

Physics Review Sheet: Electrostatics

Key

Use the word bank to complete the fill in the blank. Words may be used more than once.

Attract	Insulator	Newton
Conduction	Inverse	Nuclear
Conductor	Less	Opposite
Coulomb	Lightning	Polarization
Distance	Magnitude	Positive
Electrons	Metal	Protons
Electrostatics	More	Repel
Equal	Negative	Same
Friction	Neutral	Stronger
Induction	Neutrons	Van de Graaff

- The charge on an electron is negative, the charge on a proton is positive, and the neutron is zero.
- Stable atoms contain equal numbers of protons and electrons.
- Like charges repel and opposite charges attract.
- According to Coulomb's Law, the electrical force depends on the distance between the charges and the magnitude of each charge.
- Charged particles experience an electric force.
- A negative ion has more electrons and a positive ion has less electrons.
- A material is a conductor if it allows the electrons to move freely throughout it. An example is metal.
- Materials that acquire a charge through direct contact with another charged object are charged through conduction. Those that acquire a charge from another charged object, but have not been in direct contact with it are charged by induction.
- An object that is charged through conduction will have the same charge as the object that is charging it.
- An object that is charged through induction will have the opposite charge as the object that is charging it.
- In nature, lightning is an example of static electricity.
- A charged balloon sticks to a wall because the charges in the wall rearrange themselves. This is referred to as charge polarization.
- Electrical polarization occurs when the charge distribution in a single molecule separates.
- The unit of charge is the Coulomb.
- The unit of force is the Newton.
- A Van de Graaf generator is a lab device used to build up high voltages.
- Electrostatics is the study of electricity at rest.
- Electrical forces are stronger than gravitational forces.
- The strongest force is the strong nuclear force.
- The only sub-atomic particle that will transfer is the electron.

Problems

① $2.0\text{ N} = \frac{(9 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2)(Q_1)(Q_2)}{(1.5)^2} = \boxed{Q_1 = Q_2 = 2.2 \times 10^{-5} \text{ C}}$

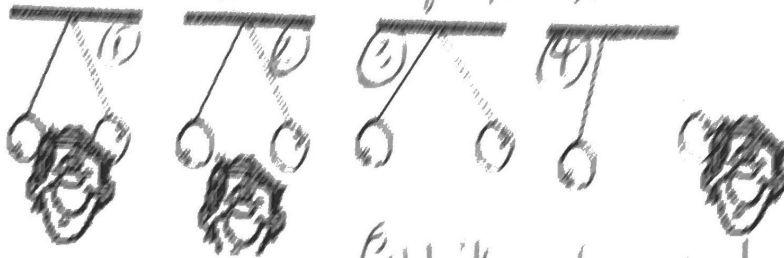
- Two coins lie 1.5 meters apart on a table. They carry identical electric charges. Approximately how large is the charge on each coin if each coin experiences a force of 2.0 N?
- Two small equal pith balls are 3 cm apart in air and carry charges of +3 nC and -12 nC respectively. Compute the magnitude and type of force.

$F = \frac{(9 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2)(3 \times 10^{-9} \text{ C})(-12 \times 10^{-9} \text{ C})}{(0.03 \text{ m})^2} = \boxed{-3.6 \times 10^{-4} \text{ N}}$ attractive

Diagrams

Name the charge process that is demonstrated below, explain why and analyze the results.

