Electrostatics

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What is Electrostatics?

It's defined as "the study of stationary electric charges or fields as opposed to electric currents".

General Formula: $F_e=kq_1q_2/r^2$

The "q" values represent the charge of each subject in coulombs(C) while "r" is the distance between them in meters(m) and "k" is the constant variable($9.0x10^{-9}$ Nm^2/C^2).

If F_e is positive, the force will be repulsive; if negative, the force will be attractive.

Follows the inverse square law principle

Example Problem

A proton and an electron are placed 5.0×10^{-7} m apart. Given that their charges are 1.6×10^{-19} C and -1.6×10^{-19} C respectively, what is the magnitude and direction of the the electrostatic force between them?

Common Misconceptions

- Batteries create charge
  - False, they simply push charges through making a potential difference. The charges come from the electrons in the wires themselves and no charges are “made” as it must obey the Conservation of Electric Charge.
- Electric potential is the same as electric potential energy
  - Electric potential energy is the energy a charge has because of its position in the electric field, while electric potential is potential energy per charge
- Lightning will always hits the tallest object
  - False, otherwise Mt. Everest would be the only object hit by lightning. Where it will be hit is relative to the location of the potential difference in charge that causes the lightning.

Law of Conservation of Electric Charge

Electric charge cannot be created or destroyed. The total amount of electric charge produced in any process is always zero.

If one object acquires a positive charge, then an equal amount of negative charge will be found in areas or objects close to that charge.

Transferring Charges

Materials that are made of metal are said to be conductors of electricity

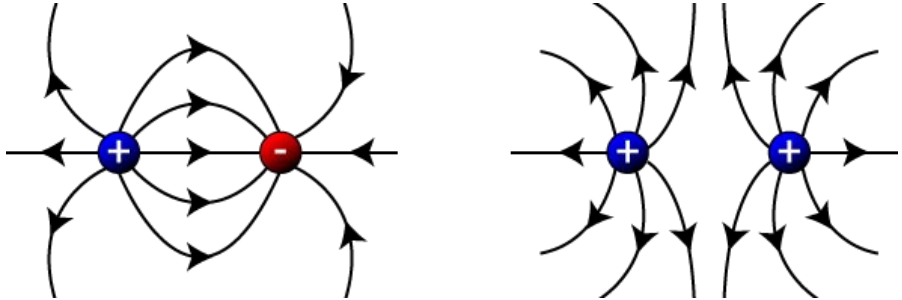
Materials like wood or rubber are commonly known as insulators

Conductors allow electrons to be transferred from one object to another.

1. Conduction
2. Induction
3. Friction

Electric Fields

- It is the region of influence of an electrical force.
- $E=F/q$
- $E=kQ/r^2$
- Electric Field lines are drawn to show the direction of force coming from a field. (Positive to Negative)



Electric Potential and Electric Potential Energy

Electric Potential Energy: how much energy a charge has due to its position in an electric field

- $PE_e = kQq/r$

Electric Potential: Potential energy per charge

- Can also be called potential difference or voltage
- $\Delta V = \Delta PE_e/q$
- For a point charge: $V = kQ/r$ (measured in volts)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189-505-5
193-10 8216
103K
500V
224K
1000
151
561
10
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Capacitors

A capacitor device used to store an electric charge, consisting of one or more pairs of conductors separated by an insulator.

Q=CV … where C is the the capacitance, V is the voltage of the system, and Q is the charge. [measured in farads (F)]

C=ε0A/d... where C=capacitance, ε0=the permittivity constant, A= the capacitor plate area, and d= the distance between the plates. [ε0=8.85×10 -12 C2/Nm2]

The charges on the plates of a capacitor will always be equal and opposite

Example (FOR THE CLASS)

A capacitor is built by placing two 4.6cm X . 79cm conducting plates 1.69mm apart from each other.

What is the capacitance of the capacitor?

Questions???