Problems for HW 2

C. Gwinn

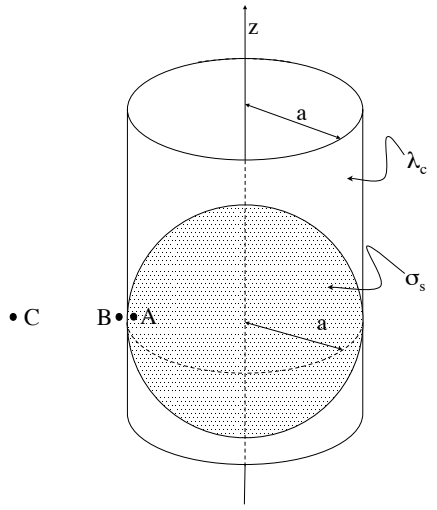
Due 12 Oct 2007, 5 pm

1 HW2 Problem 1

A charged, hollow cylinder has radius a, and is covered with a constant surface charge $\sigma_c = \lambda_c/2\pi a$ (the net charge per unit length is λ_c). A hollow sphere, also with radius a, lies inside the cylinder, with its center on the cylinder's axis and its equator just touching the cylinder. The sphere carries a uniform surface charge $\sigma_s = -\sigma_c$. Point A lies just inside the sphere where it touches the cylinder. Point B lies adjacent to it, just outside the sphere and cylinder.

a) For part a only: Assume that the cylinder has length $3a$, and extends a distance a below the sphere's equator and a distance $2a$ above the equator. • Find the *difference* in electric field between points A and B.

b) Assume that the cylinder has infinite length, for parts b and c only. • Find the electric fields at points A and B.

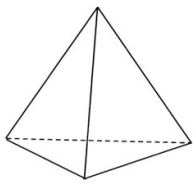


c) Again assume that the cylinder has infinite length. Point C lies on the line connecting the center with points A and B, but twice as far from the axis of the cylinder. • Find the electric potential at the center of the cylinder, and at points A, B, and point C.

2 HW2, Problem 2

A regular tetrahedron has 4 sides that are equilateral triangles. It has 6 edges of equal length, and 4 corners. Suppose that a charge $+q$ is placed at each of the 4 corners of a regular tetrahedron. • Find the electric potential at the center of the tetrahedron.

(Hint: A regular tetrahedron can be inscribed into a cube in such a way that its corners lie at corners of the cube, and its edges are diagonals of the cube's faces.)



3 Problems from Griffiths

2.21, 2.22, 2.26, 2.29, 2.30