2nd Semester AP Physics (Ashwin Jacob)

Electrostatics

3 Rules of Electrostatics

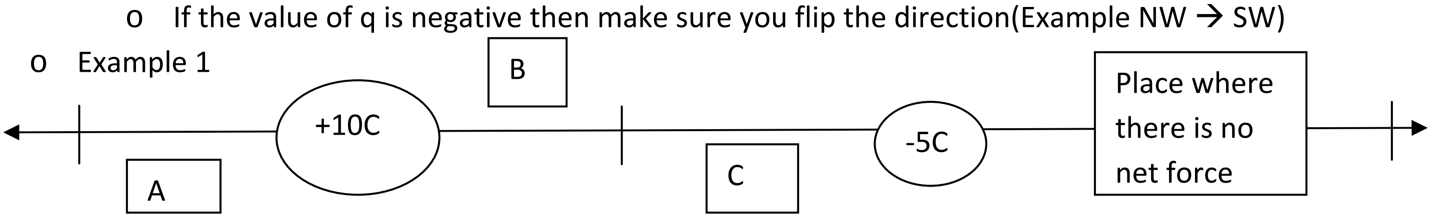
1. Like charges Repel
2. Opposite charges attract
3. Charges Objects attract neutral objects

Only transfer of electrons that produce charging!

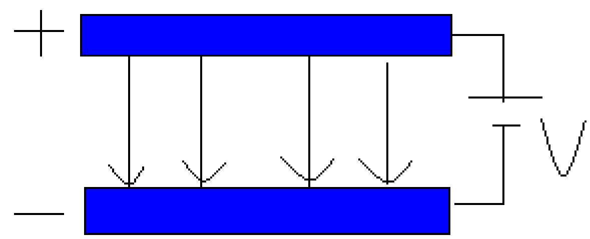
- Insulators-keep charge at that place
  - Example: When you charge a balloon. It has charge only on that surface area that you charged it on; the other surface areas have neutral charges.
- There are two types of charges
  - Charge by Contact (Example: Friction)
  - Induction(Example: Redistribute and separate or grounding)
  - The electrons in the top of electroscope move down to the bottom, the electroscope is temporarily polarized, with the top positive and the bottom negative when your hand touches the top of the electroscope, the electrons flow from the bottom into your hand, and when you take your hand away, the entire electroscope becomes positive(Julia Wang's Example)

Vector	Scalar(Sign matter)
$\vec{F} = k\frac{\lvert qQ \rvert}{r^2}$	$U_e = k\frac{qQ}{r}$
$\vec{E} = k\frac{\lvert Q \rvert}{r^2}$	$V = k\frac{Q}{r}$
$\vec{F} = q\vec{E}$	$W = -\Delta U_e = -q\Delta V$

- Please note that in vectors the sign do not matter because you are using directions
- **Coulomb's Law**: the force of attraction or repulsion between two point charges is directly proportional to the product of the two charges and inversely proportional to the square of the separation between the charges.
- If you see "µC", the symbol mean micro-coulombs, so you multiply your value by ___$*10^{-6}$
- Electric Fields go way if positive and electric field go towards if negative(this is for a positive electric field which makes sense with the **3 laws)**
- If they ask you to find the Electric Field first, then they ask you to find the Force, just use $\vec{F} = q\vec{E}$ to find F
  - If the value of q is negative then make sure you flip the direction(Example NW → SW)
- Example 1



- Example 1 shows where there is a neutral charge in the electric field
- Formula for finding total charge
  - $Q = Ne^-$
  - $e^- = 1.6 * 10^{-19}$ C
- Parallel Plate Apparatus
  - No matter where the electron is, the value of the Electric field is the same
  - Electric Field Formula (ONLY for Parallel Plate)
    - Please note that this formula only applies to parallel plate and other formulas do not work in this situation
    - $\vec{E} = {}^{\Delta V}/_{d}$



  - Please note that if the electron was suspended
    - then the electron's weight would equal to F_e
- Accelerating Plates
  - $\vec{a} = \frac{qV}{md}$
- Deflecting Plates
  - If you had a problem with electricity to calculate the distance it travels vertically, then you can use kinematics
    - $y_f = \frac{1}{2}at^2$
    - $x = v_x t$ → This equation can help you find "t"

Scalars

- You can use Electric Potential Energy to find the speed of an electron or proton or whatever the question states using $U_e = K$
- K is still ${}^{1}/_{2}\,mv^2$
- Voltage and Potential are the same
- Electric field lines are perpendicular to equipotential lines
- High Voltage always wants to move to low current
- Voltage is Joules per Coulomb of Charge