

Reading Quiz 4 for Electromagnetic Theory (PHYS330)

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Abstract

A summary of content covered in chapter 3 (so far) of Introduction to Electrodynamics.

1 Bound Charges

1. Compute the *bound surface charge density*, σ_b , for each polarization distribution:
 - A uniformly polarized sphere with radius a , in which the constant field \vec{P} is aligned with the z-axis.
 - A slab of dielectric material with thickness z_0 and lateral dimensions x_0 and y_0 , with uniform \vec{P} inside, oriented along the z-axis.
2. Compute the *bound volume charge density*, ρ_b , for each polarization distribution:
 - $\vec{P} = P_0 \vec{r}$ (spherical coordinates)
 - $\vec{P} = P_0 P_2 (\cos \theta) \hat{\theta}$ (spherical coordinates)

2 The Electric Displacement and Linear Dielectrics

1. Two different systems are shown in Fig. 1 below. Show that the E-field for $a < r < b$ in Fig. 1 (left) is equal to the E-field in Fig. 1 (right).

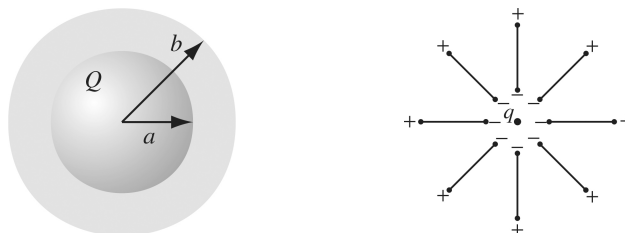


Figure 1: (Left) A metal sphere of charge Q and radius a is surrounded by linear dielectric material of permittivity ϵ out to radius b . (Right) A point charge embedded in a homogeneous linear dielectric with permittivity ϵ .