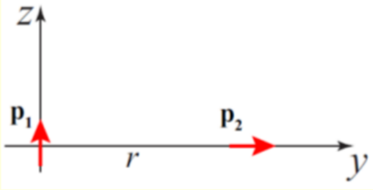
Ques1.

Two perfect dipoles $\vec{p}_1$ and $\vec{p}_2$ are separated by a distance r, as shown in the figure. The torque on the dipole $\vec{p}_2$ due to $\vec{p}_1$ is



- $\frac{p_1 p_2}{4\pi\epsilon_0 r^3}(-\hat{x})$
- $\frac{p_1 p_2}{2\pi\epsilon_0 r^3}\left(\frac{\hat{x}-\hat{z}}{\sqrt{2}}\right)$
- $\frac{p_1 p_2}{2\pi\epsilon_0 r^3}(\hat{x})$
- $\frac{p_1 p_2}{2\pi\epsilon_0 r^3}(-\hat{x})$
- $\frac{p_1 p_2}{4\pi\epsilon_0 r^3}\left(\frac{\hat{x}+\hat{z}}{\sqrt{2}}\right)$

Ques2.

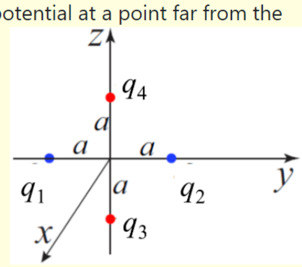
Two homogeneous cylindrical regions 1 ($s < 4$ cm) and 2 ($s > 4$ cm) have dielectric constants 3.5 and 1.5, respectively. The interface between the two dielectric surface, at $s = 4$ cm, has free surface charge density $\sigma_f = 5\ \mathrm{nC/m^2}$. If $\vec{D}_2 = 14\hat{s} - 9\hat{\phi} + 12\hat{z}\ \mathrm{nC/m^2}$, the value of $\vec{D}_1 =$ [9] $\hat{s} +$ [-21] $\hat{\phi} +$ [28] $\hat{z}\ \mathrm{nC/m^2}$. Provide answer in integer form.

Ques3.

The dipole moment of a spherical shell of radius $2R$ having a surface charge density $\sigma_0 \cos\theta$ can be given by $\frac{k\pi\sigma_0 R^l}{m}(\hat{n})$. Then, $k =$ [32], $l =$ [3], $m =$ [3] and $n =$ [z]. Write the values of k, l, m in integer form. Write appropriate direction such as x, y, z, r, theta, phi for n.

Ques4.

For the charge distribution shown in figure, $q_1 = -3q, q_2 = -3q, q_3 = 4q, q_4 = 3q$. Then the potential at a point far from the origin is given by:



- $V(\vec{r}) = \frac{1}{4\pi\epsilon_0}\frac{q(r - a\cos\theta)}{r^2}$
- $V(\vec{r}) = \frac{1}{4\pi\epsilon_0}\frac{q(1 - 2\cos\theta)}{r}$
- $V(\vec{r}) = \frac{1}{4\pi\epsilon_0}\frac{q}{r}$
- $V(\vec{r}) = \frac{1}{4\pi\epsilon_0}\frac{qa\cos\theta}{r^2}$
- $V(\vec{r}) = \frac{1}{4\pi\epsilon_0}\frac{qa}{r^2}$