Name Answer Key Date _____

Honors Physics Electrostatics WS #10H

Period _____ Mrs. Nadworny

Review

Directions: Solve the following problems using the GUESS method, dimensional analysis (when necessary) and proper significant figures. Be sure to show ALL work.

1. A negatively charged plastic comb is brought close to, but does not touch, a small piece of paper. If the comb and paper are attracted to each other, the charge on the paper

   (A) must be positive
   (B) must be negative
   (C) may be positive or neutral
   (D) may be negative or neutral

2. Metal sphere A has a charge of – 2 units and an identical metal sphere, B, has a charge of – 4 units. If the spheres are brought into contact with each other and then separated, the charge on sphere B will be

   (A) – 2 units (B) – 3 units (C) 0 units (D) + 4 units

3. An object cannot have a charge of

   (A) 3.2×10^{-19}C (B) 4.5×10^{-19}C (C) 8.0×10^{-19} C (D) 9.6×10^{-19} C

4. The charge to mass ratio of an electron is

   (A) 1.76×10^{-11} C/kg (B) 5.69×10^{-12} C/kg (C) 1.76×10^{11} C/kg (D) 5.69×10^{12} C/kg

5. 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) $\sqrt{\frac{4ke^2}{m_\alpha r}}$

6. The energy of 3.0×10^3 eV is equivalent to how many Joules?

$$3.0\times10^{3}eV\left(\frac{1.60\times10^{-19}J}{1eV}\right)=4.8\times10^{-16}J$$

7. How many excess electrons are on a sphere with a charge of -8.72×10^{-17} C?

$$-8.72\times10^{-17}C\left(\frac{1e}{1.60\times10^{-19}C}\right)=545\text{ electrons}$$

8. A capacitor has a capacitance of 3.00×10^{-12} farads. Calculate the potential difference required to store 2.10×10^{-11} Coulombs.

$$V=\frac{Q}{C}=\frac{2.10\times10^{-11}C}{3.00\times10^{-12}F}=7.00V$$

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9. Two negative charges of -24 μC each are separated by 4.0 cm. What force exists between the charges?

$$F = \frac{kq_1q_2}{r^2} = \frac{8.99\times10^9\ \frac{Nm^2}{C^2}(24\times10^{-6}C)(24\times10^{-6}C)}{(0.040m)^2} = 3.2\times10^3 N \text{ away}$$

10. A positive charge of 4.3 x 10^{-7} C exerts a repulsive force of 8.0 N on a second charge 5.0 centimeters away. Determine the second charge.

$$q_1 = \frac{Fr^2}{kq_2} = \frac{(8.0N)(0.050m)^2}{(8.99\times10^9\ \frac{Nm^2}{C^2})(4.3\times10^{-7}C)} = +5.2\times10^{-6}C$$

11. What is the strength of the electric field at a distance of 5.6 x 10^{-12} meter away from a proton?

$$E = \frac{kq}{r^2} = \frac{\left(8.99x10^9\ \frac{N\cdot m^2}{C^2}\right)\left(1.60x10^{-19}C\right)}{(5.6\times10^{-12}m)^2} = 4.6\times10^{13}\ \frac{N}{C} \text{ away}$$

12. An electric field with an intensity of 2.5 x 10^4 N/C exerts a force of 7.6 x 10^{-3} N on a positive charge. What is the magnitude of the charge?

$$q = \frac{F}{E} = \frac{7.6\times10^{-3}N}{2.5\times10^4\ \frac{N}{C}} = 3.0\times10^{-7}C$$

13. How much work is required to move a charge of 5.5 x 10^{-8} C between two points that have a potential difference of 84.3 V?

$$W = q\Delta V = (5.5\times10^{-8}C)(84.3V) = {}^{+}4.6\times10^{-6}J$$

14. Two charged plates are separated by a distance of 4.5 cm. There is an electric potential difference of 650 V between the plates. Calculate the magnitude of the electric field in the middle of the plates.

$$E = \frac{\Delta V}{d} = \frac{650V}{.045m} = 1.4\times10^4\ \frac{N}{C}$$

Answers in size order: 4.8 x 10^{-16}, 3.0 x 10^{-7}, 4.6 x 10^{-6}, 5.2 x10^{-6}, 7.00, 545, 3.2 x 10^3, 1.4 x 10^4, 4.6 x 10^{13}