Physics 200

Chapter 24 Gauss's Law (Homework)

1. A very large conducting sheet is placed in an electric field, E. Determine the charge density on the top and bottom surface of the sheet.

2. An infinitely long non-conducting solid cylinder with a radius, R, has a constant charge density, ρ. Determine the electric field strength a distance, r, from the center of the cylinder if $r < R$ and if $r > R$.

3. Determine the magnitude of the electric field between the inner and outer conductors of a coaxial cable. The inner conductor has a charge density, $-\lambda$, and the outer conductor has a charge density, λ.

4. Two identical non-conducting spheres each having a radius "a" are connected by a long piece of string whose length is "L". Determine the tension in the string if each sphere has a uniformly distributed charge, Q. (Assume $L >> a$)

5. An infinite non-conducting plate has thickness, t, and charge density, ρ. Determine the magnitude of the electric field a distance, x, from the midpoint of the plate. (Assume $x < t/2$)

6. Two concentric conducting spheres have radii of "a" and "b" and respectively charges of "q" and "Q". What is the magnitude of the electric field a distance, r, from the center of the inner sphere when $r < a$, when $a < r < b$ and when $b < r$? (Assume $a < b$.)

7. Two conducting sphere's have radii "a" and "b" and are separated by a distance, D. Calculate the strength of the electric field at the midpoint between the spheres if they have the same charge density, σ.

8. Two non-conducting sphere's have radii "a" and "b" and are separated by a distance, D. Calculate the strength of the electric field at the midpoint between the spheres if they have the same charge density, ρ.

9. A solid non-conducting sphere has charge density that depends only upon "r", the distance from the sphere's center. How does the charge density depend upon "r" if the magnitude of the electric field is the same at every location within the sphere?

10. A particle of mass, m, and charge, $-q$, moves diametrically through a uniformly charged non-conducting sphere of radius, R, and charge, Q. Calculate the angular frequency of the particle's simple harmonic motion.