Name_____

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Unit I - Worksheet 3: Coulomb's Law

1. Given the mathematical representation of Coulomb's Law, $F = k\frac{q_1 q_2}{r^2}$, where $k = 9.0 \times 10^9 \, Nm^2/C^2$, describe in words the relationship among electric force, charge, and distance.

2. By how much does the electric force between a pair of charged bodies diminish when their separation is doubled? tripled?

3. The most common isotope of hydrogen contains a proton and an electron separated by about 5.0×10^{-11} m. The mass of a proton is approximately 1.7×10^{-27} kg. The mass of the electron is approximately 9.0×10^{-31} kg.

   a) Use Newton's law of universal gravitation to calculate the gravitational force between the electron and proton in the hydrogen atom.
   b) Use 1.6×10^{-19} C as the elementary unit of charge to determine the force of attraction between the two particles.
   c) How many orders of magnitude greater is the electric force between the two particles than the gravitational force between the two particles? How important are gravitational force effects in this case?

4. Two charged spheres are on a friction-less horizontal surface. One has a charge of $+3.0 \times 10^{-6}$ C, the other a $+6.0 \times 10^{-6}$ C charge. Sketch the two spheres, showing all forces on them. Make the length of your force arrows proportional to the strength of the forces.

5. Two positive charges of 6.0×10^{-6} C are separated by 0.50 m. Draw a force diagram for each of the charges, considering only electrostatic forces. What is the magnitude of the force between the charges? Is this force repulsive or attractive?

6. A negative charge of 2.0×10^{-4} C and a positive charge of 8.0×10^{-4} C are separated by 0.30 m. What is the magnitude of the force between the charges? Is this force repulsive or attractive?

7. A young man accumulates a charge q_1 of $+2.0 \times 10^{-5}$ C while sliding out of the front seat of a car. His girlfriend, who had been waiting in the wind, has picked up some extra electrons and now has a charge q_2 of -8.0×10^{-5} C.

   Draw a sketch of the situation. Estimate the magnitude of the electrical force that each person exerts on the other when separated by a distance of 6.0 m. Is the force attractive or repulsive?