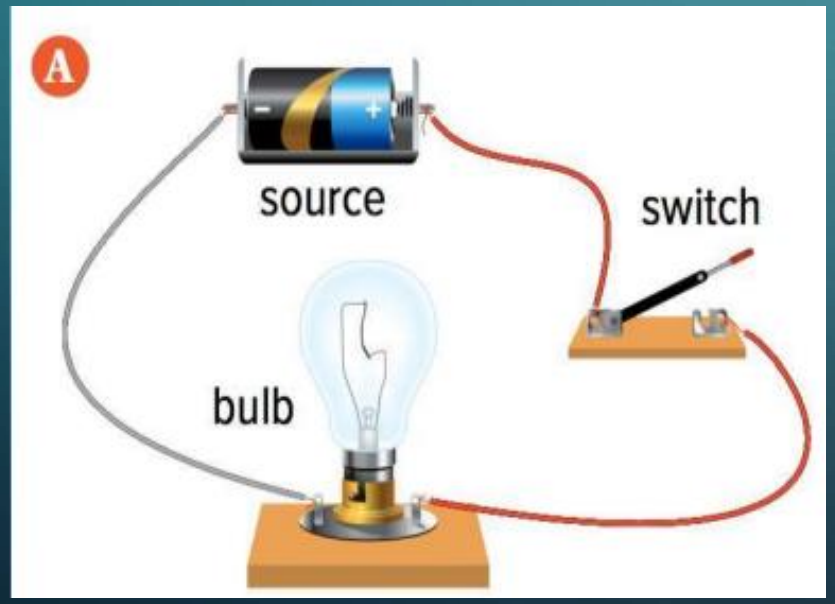


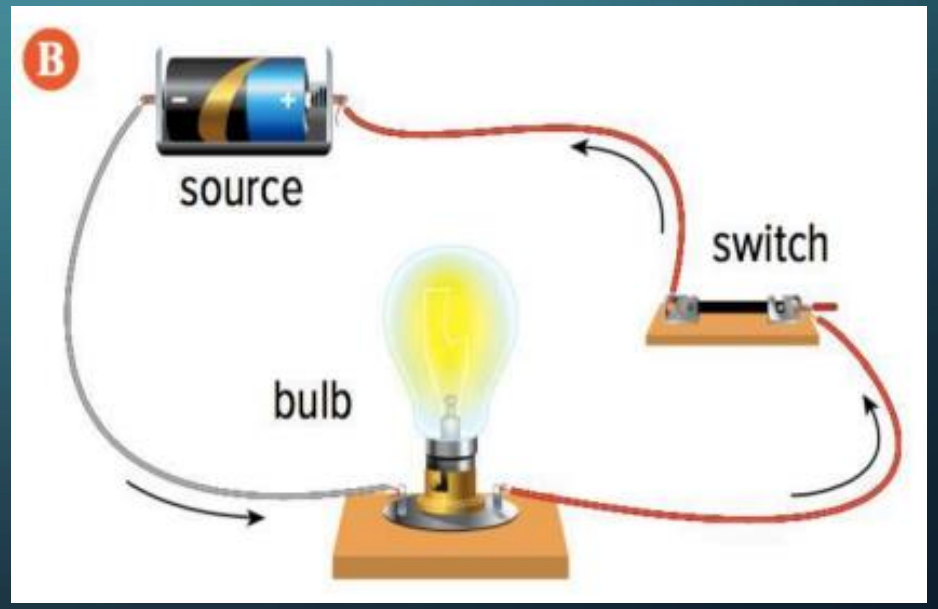
SWITCH

We can control the flow of current with a switch.

If the switch is **open**, the circuit is open and current cannot flow.

If the switch is **closed**, the circuit is closed and current can travel.

