Name ________Answer Key_________ Date ______________________________

Honors Physics Electrostatics WS #5H

Period ______________ Mrs. Nadworny

Coulomb's Law

Directions: Solve the following problems using the GUESS method and proper significant figures. Be sure to show ALL work.

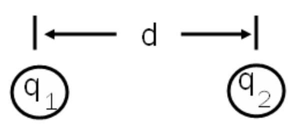
1. An electrostatic force exists between two +3.20 × 10^{-19} coulomb point charges separated by a distance of 0.030 meter. As the distance between the two point charges is decreased, the electrostatic force of
   (A) attraction between the two charges decreases
   (B) attraction between the two charges increases
   (C) repulsion between the two charges decreases
   (D) repulsion between the two charges increases

2. What is the magnitude of the electrostatic force exerted on an electron by another electron when they are 0.10 meter apart?
   (A) 2.6 × 10^{-36} N (B) 2.3 × 10^{-26} N (C) 2.3 × 10^{-27} N (D) 1.4 × 10^{-8} N

3. When two point charges of magnitude q_1 and q_2 are separated by a distance, r, the magnitude of the electrostatic force between them is F. What would be the magnitude of the electrostatic force between point charges $2q_1$ and $4q_2$ when separated by a distance of 2r?
   (A) F (B) 2F (C) 4F (D) 16F

4. An electrical force of 8.0 × 10^{-5} newton exists between two point charges, q_1 and q_2. If the distance between the charges is doubled, the new electrical force between the charges will be
   (A) 1.6 × 10^{-4} N (B) 3.2 × 10^{-4} N (C) 2.0 × 10^{-5} N (D) 4.0 × 10^{-5} N

5. The diagram represents two charges, q_1 and q_2, separated by distance d. Which change would produce the greatest increase in the electric force between the two charges?



   (A) doubling d and charge q_1, only
   (B) doubling d and charges q_1 and q_2
   (C) doubling d, only
   (D) doubling q_1, only

6. An electron of mass m_e orbits an alpha particle of mass m_α in a circular orbit of radius *r*. Which expression gives the speed of the electron?
   (A) $\sqrt{\frac{2ke^2}{m_e r}}$ (B) $\sqrt{\frac{2ke^2}{m_\alpha r}}$ (C) $\sqrt{\frac{4ke^2}{m_e r}}$ (D) $\sqrt{\frac{4ke^2}{m_\alpha r}}$

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7. An electron and a proton are 0.89 meter apart. They are in deep space away from all other gravitational influences.

   a. Calculate the electrostatic force between them.

$$F_e = \frac{kq_1q_2}{r^2} = \frac{8.99\times10^{9}\ \frac{N\bullet m^2}{C^2}(1.6\times10^{-19}C)(1.6\times10^{-19}C)}{(0.89m)^2} = 2.9\times10^{-28}N \text{ attractive}$$

   b. Calculate the gravitational force between them.

$$F_G = \frac{Gm_1m_2}{r^2} = \frac{6.67\times10^{-11}\ \frac{N\bullet m^2}{kg^2}(9.11\times10^{-31}kg)(1.67\times10^{-27}kg)}{(0.89m)^2} = 1.3\times10^{-67}N \text{ attractive}$$

8. Two positive point charges, q_1 and q_2, are a certain distance, d, apart. What happens to the magnitude of the electrostatic force between them if:

   a. The charge on q_1 is doubled?

$$F_e = \frac{kq_1q_2}{r^2} = \frac{k(2q_1)q_2}{r^2} \quad \text{x2}$$

$$F_e = \frac{kq_1q_2}{r^2} = \frac{(1)(2)(1)}{(1)^2} = 2 \text{ double}$$

   b. The charge on q_1 is doubled and the charge on q_2 is tripled?

$$F_e = \frac{kq_1q_2}{r^2} = \frac{k(2q_1)(3q_2)}{r^2} \quad \text{x6}$$

$$F_e = \frac{kq_1q_2}{r^2} = \frac{(1)(2)(3)}{(1)^2} = 6$$

   c. The distance between q_1 and q_2 is cut in half?

$$F_e = \frac{kq_1q_2}{r^2} = \frac{kq_1q_2}{(\frac{r}{2})^2} = \frac{kq_1q_2}{\frac{r^2}{4}} \quad \text{x4}$$

$$F_e = \frac{kq_1q_2}{r^2} = \frac{(1)(1)(1)}{(\frac{1}{2})^2} = 4 \text{ quadruple}$$

Answers in size order: 1.3×10^{-67}, 2.9×10^{-28}, 2, 4, 6