Name _____

UNIVERSITY OF ALABAMA
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Quiz 3: Potential

$$\Delta V_{BA} = V_B - V_A = -\int_A^B \vec{\mathbf{E}} \cdot d\vec{\mathbf{l}} \qquad V(r) = \frac{k_e q}{r} \quad \text{point charge } q \text{ at } r = 0$$

$$\vec{\mathbf{E}} = \frac{dV}{dx}\,\hat{\mathbf{x}} + \frac{dV}{dy}\,\hat{\mathbf{y}} + \frac{dV}{dz}\,\hat{\mathbf{z}} \qquad KE = \frac{1}{2}mv^2 \quad m_{\text{electron}} \ll m_{\text{proton}}$$

1. In a certain region of space, the electric potential is zero everywhere along the x axis. From this we can conclude that the x component of the electric field in this region is

- □ zero
- □ in the x direction
- □ in the $-x$ direction.

2. In a certain region of space, the electric field is zero. From this we can conclude that the electric potential in this region is

- □ zero
- □ constant
- □ positive
- □ negative.

3. An electron initially at rest is accelerated through a potential difference of 1 V, and gains kinetic energy KE_e. A proton, also initially at rest, is accelerated through a potential difference of -1 V, and gains kinetic energy KE_p. Which of the following must be true?

- □ $KE_e < KE_p$
- □ $KE_e = KE_p$
- □ $KE_e > KE_p$
- □ not enough information

4. Consider a collection of charges in a given region, and suppose all other charges are distant and have negligible effect. The electric potential is taken to be zero at infinity. If the electric potential at a given point in the region is zero, which of the following statements must be true? (Only one is *always* true.

- □ The electric field is zero at that point.
- □ The electric potential energy is a minimum at that point.
- □ There is no net charge in the region.
- □ Some charges in the region are positive and some are negative.
- □ The charges have the same sign and are symmetrically arranged around the given point.

5. A spherical balloon contains a positively charged object at its center. As the balloon is inflated to a greater volume while the charged object remains at the center, does the electric potential at the surface of the balloon:

- □ increase
- □ decrease
- □ remain the same