Phys 132 - Fundamentals of Physics 2
Homework 1

Name: Solutions
Due Thu, Jan 18, 2007

Print out this homework assignment. Complete each of the following problems and circle your answer. For those problems that involve math, show all your work NEATLY. Use complete equations, no scribbles.

This is the Updated HW1, with Problem 7 already removed.

1. A charged conductor is brought near an uncharged insulator. Which one of the following statements is true?
   A) Both objects will repel each other.
   B) Both objects will attract each other. – See Figure 18.9
   C) Neither object exerts an electrical force on the other.
   D) The objects will repel each other only if the conductor has a negative charge.
   E) The objects will attract each other only if the conductor has a positive charge.

2. Two uncharged conducting spheres, **A** and **B**, are suspended from insulating threads so that they touch each other. While a negatively charged rod is held *near, but not touching* sphere **A**, the two spheres are separated. How will the spheres be charged, *if at all*?

	Sphere **A**	*Sphere* **B**
A)	0	+
B)	-	+
C)	0	0
D)	-	0
E)	+	-

The total charge of A and B must stay zero. Some negative charges from A are pushed over to B, leading to the answer.

3. Complete the following statement: When an ebonite rod is rubbed with animal fur, the rod becomes negatively charged as
   A) positive charges are transferred from the fur to the rod.
   B) negative charges are transferred from the rod to the fur.
   C) negative charges are created on the surface of the rod.
   D) negative charges are transferred from the fur to the rod.
   E) positive charges are transferred from the rod to the fur.

Only negative charges move (usually) and a negatively charged object gets more of them.

4. An aluminum nail has an excess charge of +3.2 μC. How many electrons must be added to the nail to make it electrically neutral?
   A) 2.0×10^{13}
   B) 2.0×10^{19}
   C) 3.2×10^{-6}
   D) 3.2×10^{6}
   E) 5.0×10^{-14}

$$q = Ne$$

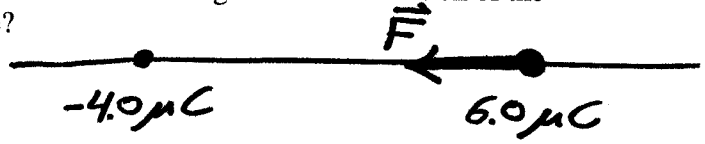
$$N = \frac{q}{e} = \frac{3.2 \times 10^{-6}\ C}{1.6 \times 10^{-19}\ C} = 2.0 \times 10^{13}$$

5. At what separation will two charges, each of magnitude 6 μC, exert a force of 1.4 N on each other?
   A) 5.1×10^{-6} m
   B) 0.23 m
   C) 0.48 m
   D) 2.0 m
   E) 40 m

$$F = k\frac{|q_1||q_2|}{r^2} \quad \rightarrow \quad r^2 = k\frac{|q_1||q_2|}{F} \quad \rightarrow \quad r = \sqrt{k\frac{|q_1||q_2|}{F}}$$

$$r = \sqrt{8.99 \times 10^9 \frac{N\,m^2}{C^2} \frac{(6.0 \times 10^{-6}\ C)^2}{1.4\ N}}$$

6. A −4.0-μC charge is located 0.30 m to the left of a +6.0-μC charge. **Draw a sketch of the situation and label the two charges.** What is the magnitude and direction of the electrostatic force on the positive charge?
   A) 2.4 N, to the right
   B) 2.4 N, to the left
   C) 4.8 N, to the right
   D) 4.8 N, to the left
   E) 7.2 N, to the right



$$F = k\frac{|q_1||q_2|}{r^2} = \left(8.99 \times 10^9 \frac{N\,m^2}{C^2}\right)\frac{(4.0 \times 10^{-6}\ C)(6.0 \times 10^{-6}\ C)}{(0.30\ m)^2}$$

$$= 2.4\ N \quad \text{(to the left)}$$