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Physic 51 Section ___
Problem Set 2
17 September 2018

Collaborators:

HRK P27.3 Solo A small sphere whose mass m is 1.12 mg carries a charge $q = 19.7$ nC. It hangs in the in the Earths gravitational field from a silk thread that makes an angle $\theta = 27.4^{\text{deg}}$ with a large, uniformly charged, non conducting sheet as in Fig. 27-32. Calculate the uniform charge density σ for the sheet

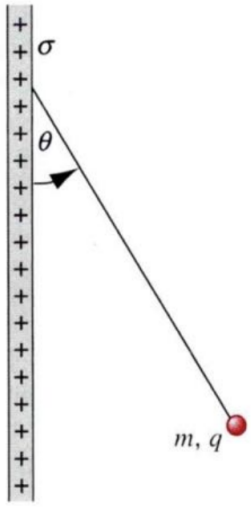

FIGURE 27-32. Problem 3.

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HRK P27.7 A point charge $+q$ is a distance $d/2$ from a square surface of side d and is directly above the center of the square as shown in Fig. 27-26. Find the electric flux through the square. (Hint: Think of the square as one face of a cube with edge d

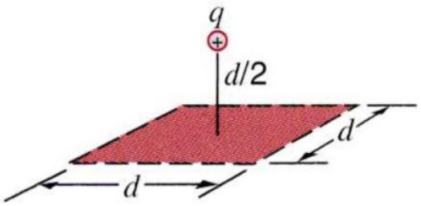

FIGURE 27-26. Exercise 7.

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HRK P27.16 A plane slab of thickness d has a uniform volume charge density of 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.

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HRK 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;

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

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HRK P27.4 Figure 27-33 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.

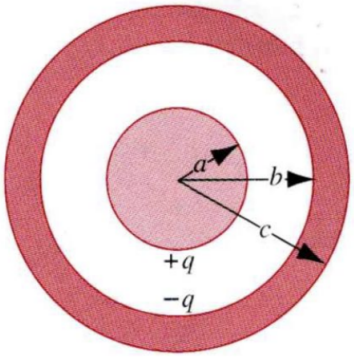

FIGURE 27-33. Problem 4.

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HRK E29.29 A $1-\mu C$ point charge is embedded in the center of a solid pyrex sphere of radius $R = 10\text{cm}$. (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 of the sphere. (c) What is the induced surface charge density σ_{ind} on the surface of the Pyrex sphere?

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