

EM 7a/196A

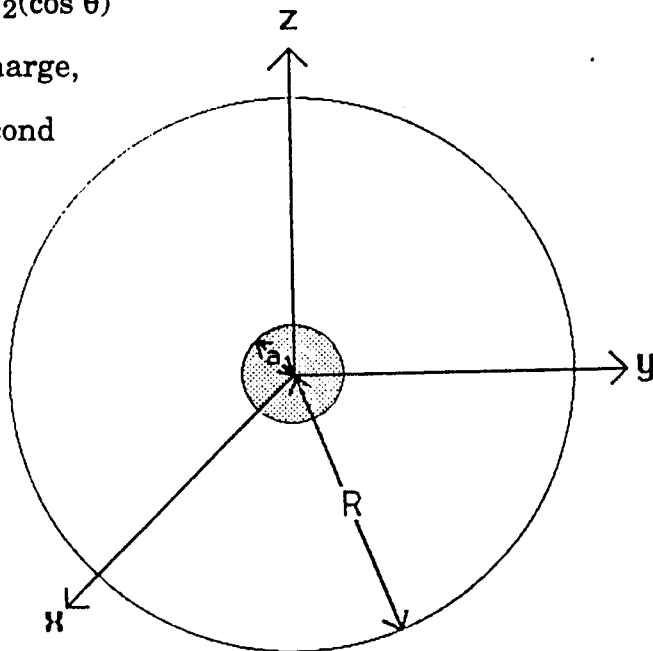
A small dielectric sphere of radius a and dielectric constant ϵ is placed at the center of a large hollow metal sphere of radius $R \gg a$. The space between the dielectric sphere and the inner surface of the metal sphere is vacuum.

The surface of the dielectric sphere has an azimuthally symmetric charge distribution given by $\sigma(\theta) = (Q/4\pi a^2)P_2(\cos \theta)$

where Q is a constant with units of charge,

θ is the polar angle, and P_2 is the second order Legendre polynomial.

- (a) Let the potential of the metal sphere be V_0 . Find the electrostatic potential everywhere within the metal sphere in terms of V_0 , Q , a , R , ϵ , and θ .



- (b) Sketch the electric field lines in the x - y plane, $z = 0$; be sure to include the interior of the dielectric sphere, and the interior and exterior of the metal sphere.
- (c) What is the electrostatic energy stored in the dielectric sphere?