

University of Virginia

Department of Physics

Physics 606: How Things Work II

Lecture #10 Slides:

Electronic Air Cleaners II

Electric Charge 2

- Charge is conserved
- Charge is quantized
 - One fundamental charge is $1.6 \cdot 10^{-19}$ coulomb
- Charge is an intrinsic property of matter
 - Electrons are negatively charged
 - Protons are positively charged
 - Each has one fundamental charge

Net Charge

- Net charge is the sum of an object's charges
- Most objects have zero net charge (neutral)
- Neutral objects contain equal + & – charges

Question:

A woman rubs her feet on the carpet and gives a shock to her identical twin. If the twin also rubs her feet on the carpet before being touched, the shock will be

1. larger.
2. smaller.
3. the same size.

Voltage

- Charge has electrostatic potential energy (EPS)
- Voltage measures the EPS per unit of charge
 - Raising the voltage of positive charge takes work
 - Lowering the voltage of negative charge takes work
- Voltage is measured in joules/coulomb or volts

Charging Objects

- Like charge separate whenever possible
 - They disperse on the outside of a conductor
 - They accumulate on an outside point or thin wire
- Charging is limited by charge escape
 - Severe repulsion leads to corona discharge
 - Charges leap onto air molecules and escape
 - Air molecules often glow during corona discharge
- If ionization occurs, a spark or arc forms

Polarizing Objects

- Nearby charges can shift an object's charges
- When negatively charged dust nears a wall,
 - the wall's positive charges move toward dust
 - the wall's negative charges move away from dust
 - the wall becomes electrically polarized
- Charged dust clings to walls and surfaces