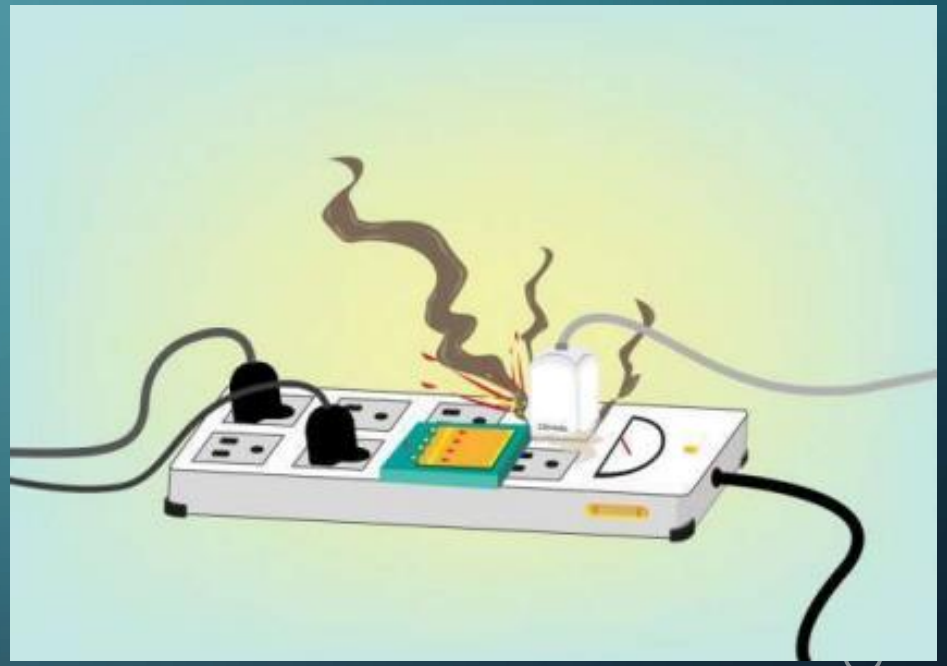




SHORT CIRCUIT

It is also possible to create a **short circuit**.

A short circuit results when the resistance within the circuit is too low, making the current so high that it becomes dangerous.



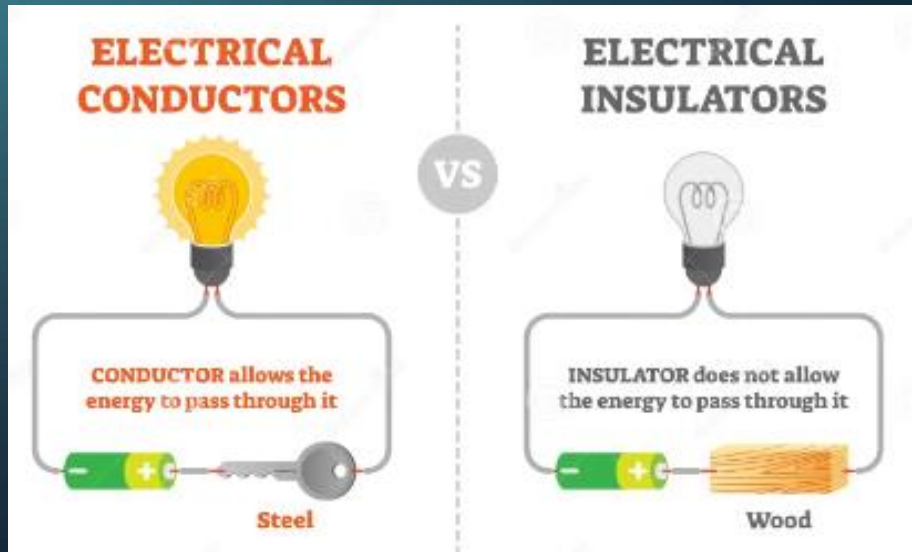
Example: If there wasn't a load (light bulb) to resist the flow of current, the current would be so large that the conductor would get very hot and start a fire.

