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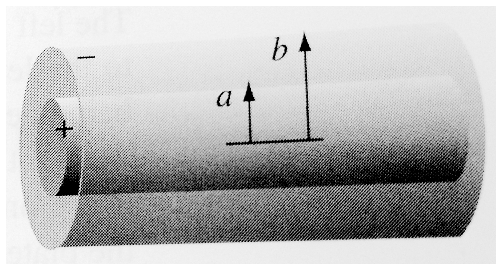
Physics 151
Problem Set 1
6 September 2017

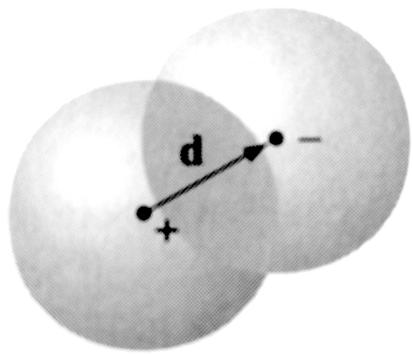
Help:

2.16
A long coaxial cable (Fig 2.26) carries a uniform *volume* charge density ρ on the inner cylinder (radius a), and a uniform *surface* charge density on the outer cylindrical shell (radius b). This surface charge is negative and is of just the right magnitude that the cable as a whole is electrically neutral. Find the electric field in each of the three regions: (i) inside the inner cylinder ($s < a$), (ii) between the cylinders ($a < s < b$), (ii) outside the cable ($s < b$). Plot $|\mathbf{E}|$ as a function of s.



2.18

Two spheres, each of radius R and carrying uniform volume charge densities $+\rho$ and $-\rho$, respectively, are placed so that they partially overlap (Fig 2.28). Call the vector from the positive center to the negative center $\mathbf{d}$. Show that the field in the region of overlap is constant, and find its value. [*Hint*: Use the answer to Prob. 2.12.]



2.26 Wolfram OK

A conical surface (an empty ice-cream cone) carries a uniform surface charge σ. The height of the cone is h, as is the radius of the top. Find the potential difference between points **a** (the vertex) and **b** (the center of the top).

2.60

A point charge q is at the center of an uncharged spherical conducting shell, of inner radius a and outer radius b. *Question*: How much work would it take to move the charge out to infinity (through a tiny hole drilled in the shell)? [*Answer*: $(q^2/4\pi\epsilon_0)(1/a)$]