

Kirchoff's Laws & Ohm's Laws

Electrons lose electric energy as they pass through loads (computers, iPods, lights, toasters etc.) They travel in series and in parallel circuits.

Draw an example of each:

Series circuit (1 path for electrons)

Parallel circuit (2+ paths for electrons)

Kirchoff (German scientist in mid-1800's asked these questions:

1. When electrons pass through several loads, what determines how much electric potential energy they lose?
2. When electrons have a choice of paths, what determines how many go each way?

Kirchoff) looked to:

Conservation of Energy. Electrons gain energy in **sources** (batteries or electric outlet) and lose energy in **loads** (electric devices). Energy gained = energy lost.

Conservation of Charge – electric charge is neither created or destroyed in a circuit. Nor does it accumulate.

Kirchoff's voltage Law (KVL) – Around any complete electrical path, the increases in electric potential (battery) is equal to the sum of the decreases in electrical potential (loads).

Kirchoff's current law (KCL) – At any junction point in the electric circuit, the total current **into** the junction is equal to the total electric current **out**.

Practise: (done in class)

Ohm – German scientist in mid-1800's - known for his study of resistance . When electrons flow through a load, they meet opposition and lose some energy. This energy is transformed into other useful forms of energy (heat, light, kinetic, sound). For a circuit with a particular resistor, Ohm increased the voltage and found the current increased. It did so at a constant rate.

Graph: typical Ohm results (use Fig. 13.4 in section 13.1)

Not all resistors are 'ohmic'. If there is not a straight line slope, then it is said to be a 'non-ohmic' resistor.

Graph: nonohmic results (use Fig. 13.4 in section 13.1)

Ohm stated: The potential difference between any 2 points in a conductor varies directly as the current between the 2 points. ...or.... $V/I = \text{constant}$ The constant is 'resistance' (R).

$$R = V/I$$

Resistance is measured in 'ohms' (Ω) $1 \Omega = 1 \text{ V/A}$

Factors affecting Resistance – Look at Phet simulation. Also in text, section 13.1 Know relationship between resistance and each of 4 factors (directly proportional or indirectly)

1. _____
2. _____
3. _____
4. _____

Formulas / Relationships to know

Resistance in Parallel $R_T = R_1 + R_2 + R_3 \dots$

Resistance in Series $\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \frac{1}{R_3} \dots$