

Lesson #3: Voltage

Orally: *In order to understand the concept of voltage we must first understand what potential energy is.*

Potential energy is energy that is stored in an object which is available to do work.

Voltage – is electrical potential energy that is formed from high energy chemicals transferring their electrons to relatively low energy chemicals. The difference in energy between the chemicals (the + and – terminal of the battery) represents the potential energy difference (i.e., the voltage). The larger the voltage, the greater the force that electrons will be “pushed” or “pulled” through a circuit. The SI unit of Volts is V.

Orally: *The text distinguishes between the electrical property of voltage (V) and the unit which is used to quantify this phenomenon the volt (V).*

Volts can be calculated as the potential energy supplied per Coulomb of charge (Q) transferred.

$$\text{Volts (V)} = \Delta E / Q \qquad 1.0\text{V} = 1.0\text{J}/1.0\text{C}$$

Exercise:

Calculate the number of Volts produced when the change in electrical potential energy is 120J for 5.0C of charge.

$$\text{Volts (V)} = 120\text{J}/5.0\text{C} \qquad \text{Volts (V)} = 24.0\text{V}$$

Voltage is measured with a voltmeter. Since voltage measures the difference in potential energy, the voltmeter must be linked in parallel with the circuit to “see” the difference between two points in the circuit.

Orally: *Although some current must pass through the voltmeter it is considered to be negligible and the results are accurate.*

Recall what happens to cells in series (i.e., the volts add), vs. what happens when cells are placed in parallel (i.e., the volts remain the same, but the cells will last longer)

The voltage of the battery indicates the amount of force “pushing” the electrons through the wire)

When cells are in series, add the voltages together.

When cells are in parallel, voltage stays the same.

The wire in a circuit has no theoretical resistance for e- to flow, so none of the potential energy is lost in the wire.

The load (i.e., a light bulb) converts all of the potential energy into another form of energy, so the potential difference across a load shows a voltage decrease equal to the battery. Orally:

Video: Voltage explained

https://www.youtube.com/watch?v=w82aSjLuD_8

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