① Positive ② Positive charge has more

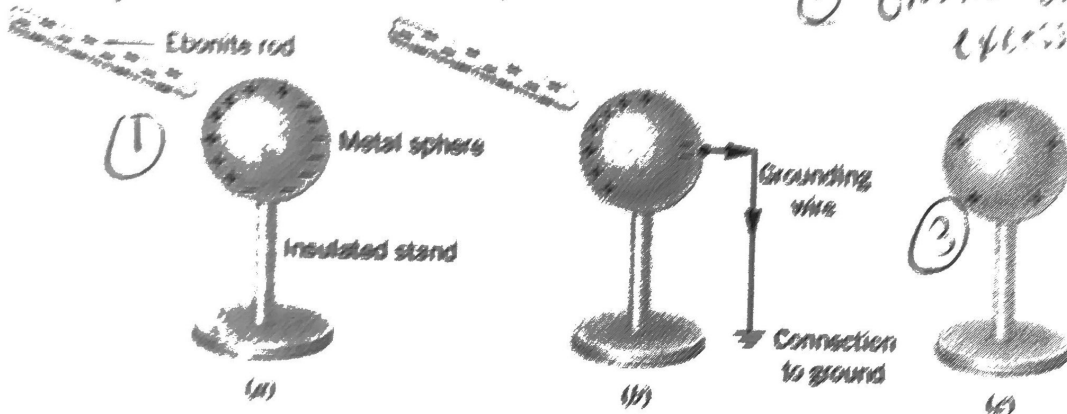


③ Like charged balloons repel.
④ Balloon attracts oppositely charged hand.

Name the charge process that is demonstrated below, explain why and analyze the results.

① Negative rod induces polarization.

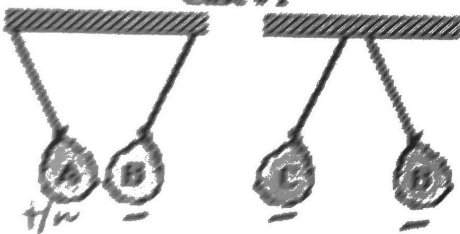
② Ground wire eliminates excess electrons.



③ Sphere is now positively charged.

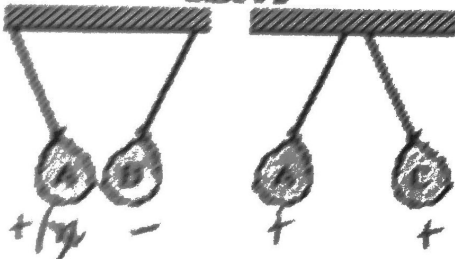
Complete the chart.

Case #1



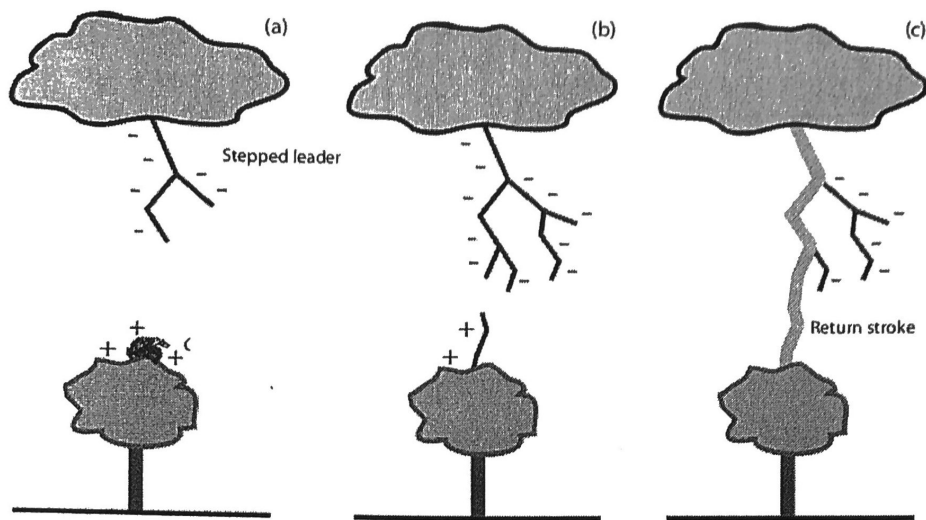
Object	Conclusive evidence to conclude the charge is +, -, neutral
A	+, neutral
B	negative
C	-

Case #2



Object	Conclusive evidence to conclude the charge is +, -, neutral
A	+
B	negative
C	+

Using the diagram below, explain the process for the formation of lightning.



- 1- Cloud becomes charged through friction amongst particles.
- 2- cloud polarized & causes (through induction) ground to become positively charged
- 3- Negative stepped leader reaches down from the cloud.
- 4- Positive streamer reaches up from ground.
- 5- Electrons travel through conductive path between leader & streamer.