**Name _____**

**PHY2049C, Homework 2**

**A- Submit a physical handwritten version at the beginning of class**

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**Problem 1**

How many electrons would have to be removed from a coin to leave it with a charge of +2.0 x 10 -7 C?

**Problem 2**

Positive charge Q is distributed uniformly along the positive y-axis between y = 0 and y = a. A negative point charge -*q* lies on the positive x-axis, a distance x from the origin (Figure 1). (a) Calculate the x- and y-components of the electric field produced by the charge distribution Q at points on the positive x-axis.

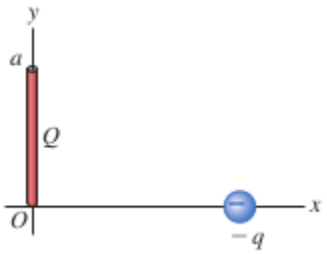


Figure 1

**Problem 3**

A point charge of -3.00 mC is located in the center of a spherical cavity of radius 6.50 cm that, in turn, is at the center of an insulating charged solid sphere. The charge density in the solid is $\rho = 6.23 * 10^{-4} C/m^3$ (a) Draw and diagram and calculate the electric field inside the solid at a distance of 9.50 cm from the center of the cavity.

**Problem 4** (Knight)

An initially neutral conductor contains a hollow cavity in which there is a +100 nC point charge. A charged rod transfers 50 nC to the conductor. Afterward, what is the charge (a) on the inner wall of the cavity wall, and (b) on the exterior surface of the conductor?

**Problem 5**

A sphere of radius R has total charge Q. The volume charge density (C/m3) within the sphere is

$$\rho = \rho_0 (1 - \frac{r}{R})$$

This charge density decreases linearly from p0 at the center to zero at the edge of the sphere.
(a). Show that $\rho_0 = 3Q/\pi R^3$
Hint: You'll need to do a volume integral.

(b). Show that the electric field inside the sphere points radially outward with magnitude

$$E = \frac{Qr}{4\pi\epsilon_0 R^3}(4 - 3\frac{r}{R})$$

(c). Show that your result of part b coincides with the field outside the sphere for r=R

**Problem 6**

A long, thin straight wire with linear charge density A runs down the center of a thin, hollow metal cylinder of radius R. The cylinder has a net linear charge density 2A, Assume A is positive. Find expressions for the electric field strength (a) inside the cylinder, r < R, and (b) outside the cylinder, r > R. In what direction does the electric field point in each of the cases?