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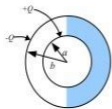
#Diego Butler



so many fake sites. this is the first one which worked! Many thanks



PROBLEM:
Two concentric, conducting spheres of inner and outer radii a and b , respectively, carry charges $+Q$. The empty space between the spheres is half-filled by a hemispherical shell of dielectric (of dielectric constant ϵ), as shown in the figure.



- (a) Find the electric field everywhere between the spheres.
- (b) Calculate the surface-charge distribution on the inner sphere.
- (c) Calculate the polarization-charge density induced on the surface of the dielectric at $r = a$.

SOLUTION:
We can split the region where we want to know the electric field into two regions, the left hemisphere and the right hemisphere, solve for the field in each region separately and then apply the boundary conditions to get the final solution. In the left region, there are no dielectric and no charges. So the electric potential obeys the Laplace equation:

$$\nabla^2 \Phi = 0$$

If we align the z -axis pointing to the right, the problem has azimuthal symmetry. The general solution to the Laplace equation in spherical coordinates for azimuthal symmetry is:

$$\Phi(r, \theta, \phi) = \sum_{l=0}^{\infty} (A_l r^l + B_l r^{-(l+1)}) P_l(\cos \theta)$$

The potential on the surface of a conductor is always constant:
$$\Phi(r=a) = C$$

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