Electrostatics Review Handout

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-Electrostatics (or Static Electricity) is the study of stationary electric charges.

-Electrically Charged Objects-

-Like charges will repel each other (positive repels positive; negative repels negative).

-Unlike charges will attract each other (positive attracts negative charge).

-Both negative and positive charges will attract neutrally charged objects.

-Charge has everything to do with the balance of protons and electrons in an atom (more electrons=negative; more protons=positive; equal amounts=neutral).

-Charge is conserved, meaning that neutral objects have no net charge (if two neutral objects touch/get rubbed together, one object gets a net negative charge, and the other gets a net positive charge, attracting the two objects).

-Usually natural materials (your hair) tend to lose electrons, synthetic materials (like plastic) tend to gain electrons, and some materials (like wood) tend to stay neutral.

-Basic Electrostatics Vocabulary-

-Conductor- Material that electric charges can easily flow through.

-Insulator- Material that electric charges **DO NOT** easily flow through.

-Electroscope- Device used to indicate existence of a charge.

-There is also an electrostatic generator used to accumulate or create an electric charge; aka the Van de Graaff Generator.

-Coulomb's Law-

-When two charges exert a force (F) on one another that is directly proportional to the product of the magnitudes of the charges (q) and inversely proportional to the square of the distance (r) between their centers.

-Equation: *F=(kq1)(q2)/r2*

-F=electrostatic force (N)

-q=charge (C)

-k=9x10 to the 9th N. m2/c2

-r=separation between charges (m)

<u>-Problem 1-</u>

- A plastic ball has a charge of +10 nC. How many electrons does it have?

- q=10x10 -9 C

- 1 electron=1.6x10 -19 C

- (1 electron/1.6x10 -19 C)(10x10 -9 C)=6.25x10 10 electrons

- -Problem 2-

- What is the magnitude and direction of the force on a charge of +4 nC that is 5cm from a charge of +50 nC

- q1=+4x10 -9 C

- q2=+50x10 -9 C

- r=.05m

- F=(kq1)(q2)/r2=9x10 9(4x10 -9)(50x10 -9)/(0.05) 2 =7.2x10 -4 N, which is repulsive (away from each other)

-Problem 3-

Consider two charged objects. One carries a charge of 18 uC. When the two are separated by a distance of 0.9m, there is a force of 2.7 N between them. What is the charge on the second object?

- q1=18x10 -6 C

- r=0.9m

- F=2.7 N

- F=(kq1)(q2)/r2

- Fr2=(kq1)(q2)

- q2=Fr2/kq1=2.7(0.9)2/9x10 9(18x10 -6)=1.35x10 -5 C-Problem 4-

-Problem 4-

-Be creative, make up your own problem, and solve it. This will help you to be better at solving Coulomb's Law equations.