Name _____

UNIVERSITY OF ALABAMA
Department of Physics and Astronomy

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Quiz 1: Electrostatics

$$\vec{\mathbf{F}}_{e,12} = k_e \frac{q_1 q_2}{r^2}\,\hat{\mathbf{r}} \qquad \sum \vec{\mathbf{F}} = m\vec{\mathbf{a}}$$

$$\vec{\mathbf{E}} = k_e \frac{q}{r^2}\,\hat{\mathbf{r}} \qquad k_e \approx 9 \times 10^9 \left[\frac{\mathrm{N}\cdot\mathrm{m}^2}{\mathrm{C}^2}\right]$$

$$\vec{\mathbf{F}}_{21} = q_2 \vec{\mathbf{E}}_1 \qquad e = 1.6 \times 10^{-19}\ [\mathrm{C}]$$

above valid for point charges $\qquad m_e = 9.11 \times 10^{-}31\ [\mathrm{kg}]$

1. An electron (of charge $-e$ and mass m_e) enters a region of uniform electric field $\vec{\mathbf{E}} = 200\,\hat{\mathbf{x}}$ [N/C] with velocity $\vec{\mathbf{v}}_i = 3.0 \times 10^6\,\hat{\mathbf{x}}$ [m/s]. What is magnitude the acceleration $|\vec{\mathbf{a}}|$ of the electron due to the electric field?

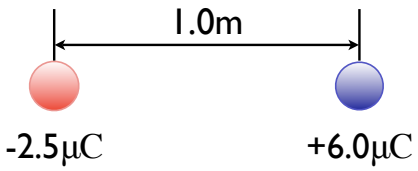
- □ -3.5×10^{13} [m/s]
- □ 4.6×10^{8} [m/s]
- □ -1.4×10^{15} [m/s]
- □ 6.8×10^{12} [m/s]

2. A test charge of 3 [μC] is at a point P where an external electric field is directed to the right and has a magnitude of 4×10^6 [N/C] If the test charge is replaced with another test charge of -3 [μC], the external electric field at P:

- □ is unaffected
- □ reverses direction
- □ changes in a way that cannot be determined

3. A "free" electron and a "free" proton are placed in an identical electric field. Which of the following statements are true? *Check all that apply.* Note that the electron mass is 9.11×10^{-31} kg, and the proton mass is 1.67×10^{-27} kg.

- □ Each particle is acted on by the same electric force and has the same acceleration.
- □ The electric force on the proton is greater in magnitude than the force on the electron, but in the opposite direction.
- □ The electric force on the proton is equal in magnitude to the force on the electron, but in the opposite direction.
- □ The magnitude of the acceleration of the electron is greater than that of the proton.
- □ Both particles have the same acceleration.



4. Determine the point (other than infinity) at which the total electric field is zero.

- □ 1.8 m to the right of the negative charge
- □ 0.61 m to the right of the positive charge
- □ 0.39 m to the right of the negative charge
- □ 1.8 m to the left of the negative charge

5. Which of the following is true for the electric force, but not the gravitational force? Check all that apply.

- ◯ The force propagates at a speed of c
- ◯ The force acts at a distance without any intervening medium
- ◯ The force between two bodies depends on the square of the distance between them
- ◯ The force between two bodies can be repulsive as well as attractive.