INSULATORS & CONDUCTORS

- When creating a circuit, it is important to understand what materials are insulators and what materials are conductors. Electrons are able to either stay on the surface of an object or travel through it.

- **Insulator**: A material charges cannot travel through

- **Conductor**: A material charges can travel through

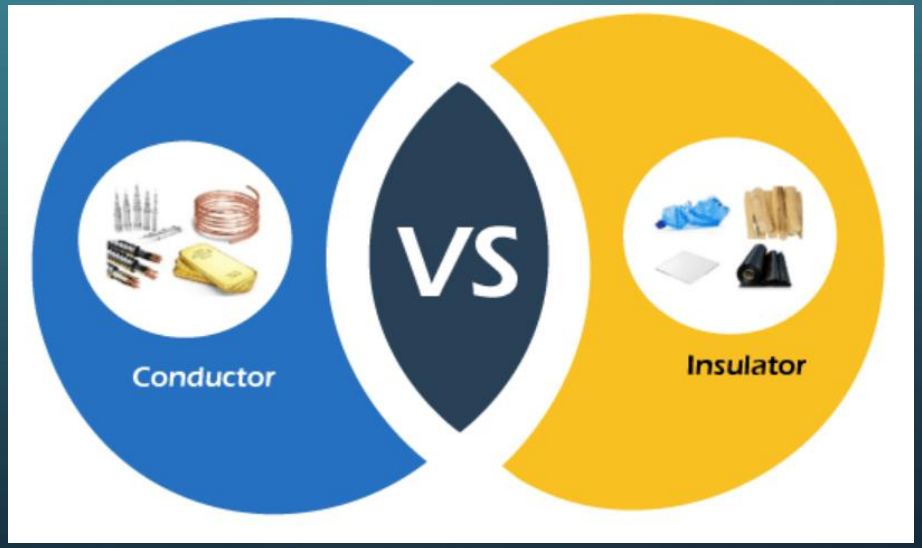


INSULATORS & CONDUCTORS

We can describe how easily charges are able to travel through a material as **conductivity.**

