Physics Honors: Potential Difference, Voltage, and Current

Electric Potential Difference

Electric Potential Difference (ΔV) is also called Potential Difference.

It is the work need to move a positive test charge from one place to another, divided by the magnitude of the charge

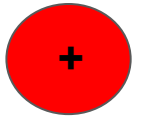
$$\Delta V = \frac{W}{Q}$$

ΔV = Potential Difference (Volts or J/C)

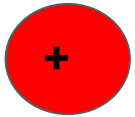
W = Work done on Q (Joules)

Q = Charge (C)

Charges Always Move From High Potential to Low Potential



High Electric Potential



Low Electric Potential

Voltage vs Volts

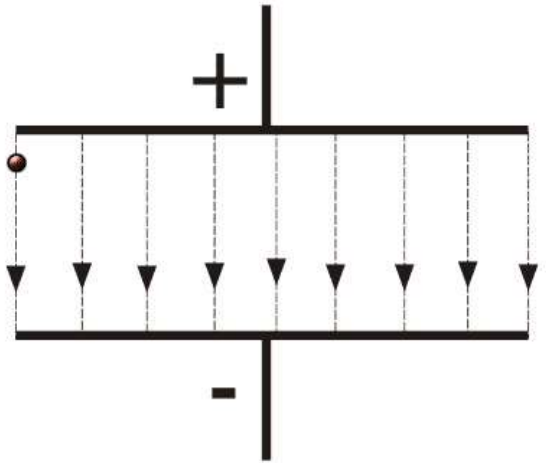
The Electric Potential Difference (ΔV) is sometimes referred to as “Voltage”

The units for Electric Potential Difference (ΔV) is Volts.

Electric Potential in a Uniform Field

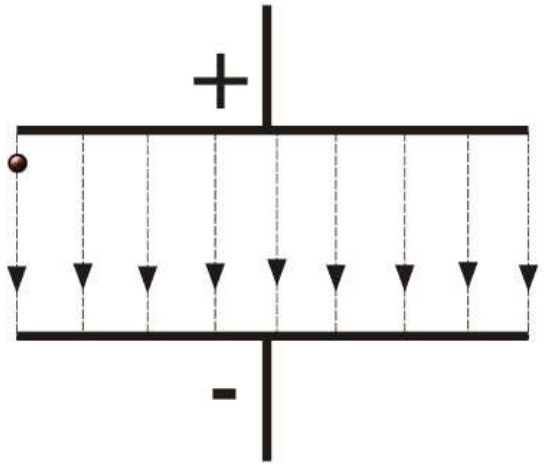
You can produce a uniform electric field by placing two large, flat conducting plates parallel to each other. One plate is charged positively, and one is charged negatively.

The magnitude and direction of the field are the same at all points between the plates (except the very edge)



Electric Potential in a Uniform Field

The potential difference between two locations in a uniform electric field equals the product of electric field intensity and the distance between the location parallel to the direction of the field



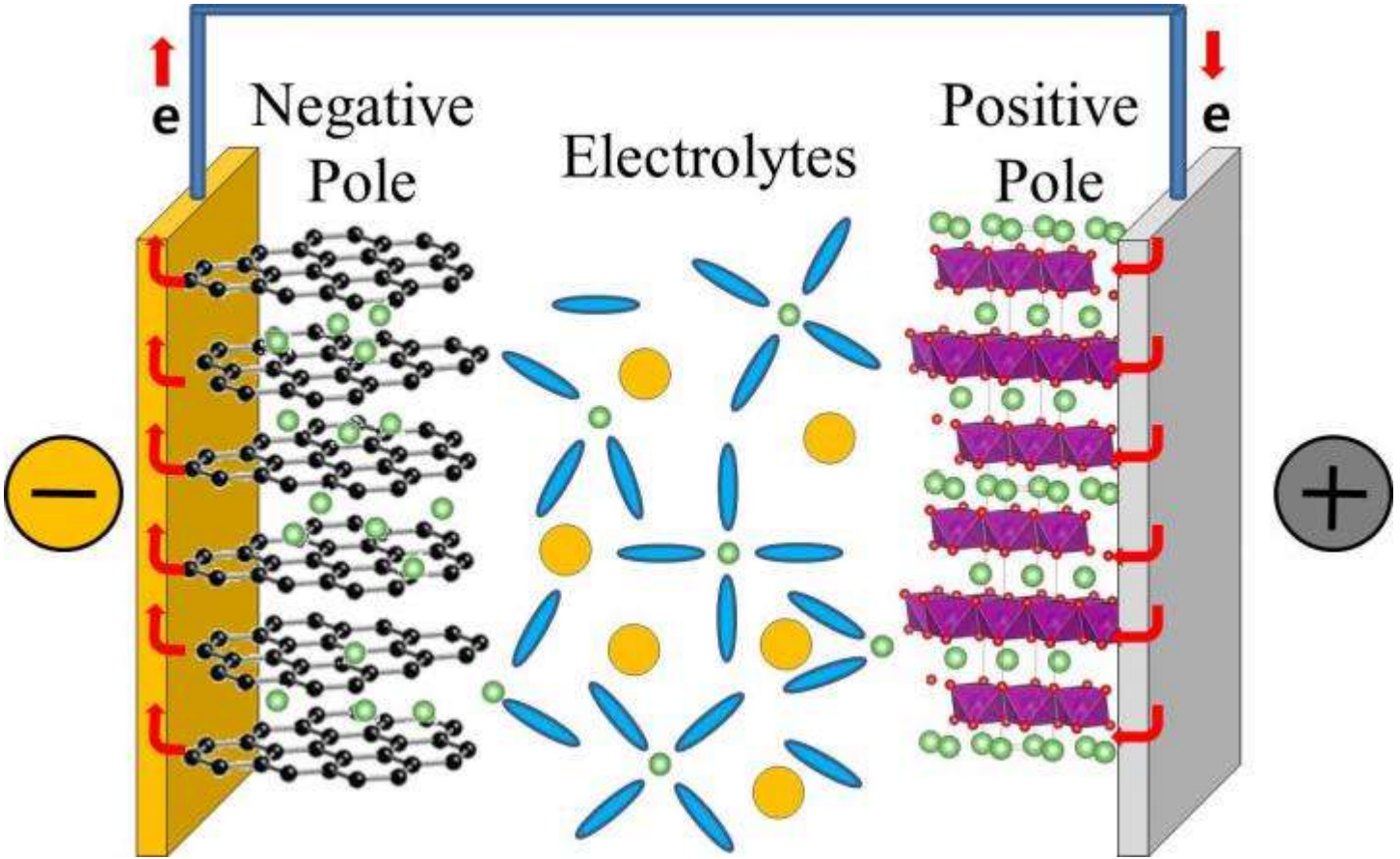
ΔV = Electric Potential (volts)

E = Electric field (n/c)

d = Distance (m)

$$\Delta V = Ed$$

Batteries



Current

The idea that electrons will always move from high voltage to low voltage is important when understanding how current work.

Electric Current is defined as a flow of charged particles.

Conventional Current is defined as the direction that positive charges flow, although usually it is electrons (negative) that flow through circuits.

Current

Current is measured in units of Amperes (A). An ampere is a flow of electric charge equal to 1 coulomb per second.

Amperes is often shortened to Amps in everyday language

Power

Power is the rate at which energy is transferred or transformed.

For circuits, power is equal to the current times the potential difference

$$P = I \Delta V$$

P = Power (Watts)

I = Current (Amperes)

ΔV = Electric Potential (Volts)

Power Practice Problem

If a simple motor has a current of 3.0 A and a potential difference of 120 V, what is the power used by the motor?