Name _____

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Quiz 2: Charges, charges everywhere

$k_e = 8.99 \times 10^9\,\mathrm{N\cdot m^2/C^2}$

$\epsilon_0 = \dfrac{1}{4\pi k_e} = 8.85 \times 10^{12}\,\mathrm{C^2/N\cdot m^2}$

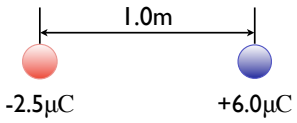
$e = 1.60 \times 10^{-19}\,\mathrm{C}$

$0 = ax^2 + bx^2 + c \Longrightarrow x = \dfrac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ quadratic

$\vec{\mathbf{F}}_{12} = q_1\vec{\mathbf{E}}_{\mathbf{2}}$ on 1 due to 2

$\vec{\mathbf{E}} = k_e\dfrac{|q|}{r^2}$ point charge

$\Phi_E = |\vec{\mathbf{E}}|A\cos\theta_{EA} = \dfrac{Q_{\text{inside}}}{\epsilon_0}$



1. Determine the point (other than infinity) at which the total electric field is zero. This point is not between the two charges.

- ◯ 3.5 m to the left of the negative charge
- ◯ 2.1 m to the right of the positive charge
- ◯ 1.3 m to the right of the positive charge
- ◯ 1.8 m to the left of the negative charge

2. A flat surface having an area of $3.2\,\mathrm{m^2}$ is rotated in a uniform electric field of magnitude $E = 5.7 \times 10^5\,\mathrm{N/C}$. What is the electric flux when the electric field is parallel to the surface?

- ◯ $1.82 \times 10^6\,\mathrm{N\cdot m^2/C}$
- ◯ 0
- ◯ $3.64\,\mathrm{N\cdot m^2/C}$
- ◯ $0.91\,\mathrm{N\cdot m^2/C}$

3. A point charge q is located at the center of a (non-conducting) spherical shell of radius a that has a charge $-q$ uniformly distributed on its surface. What is the electric field *for all points outside the spherical shell?*

- ◯ $E = 0$
- ◯ $E = q/4\pi a^2$
- ◯ $E = k_e q/r^2$
- ◯ $E = k_e q/a^2$

4. 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.*

- ◯ 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.

5. Two isolated identical conducting spheres have a charge of q and $-3q$, respectively. They are connected by a conducting wire, and after equilibrium is reached, the wire is removed (such that both spheres are again isolated). What is the charge on each sphere?

- ◯ q, $-3q$
- ◯ $-q$, $-q$
- ◯ 0, $-2q$
- ◯ $2q$, $-2q$