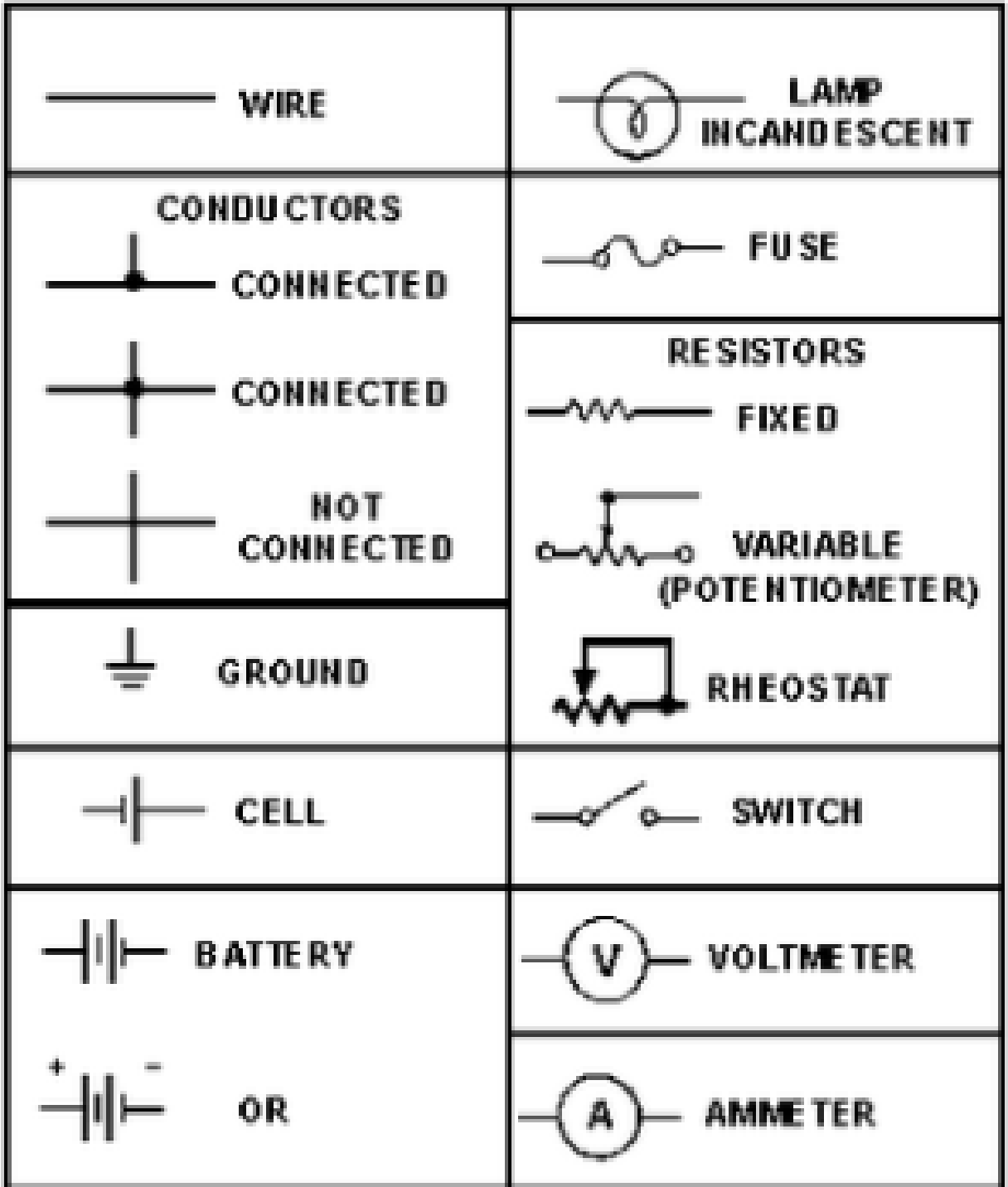
The higher the conductivity of a material, the easier electrons are able to travel through it.

Example: metals tend to be good conductors whereas plastics are insulators



CIRCUIT SYMBOLS

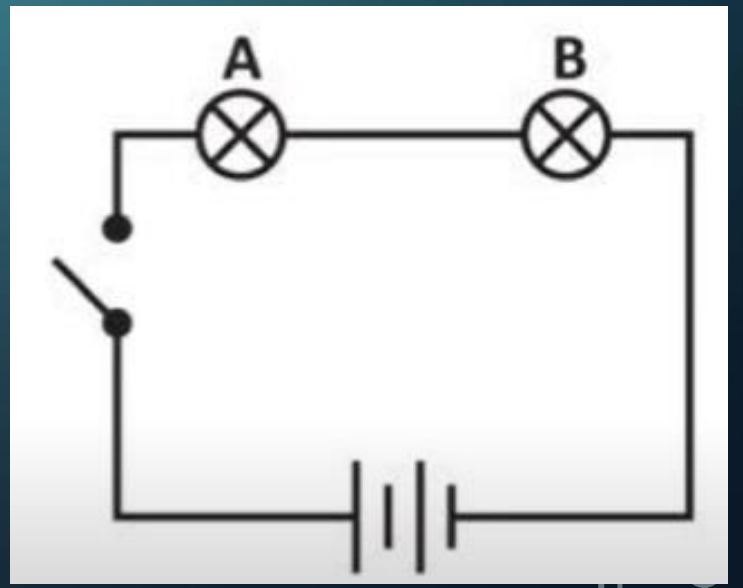
- Circuit diagrams are important as they provide a clear and concise way of communicating the **design of an electrical circuit.**
- They help in understanding the **functioning** of the circuit, making it easier to diagnose and **fix any problems**.
- These **symbols** are used in circuits and electrical diagrams to recognize a component.



