Home Work Problem Set 2

3-1 In Fig. 23-45, a small, nonconducting ball of mass *m* = 1.0 *mg* and charge *q* = 2.0 ×10-8 C (distributed uniformly through its volume) hangs from an insulating thread that makes an angle = 30° with a vertical, uniformly charged nonconducting sheet (shown in cross section). Considering the gravitational force on the ball and assuming the sheet extends far vertically and into and out of the page, calculate the surface charge densityσof the sheet. (HRW23-41)

3-2 A solid nonconducting sphere of radius R = 5.60 cm has a nonuniform charge distribution of volume charge densityρ= (14.1 pC/m3)r/R, where r is radial distance from the sphere’s center. (a) What is the sphere’s total charge? What is the magnitude E of the electric field at (b) r = 0, (c) r = R/2.00, and (d) r = R? (e) Sketch a graph of E versus r. (HRW23-55)

3-3 A nonconducting solid sphere has a uniform volume charge density ρ. Let *r* be the vector from the center of the sphere to a general point P within the sphere. (a) Show that the electric field at P is given by (Note that the result is independent of the radius of the sphere.) (b) A spherical cavity is hollowed out of the sphere, as shown in Fig. 23-57. Using superposition concepts, show that the electric field at all points within the cavity is uniform and equal to where *a* is the position vector from the center of the sphere to the center of the cavity. (Note that this result is independent of the radius of the sphere and the radius of the cavity.) (HRW23-77)

 