Electrostatics
Honors Physics 2011/12

Name KEY

$$F = \frac{Kq_1q_2}{d^2} \quad K = 9.0 \times 10^9 \frac{Nm^2}{C^2} \qquad 1\ \mu C = 10^{-6}\ C$$

Coulomb's Law Problem Set 1

1. A sphere carrying a charge of + 2.0 μ C is placed 15 cm from a sphere carrying a charge of - .50 μC. What is the force between the two spheres? *(0.4 N)*

$$F = \frac{Kq_1q_2}{d^2} = \frac{(9\times10^9)(2\times10^{-6})(.5\times10^{-6})}{(0.15)^2} = 0.40\text{N Attraction}$$

2. A charge of 4.0 x 10^{-5} C is attracted by a second charge with a 350 N force when the separation is 10.0 cm. Calculate the magnitude of the second charge *(9.72 μ C)*

$$F = \frac{Kq_1q_2}{d^2}$$

$$350 = \frac{(9\times10^9)(4\times10^{-5})q_2}{(0.10)^2}$$

$$350 = 36{,}000{,}000\, q_2$$

$$q_2 = \frac{350}{36{,}000{,}000}$$

$$q_2 = 9.72\times10^{-6}$$

3. What is the magnitude of the charge on two equally charged spheres that exert a force on each other of 0.300 N when 75.0 cm apart? *(4.33 μ C)*

$$q_1 = q_2 = q$$

$$F = \frac{Kqq}{d^2} = \frac{Kq^2}{d^2}$$

$$0.30 = \frac{9\times10^9 q^2}{(.75)^2} = (16\times10^9)q^2$$

$$q^2 = \frac{0.3}{16\times10^9} = 1.875\times10^{-11}$$

$$q = \sqrt{1.875\times10^{-11}} = 4.33\times10^{-6}$$

4. What is the distance between two spheres, each with a charge of 2.5 x 10^{-6} C, when the force between them is 0.50 N? *(.335 m)*

$$F = \frac{Kq_1q_2}{d^2} \Rightarrow F\cdot d^2 = Kq_1q_2$$

$$0.5d^2 = 9\times10^9(2.5\times10^{-6})^2$$

$$.5d^2 = 0.05625$$

$$d^2 = \frac{0.05625}{.5} = 0.1125$$

$$d = \sqrt{0.1125} =$$

$$d = 0.335\ m$$