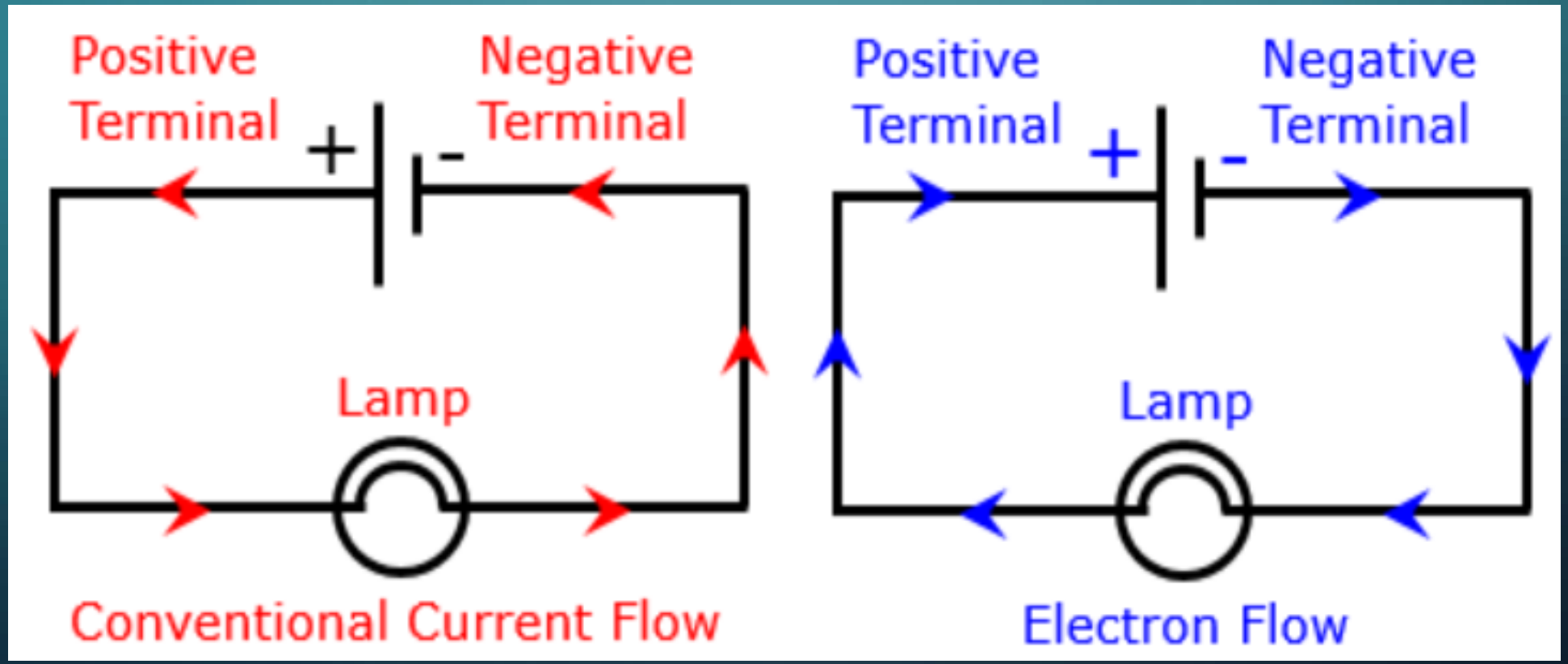
DRAWING CIRCUIT DIAGRAMS

When drawing circuit diagrams, there are important rules to remember:

- Cables and wires in a circuit are drawn as **straight lines**.
- Make right-angle corners so that the finished diagram is a **rectangular shape.**
- Wires should **not cross over** each other.
- We need to use the **correct symbols** for each component in the circuit.
- When drawn, the circuit forms a closed loop. There should be **no breaks in a complete circuit**.



CONVENTIONAL FLOW VS. ELECTRICAL FLOW



PHYSICISTS WERE WRONG!