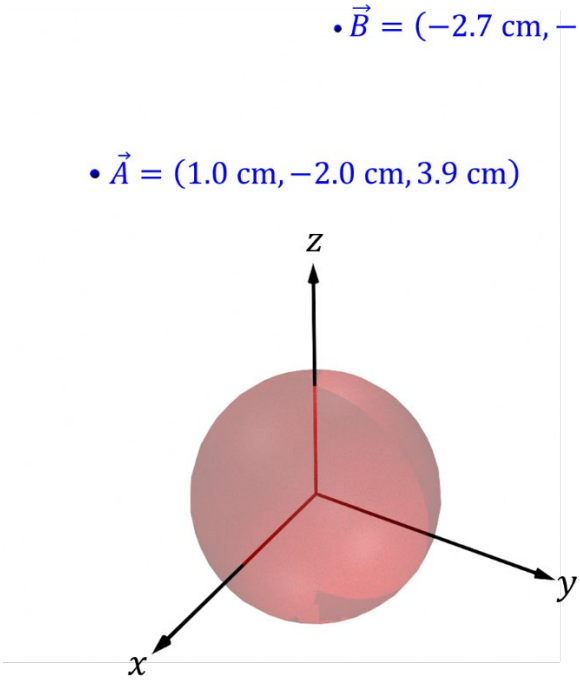
Reading

Required Reading

- Chapter 4, pp. 141-167.
- Chapter 5, pp. 198-208.

Electric Potential

A charged sphere is placed at the origin inside of a ceramic medium with dielectric constant $\varepsilon_r = 12.2$. The sphere has a radius $R = 1.5$ cm and a surface charge density of $\rho_s = 13\ \mu C/m^2$ uniformly distributed across its surface.



Problem 1 – Surface Charge

Calculate the electric potential at position $(1.0\text{ cm}, -2.0\text{ cm}, 3.9\text{ cm})$.

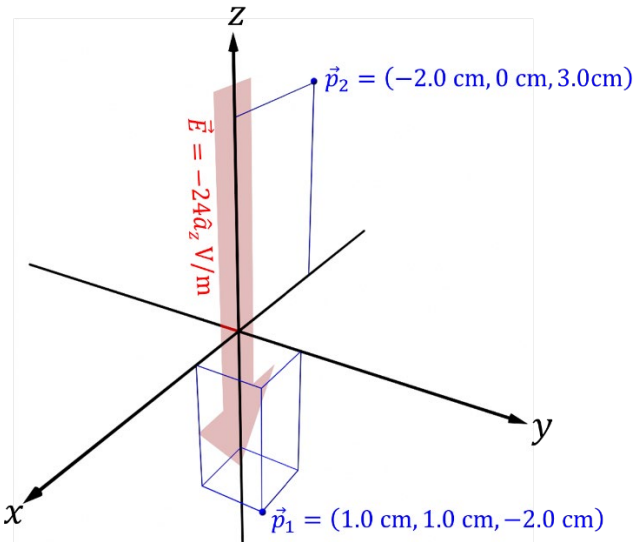
Problem 2 – Potential Difference

Calculate the potential difference between points $\vec{A} = (1.0\text{ cm}, -2.0\text{ cm}, 3.9\text{ cm})$ and $\vec{B} = (-2.7\text{ cm}, -1.3\text{ cm}, 4.9\text{ cm})$.

Work & Energy

Problem 3 – Work

A charge of $174\ \mu\text{C}$ resides in a uniform electric field given by $\vec{E} = -24\hat{a}_z\ \text{V/m}$. Calculate the work it would take to move the charge from $(1.0\ \text{cm}, 1.0\ \text{cm}, -2.0\ \text{cm})$ to $(-2.0\ \text{cm}, 0\ \text{cm}, 3.0\ \text{cm})$.



Boundary Conditions

Problem 4 – Interface Between Two Dielectrics

Two semi-infinite dielectric mediums meet at the yz plane. The dielectric constant of medium 1 for $x < 0$ is $\varepsilon_{\text{r1}} = 5.0$ and in medium 2 for $x \geq 0$ is $\varepsilon_{\text{r2}} = 3.0$. If the electric field intensity in medium 1 is $\vec{E}_1 = 80\hat{a}_x - 60\hat{a}_y + 4\hat{a}_z\ \text{V/m}$, calculate the electric field intensity in medium 2 as well as the angles of both electric fields relative to the surface normal.