Essentials of Electricity 2:
Circuits

A **circuit** is a path through which electrical energy flows. Electrons are attracted down a wire towards a source of positive charge. In order for a circuit to work, the path must form an uninterrupted loop, i.e., the circuit must be **closed**. If there is a gap in the circuit, the circuit is **open** and no electricity will flow. We can measure how much energy flows through a circuit in terms of the amount of charge (q) that flows past a point in a fixed amount of time (t). This is the **current (I)**, and it is measured in **amperes (A)** or **amps**. The equation for current is shown below:

$$I = \frac{q}{t}$$

The direction in which current flows is defined as the direction in which a *positive* charge would move through the circuit.

COMPONENTS OF AN ELECTRICAL CIRCUIT

A **battery** is a source of electrical energy. It has two **terminals**, which are places to connect to the battery. Current flows from the positive terminal through the circuit to the negative terminal.

A **resistor** or **load** on a circuit is anything that draws out some of the energy in the circuit because the current has a harder time flowing through it. Appliances are resistors (they use the energy to do things) but the wire itself is also a resistor, since it turns some of the energy into heat. **Resistance (R)** is a measure of how easily current flows through something. Resistance can be calculated in terms of voltage and current using **Ohm's Law**:

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

The units of resistance are **ohms (Ω)**. Note that current is not a constant; it changes with the arrangement of wires and loads in a circuit. A battery will always have a consistent voltage, and a load will have a consistent resistance. These two things will determine the amount of current in any part of a circuit.

Each battery and each resistor in a circuit has a potential difference across it. A resistor in a circuit is a **potential drop**, meaning the potential difference across the resistor is a negative number. A battery that is powering a circuit is a **potential rise**, meaning the potential difference across the battery is a positive number. If there's only one battery, it must be the power source, so it must be a potential rise. But be careful! It is important to pay attention to the direction of battery symbols in circuit diagram if there's more than one battery. If a battery is installed backwards in a circuit, it serves as a resistor and becomes a potential drop!

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