Unit 9 - Week 8

Assignment 8

The due date for submitting this assignment has passed.
As per our records you have not submitted this assignment.

Due on 2020-03-25, 23:59 IST.

Bound Charges

A sphere of radius R carries a polarization $\vec{P}(\vec{r}) = k\vec{r}$, where k is the constant and $\vec{r}$ is the vector from the center.

1) What is the bound charges σ_b and ρ_b ? ***4 points***

- $\sigma_b = kR^2$, $\rho_b = 3kR$
- $\sigma_b = kR$, $\rho_b = -3k$
- $\sigma_b = kR/4, \rho_b = 3k$
- $\sigma_b = kR, \rho_b = 4k$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$\sigma_b = kR$, $\rho_b = -3k$

2) Find the field inside and outside the sphere. ***5 points***

- $r < R$, $\vec{E} = -\frac{k}{\epsilon_0}\vec{r}$
  $r > R, \vec{E} = 0$
- $r < R$, $\vec{E} = \frac{k}{\epsilon_0}\vec{r}$
  $r > R, \vec{E} = 0$
- $r < R, \vec{E} = 0$
  $r > R$, $\vec{E} = \frac{k}{\epsilon_0}\vec{r}$
- $r < R$, $\vec{E} = -\frac{k}{\epsilon_0}\vec{r}$
  $r > R, \vec{E} = \frac{k}{\epsilon_0}\vec{r}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$r < R$, $\vec{E} = -\frac{k}{\epsilon_0}\vec{r}$
$r > R, \vec{E} = 0$

3) **Dielectrics** ***6 points***

A sphere of linear dielectric material has embedded in it a uniform free charge density ρ . Find the potential at the center of the sphere (relative to infinity), if its radius is R and its dielectric constant is ϵ_r

- $V = \frac{\rho R^2}{3\epsilon_0}\left(1 + \frac{1}{2\epsilon_r}\right)$
- $V = \frac{\rho R^2}{\epsilon_0}\left(1 + \frac{1}{\epsilon_r}\right)$
- $V = \frac{\rho R^2}{3\epsilon_0}\left(1 + \frac{1}{\epsilon_r}\right)$
- $V = \frac{\rho R^2}{3\epsilon_0}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$V = \frac{\rho R^2}{3\epsilon_0}\left(1 + \frac{1}{2\epsilon_r}\right)$

4) **Coaxial cable** ***5 points***

A certain coaxial cable consists of a copper wire, radius a , surrounded by a concentric copper tube. The inner and outer radii of the tube is b and c. The space between is partially filled (from b out to c) with material of dielectric constant ϵ_r . Find the capacitance per unit length of this cable.

- $c = \frac{2\pi\epsilon_0}{exp\left(\frac{b}{a}\right)}$
- $c = \frac{2\pi\epsilon_0}{ln\left(\frac{b}{a}\right) + \frac{1}{\epsilon_r} ln\left(\frac{c}{b}\right)}$
- $c = \frac{2\pi\epsilon_0}{\left(\frac{b}{a}\right) + \frac{1}{\epsilon_r} ln\left(\frac{c}{b}\right)}$
- $c = \frac{2\pi\epsilon_0}{ln\left(\frac{a}{b}\right)}$

No, the answer is incorrect.
Score: 0

Accepted Answers:
$c = \frac{2\pi\epsilon_0}{ln\left(\frac{b}{a}\right) + \frac{1}{\epsilon_r} ln\left(\frac{c}{b}\right)}$