**Electrostatics Worksheet** # ______Name ____________________________________________ Period ____

Electric Force: $F = \frac{kq_1q_2}{r^2}$ Gravity Force: $F == \frac{G\, m_1m_2}{r^2}$ 1 C = $6.241\times10^{18}$ electrons Electric Potential: $V = PE_e/q$

$k = 9\times10^9 \frac{Nm^2}{C^2}$ $G = 6.67\times10^{-11} \frac{Nm^2}{kg^2}$ 1 amp = 1C/s Electric Field: $E = \frac{kq}{r^2}$ $F = qE$

$e^-$ mass = $9.11\times10^{-31}$ kg $e^-$ charge = $-1.6\times10^{-19}$ C Proton mass = $1.67\times10^{-27}$ kg Proton charge = $-1.6\times10^{-19}$ C

***SHOW ALL WORK ON A SEPARATE SHEET***

1. A young man accumulates a charge q**1** of +2.0 E–**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 E–**5** C.
   a. Determine 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?

   b. Suppose the two people in the previous problem move toward each other. Calculate the magnitude of the electrical force of one on the other when their separation is reduced by a factor of 10.

2. A raindrop acquires a negative charge of 3.0E-18 C as it falls. What is the force of attraction when the raindrop is 6.0 cm from the bulb on the end of the car antenna that holds a charge of 2.0E-6 C?

3. In a grain elevator on Farmer Judd's farm, pieces of grain become electrically charged while falling through the elevator. If one piece of grain is charged with 5.0E-16 C while another holds 2.0E-16 C, what is the electrostatic force between them if they are separated by 0.050 m?

4. Rocco, an auto body painter, applies paint to automobiles by electrically charging the car's outer surface and oppositely charging the paint particles that he sprays onto the car. This causes the paint to adhere easily to the car's surface. If two paint particles of equal charge experience a force of 4.0E-8 N between them at a separation of 0.020 cm, what is the charge on each?

5. After unpacking a shipment of laboratory glassware, Mrs. Payne dumps the box of Styrofoam into a recycling bin. The chips rub together and two chips 0.015 m apart repel each other with a force of 6.0E-3 N. What is the charge on each of the chips?

6. Wiz, the cat, is batting two Ping-Pong balls hanging from insulating threads with their sides just barely touching. The balls each acquire a positive charge of .5E-9 C from Wiz's fur and swing apart. If a force of 6.0E-5 N acts on one of the balls, how far apart are they from each other? Is the force between them one of attraction or repulsion?

7. A particle of ink in an ink-jet printer carrying a charge of 8.0E-13 C is deflected onto the paper by a force of 3.2E-4 N. How strong is the field that causes the force?

8. In the human body, nerve cells work by pumping sodium ions out of the cell in order to maintain a potential difference across the cell membrane. If a sodium ion carries a charge of 1.60E-19 C as it is pumped with an electrical force of 2.0E-12 J, what is the electric field between the inside and outside of the nerve cell?

9. Two van de Graaff generators, whose centers are separated from one another by 0.5. m, each become charged after being switched on. One van de Graaff generator holds +3.0E-2 C, while the other holds -2.0E-2 C. What is the magnitude and direction of the electric field halfway between them?