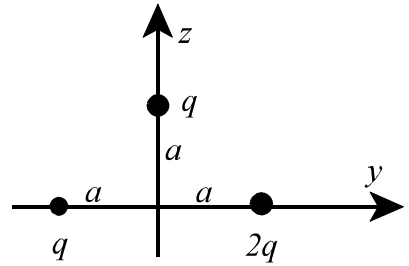


Phys 221 – E&M I – Test 3 – April 25, 2001

1. (25 pts) Three charges lie in the yz plane as shown. There is a charge q at $y = -a$, a charge $2q$ at $y = a$, and a charge q at $z = a$.



a) Calculate the monopole and dipole moments for this distribution.

b) Find the approximate potential at points far from the distribution. Give your results in spherical coordinates.

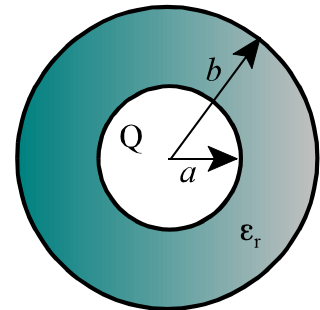
2. (25 pts) A sphere of linear dielectric material, radius R , and dielectric constant ϵ_r is placed in an otherwise uniform electric field \vec{E}_0 .

a) Determine the potential inside and outside the sphere.

b) Determine the electric field inside the sphere.

c) What is the dipole moment of the sphere? Write down the electric field outside the sphere using the dipole moment.

3. (25 pts) A spherical conductor, of radius a , carries a charge Q . It is surrounded by linear dielectric material with a dielectric constant ϵ_r , out to a radius b .

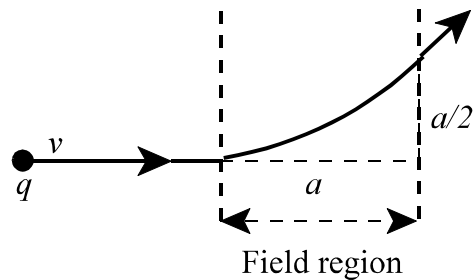


a) Determine the electric field in all three regions, $r < a$; $a < r < b$; $r > b$.

b) Determine the polarization in all three regions.

c) Determine the bound volume and surface charge densities.

4. (25 pts) A particle of charge q and mass m enters a region of magnetic field \vec{B} (pointing out of the paper). The magnetic field deflects the particle a distance $a/2$ above the original line of flight after traveling a distance a in the field region.



a) Is the charge positive or negative?

b) In terms of q , m , B , and a , find the speed v of the particle.