Physics 222

Quiz 1 – Electric Field, Form: A

Name: _____

Date: _____

For each situation below, sketch the electric field at the point P due to the charged particles shown. Assume there are no hidden charges anywhere.

1. Positively charged particle.

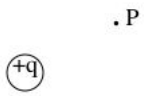

Figure 1:

2. Negatively charged particle.

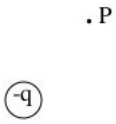

Figure 2:

3. Dipole.

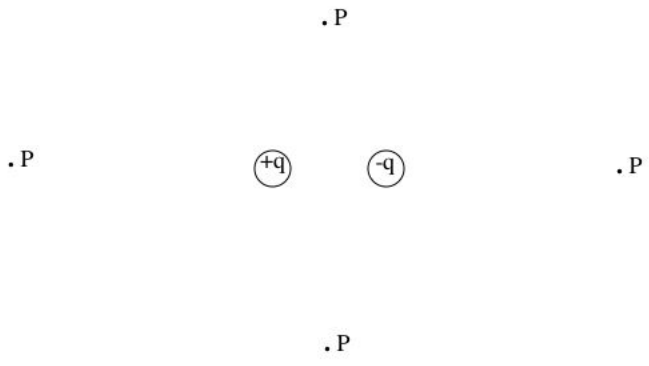

Figure 3:

4. Two dipoles.

Figure 4:

5. What is the electric field at point P due to the two dipoles shown in Figure 4 if $q = 1.6 \times 10^{-19}$, $s = 2 \times 10^{-10}$ m and $d = 5 \times 10^{-8} m$? (Note that electric field is a vector, so you should express it in vector form.)

6. Consider the dipole shown in Figure 3. Suppose the distance of P along the +y axis is much greater than the length of the dipole, s, so you can use the large distance approximation for the magnitude of the electric field at that point. If the magnitude of the electric field at P when P is at a distance r is E, what would be the magnitude of the field at a distance $2r$ along the same axis?

   (a) $2E$

   (b) $4E$

   (c) $\frac{1}{2}E$

   (d) $\frac{1}{4}E$

   (e) $\frac{1}{8}E$

7. Suppose that a proton in space is at rest, and the electric field at a point P in space due to that proton is $\vec{E}$. Then, instantly, the proton is moved to a new location. What happens to the electric field at point P during this process?

   (a) The electric field will instantly change.

   (b) The electric field will remain the same indefinitely.

   (c) The electric field will remain the same for a very short time after the proton is moved, but will eventually change.

Answer Key for Exam A

1. The electric field vector should be drawn at point P, and it should point up and to the right, radially away from the particle (because it is a positively charged particle).
2. The electric field vector should be drawn at point P, and it should point up and to the right, radially toward the particle (because it is a negatively charged particle).
3. At the top and bottom points marked P, the electric field points to the right.

   At the right and left points marked P, the electric field points to the left.
4. The electric field at point P due to each dipole points to the left. Thus, the net electric field is to the left.
5. $$\vec{E} = 23040 < -1, 0, 0 > \text{ N/C}$$

6. (e)

7. (c)