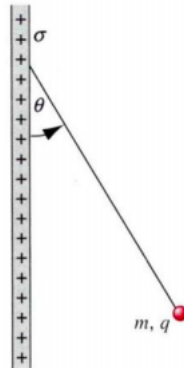**Problem – (P27.3)***   A small sphere whose mass m is 1.12 mg carries a charge q = 19.7 nC. It hangs in the Earth's gravitational field from a silk thread that makes an angle θ = 27.4° with a large, uniformly, charged, nonconducting sheet as seen in the figure below. Calculate the uniform charge density σ for the sheet.

Solution:

Problem – (E27.7)   A point charge $+q$ is a distance $d/2$ from a square surface of side d and is directly above the center of a square, as shown in the figure below. Find the electric flux through the square. (Hint: Think of the square as one face of a cube with edge d.)
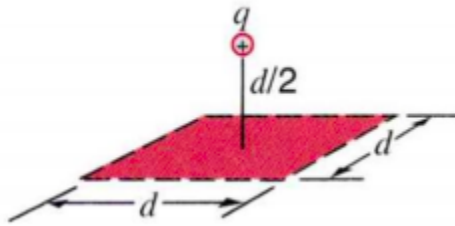
Solution:

Problem – (P27.16)   A plane slab of thickness d has a uniform volume charge density ρ. Find the magnitude of the electric field at all points in space both (a) inside and (b) outside the slab, in terms of x, the distance measured from the median plane of the slab.
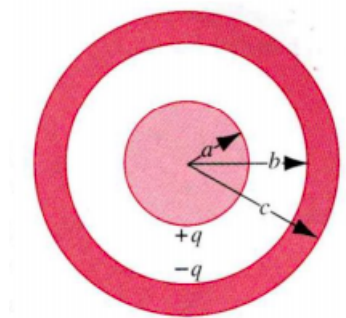
Solution:

Problem – (P27.17)   A solid nonconducting sphere of radius R carries a nonuniform charge distribution, with charge density $\rho = \rho_S r / R$, where ρ_S is a constant and r is the distance from the center of the sphere. Show that (a) the total charge on the sphere is $Q = \pi \rho_S R^3$ and (b) the electric field inside the sphere is given by

$$E = \frac{1}{4\pi\epsilon_0} \frac{Q}{R^4} r^2.$$

Solution:

Problem – (P27.4)   The figure below shows a charge $+q$ arranged as a uniform conducting sphere of radius a and placed at the center of a spherical conducting shell of inner radius b and outer radius c. The outer shell carries a charge of $-q$. Find $E(r)$ at locations (a) within the sphere ($r < a$), (b) between the sphere and the shell ($a < r < b$), (c) inside the shell ($b < r < c$), and (d) outside the shell ($r > c$). (e) What charges appear on the inner and outer surfaces of the shell?

Solution:

Problem – ¶(E29.29)   A 1-μC point charge is embedded in the center of a solid Pyrex sphere of radius $R = 10$ cm. (a) Calculate the electric field strength E just beneath the surface of the sphere. (b) Assuming that there are no other *free* charges, calculate the strength of the electric field just outside the surface on the sphere. (c) What is the induced surface charge density σ_{ind} on the surface of the Pyrex sphere?

Solution: