Problem Set: Static Electricity

*Complete all the problems in this set in an organized fashion, showing ALL necessary WORK. Problems with only answers may be considered incorrect and lower your grade. Clearly indicate your answers by underlining or circling the final answer to each problem. This set is due at the beginning of the block. YOU MUST INCLUDE VECTOR DRAWINGS FOR EACH PROBLEM TO GET FULL CREDIT.*

**Electrical Force 20.2 pp. 170 – 171**

1. A negative charge of -2.0 x 10-4 C (qA) and a positive charge of 8.0 x 10-4 C (qB) are separated by 0.30 m. What is the force between the two charges?

2. A negative charge -6.0 x 10-6 C (qA) exerts an attractive force of 65 N on a second charge (qB) 0.050 m away. What is the magnitude of the second charge?

3. Two positive charges of 6.0 μC are separated by 0.50 m. What force exists between the charges?

4. An object with charge +7.5 x 10-7 C is placed at the origin. The position of a second object, charge +1.5 x 10-7 C, is varied from 1.0 cm to 5.0 cm. Draw a graph of the force on the object at the origin.

**Chapter Review Problems 20.2 pp. 171-174**

20. Two charges, qA and qB, are separated by a distance, *d*, and exert a force, F, on each other. Analyze Coulomb’s law and identify what new force will exist if:

a. qA is doubled

b. qA and qB are cut in half

c. *d* is tripled

d. *d* is cut in half

e. qA is tripled and *d* is doubled

22. How many Coulombs of charge are on the electrons in a nickel? Use the following method to find the answer:

a. Find the number of atoms in a nickel. A nickel has a mass of about 5 g. Each mole (6.02 x 1023 atoms) has a mass of about 58 g.

b. Find the number of electrons in the coin. A nickel is 75% Cu and 25% Ni, so each atom on average has 28.75 electrons.

c. Find how many coulombs of charge are on the electrons.

23. A strong lightning bolt transfers about 25 C to Earth.

a. How many electrons are transferred?

b. If each water molecule donates one electron, what mass of water lost an electron to the lightning? One mole of water has a mass of 18 g.

24. Two electrons in an atom are separated by 1.5 x 10-10 m, the typical size of an atom. What is the electrical force between them?

25. A positive and a negative charge, each of magnitude 1.5 x 10-5 C, are separated by a distance of 15 cm. Find the force on each of the particles.

26. Two negative charged bodies each with charge -5.0 x 10-5 C are 0.20 m from each other. What force acts on each particle?

27. How far apart are two electrons if they exert a force of repulsion of 1.0 N on each other?

28. A force of -4.4 x 103 N exists between a positive charge of 8.0 x 10-4 C and a negative charge of -3.0 x 10-4 C. What distance separates the charges?

29. Two identical positive charges exert a repulsive force of 6.4 x 10-9 N when separated by a distance of 3.8 x 10-10 m. Calculate the charge of each.

30. A positive charge of 3.0 μC is pulled on by two negative charges. One, -2.0 μC, is 0.050 m to the north and the other, -4.0 μC, is 0.030 m to the south. What total force is exerted on the positive charge?

31. Three particles are placed in a line. The left particle has a charge of -67 μC, the middle, +45 μC, and the right, -83 μC. The middle particle is 72 cm from each of the others, as shown below:

1. Find the net force on the center charge
2. Find the net force on the right charge

72 cm

72 cm

-67 μC

+45 μC

-83 μC

**Appendix B Extra Practice Problems p.306-307**

11. Two identical point charges are 3.00 cm apart. Find the charge on each of them if the force of repulsion is 4.00 x 10-7 N.

12. A charge of 4.0 x 10-5 C is attracted by a second charge with a force of 350 N when the separation is 10.0 cm. Calculate the size of the second charge.

13. Three particles are placed on a straight line. The left particle has a charge of +4.6 x 10-6 C, the middle particle has a charge of -2.3 x 10-6 C, and the right particle has a charge of -2.3 x 10-6 C. The left particle is 12 cm from the middle particle and the right particle is 24 cm from the middle particle. Find the total force on the middle particle.

14. The left particle in #13 is moved directly above the middle particle, still 12 cm away. Find the force on the middle particle.