**B-Day Due Wed., Jan 5**
**A-Day: Due Thurs., Jan 6**

# 2011 PreAP Electrostatics 2

*From the "Separating Charge" notes*:

1. Contact, induction, or polarization? (*Could be more than one.*)

A. ____ Can only occur with conductors.
B. ____ Rubbing can cause this.
C. ____ No charges are lost or gained.
D. ____ Charges are given an alternative path to escape.
E. ____ Why a balloon sticks to a wall.
F. ____ When the rubber rod is near, but not touching the electroscope.
G. _____Net charge is still zero.
H. _____Net charge afterwards is not zero.
I. _____Final charge of the sphere is the same as the charge of the object that came close.
J. _____Final charge of the sphere is opposite that of the object that came close.

2. A positive rod is brought close to a metal object, which is then charged by induction. Afterwards, is the metal positively or negatively charged?

3. Is this amount of charge possible or not: $-4.806\times10^{-19}$ C (give proof)?

*From our electrostatic demos*. (*Notes: "Separating Charge*")

4. A piece of plastic pipe was rubbed with a piece of fur.
   A. Is the plastic positive or negative?

*The plastic is suspended and another charged piece of plastic is brought close.*

   B. Does the suspended plastic pipe move away or come towards the second pipe?
   C. What will the suspended pipe do when the fur is brought close?

   D. Which is greater: the amount of electrons lost by the fur or gained by the pipe?

*Then a piece of glass is rubbed with silk. The suspended plastic pipe attracted to the glass rod.*

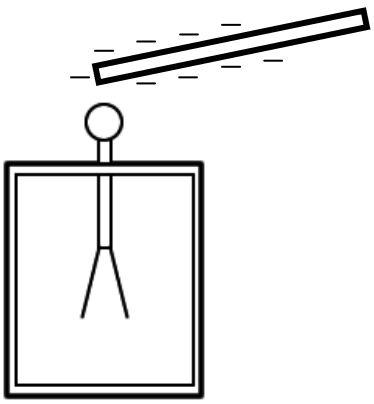
   E. So is the glass rod positive or negative?

5. A. Is a balloon a conductor or an insulator?
   B. If the left side of the balloon is rubbed with fur, does it become positive or negative?
   C. Can electrons move across the balloon?
   D. What is the charge of the right side of the balloon?

6. This time two balloons are rubbed with fur on all sides.
   A. What happens when the two balloons hang next to each other?

   B. The balloons are charged by _____.

7. One of the charged balloons is then moved next to a stream of water coming out from a water faucet. What happens and why (*be sure to talk about the properties of water*)?

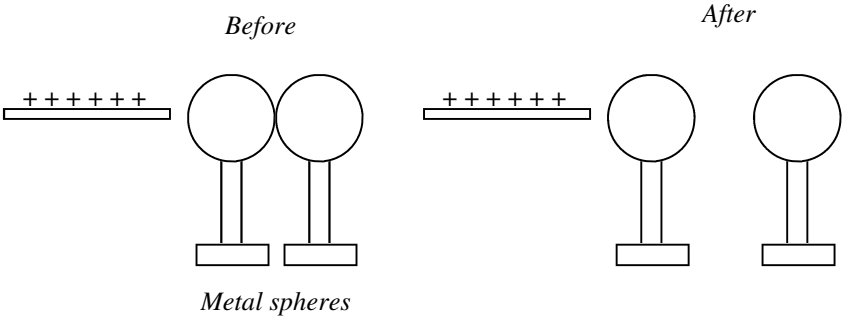


8. Electroscope questions:

A. The ball, leaves, and what connects them are all metal. Are they conductors or insulators?
B. What is the negative rod probably made of?
C. How did we make it negative?
D. When we put the negatively charged rod near the top of the electroscope, electrons in the metal ball do what?
E. What happens to the leaves?
F. Why?

*G.* The electroscope has been charged by _____.
*If I rub the electroscope with the charged rod, the leaves stay out.*
H. Why?

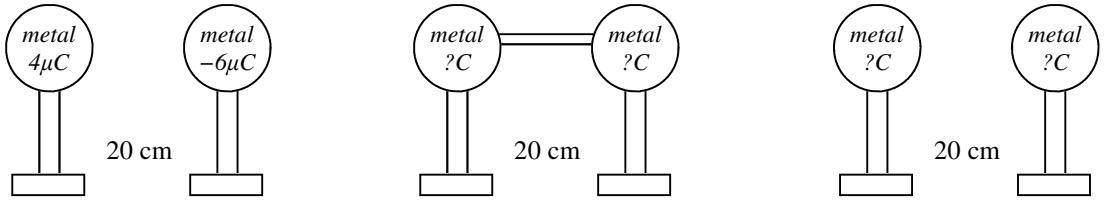
I. This is called charging by _____.




9. A positive rod is brought close to two metal spheres.
   A. On the spheres at the left, draw where electrons will go on the spheres *.

   *Then the two spheres are pulled apart.*

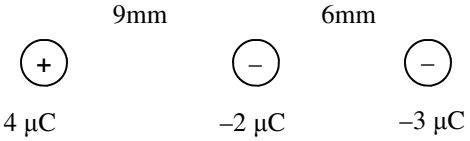
   B. What is the charge of the right sphere after the separation?




10. Two metal spheres have different charges.
    A. Which sphere must have lost electrons to have its initial charge?
    B. Calculate the force between them beforehand (*see worksheet for equation*).

    C. Then they are connected via a conducting rod. What will move: the extra electrons or protons?
    D. What will be the charge on the left sphere after they have touched?

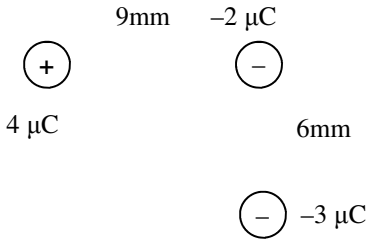
*[Hint: 4 μC = $4\times10^{-6}$ C; 9mm = $9\times10^{-3}$ m]*




11. Three charges are aligned as shown at the left.
    A. * Calculate the force of the 4μC on the –2μC charge.

    B. Draw the direction of this force.
    C. * Calculate the force of the –3μC acting on the –2μC charge.

    D. Draw the direction of this force.
    E. Since forces are vectors, calculate the total force acting on the –2μC charge (magnitude and direction).




12. Now the three charges are moved. You already know the forces between the different charges on the –2 μC charge. Calculate the net force on the –2 μC charge.

13. What is the force acting on the –3 μC charge from the –2 μC charge?

Q9A: The negative will move to the left sphere.
Q11A: 889N  Q11C: 1500 N (notice it is much bigger because it is closer).