Physics 200

Chapter 23 Electric Fields (Homework)

1. In the Bohr theory of the hydrogen atom the electron moves in a circular orbit about the proton. The radius of the orbit is "a". Calculate the speed of the electron.

2. Three charges, Q, are located at the corners of an equilateral triangle. Each side of the triangle is distance, a, long. Calculate the magnitude and direction of the electric force acting on one of the charges.

3. What is the magnitude of the electric field that will cause an electric force on an electron that is just equal to its weight?

4. Find the magnitude and direction of the electric field at the location (2 a, a) caused by a dipole whose midpoint is located at (0, 0). A dipole is two charges, "Q" and "– Q" separated by a distance, "2 a".

5. A uniformly charged rod with length, L, lies on the x-axis with its left end at the origin. Calculate the magnitude of the electric field at the location (- a, 0).

6. A non-uniformly charged ($\lambda = \beta x$) rod with length, L, lies on the x-axis with its left end at the origin. Calculate the magnitude of the electric field at the location (- a, 0).

7. A thin line of positive charge is bent into a semicircle of radius, a. The linear charge density along the semicircle is given by $\lambda = \beta \cos \theta$. Calculate the force acting on a charge, Q, located at the center of curvature. (θ is zero at the midpoint of the semicircle.)

8. Two identical uniformly charged rods lie along the x-axis. The center of the first rod is at (0, 0) and the center of the second is at (b, 0). The rods have charge, Q, and length, L. Calculate the electric force that is acting on the second rod. (Assume b is greater than L.)

9. A circular washer (inner radius, a, and outer radius, b) is positioned so that its center is at the origin and the x-axis is perpendicular to the plane of the washer. If the washer has a non-uniform charge density, $\sigma = \alpha / r$, on its right-hand surface what is the strength of the electric field at the location, (D, 0).

10. An electric dipole is placed in a uniform electric field. There is a small angle, θ, between the axis of the dipole and the direction of the field. After being released the dipole under goes simple harmonic motion. If the mass of the two charges is "m" what is the angular frequency of the oscillation?