Ramashray Baleshwar College

Dalsingsarai, Samastipur(Bihar)

A Constituent Unit of L. N. Mithila University, Darbhanga

AFFILIATED TO L.N. MITHILA UNIVERSITY, DARBHANGA

Assignment

STUDENT'S NAME :	RAHUL KUMAR
FATHER'S NAME :	YOGENDRA PANDIT
COURSE :	BSC
SEMESTER :	3RD SEMESTER
SESSION :	2024-28
MAJOR SUBJECT :	PHYSICS
PAPER / SUBJECT :	MJC-4 PHYSICS
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COLL. ROLL NO. :	174

SUBMISSION DATE

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STUDENT SIGNATURE

Physics Department

BSc. MJC-4 (Theory) 3rd Sem 2024-28.

Note: Attempt any two questions.

Question 1: What do you mean by Electric Dipole? Obtain an expression for Electric field and Potential at a point due to Electric Dipole.

Question 2: What do you mean by Gauss's Law of Electrostatics? Obtain the expression for Electric field at a point due to Spherical-charged conductor.

Question 3: What are Poission's and Laplace's equation? Obtain expression for capacity of Parallel Plate capacitor by using Laplac's equation.

Question 4: What do you mean by Dielectric Constant. Establish the relation among $\vec{P}$, $\vec{D}$ and $\vec{E}$.

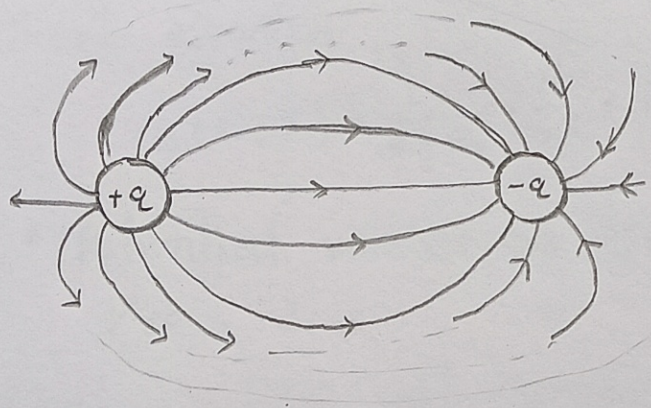
Question 5: What do you mean by polarization. Describe the types of Polarization.

Answer of Question number 1.

What is an Electric Dipole?

An electric dipole is a system of two equal and opposite point charges $+q$ and $-q$ separated by a small distance $2a$.

$$\vec{p} = q(2a)\hat{p}$$



Electric field lines always begin on a negative charge. The number of line leaving a positive charge or entering a negative charge is proportional to the magnitude of the charge.

Electric Potential due to an Electric Dipole

Consider a point P at distance r from the centre of the dipole making angle θ with the dipole axis.

Potential at P:

$$V = \frac{1}{4\pi\varepsilon_0}\left(\frac{q}{r_+} - \frac{q}{r_-}\right)$$

for a short dipole ($r >> a$), this simplifies to:

$$V(r,\theta) = \frac{1}{4\pi\varepsilon_0} \cdot \frac{p\cos\theta}{r^2}$$

Electric Field due to an Electric Dipole

The electric field is the negative gradient of potential:

$$\vec{E} = -\nabla V$$

Short dipole

$$E(r,\theta) = \frac{1}{4\pi\varepsilon_0} \cdot \frac{p}{r^3} \cdot \sqrt{1+3\cos^2\theta}$$

- Potential varies as $\frac{1}{r^2}$; field varies as $1/r^3$.

Answer of Question number 5..

Polarization:

Polarization is a phenomenon associated with transverse waves, especially light waves, in which the vibrations of the wave are restricted to a single plane perpendicular to the direction of propagation.

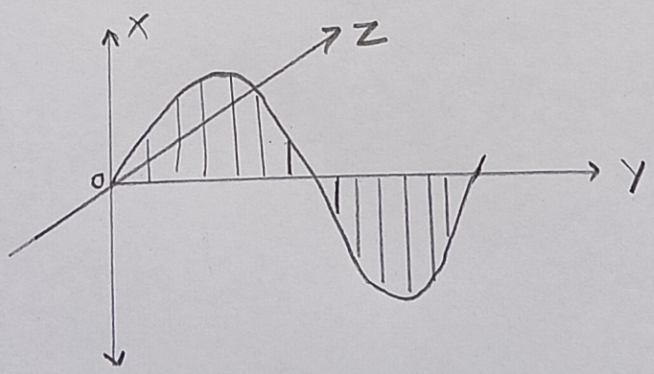
Light is ordinary (unpolarized) light, the electric field vectors vibrate randomly in all possible directions perpendicular to the direction of travel.
When these vibrations are confined to one particular direction or plane, the light is said to be polarized.

Types of Polarization.

Polarization of light is mainly classified into three types.

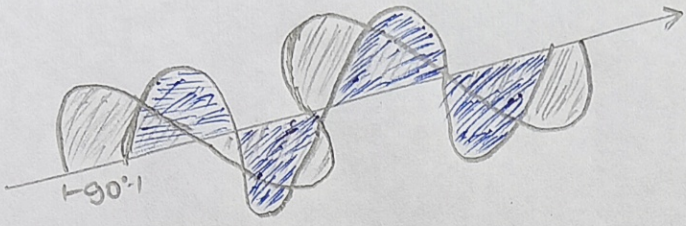
1. Linear (Plane) Polarization.

In linear polarization, the electric field vector of light vibrates only in one fixed plane perpendicular to the direction of propagation.



2. Circular Polarization :-

In circular polarization, the tip of the electric field vector rotates in a circular path as the light propagates, while maintaining a constant magnitude.



3. Elliptical Polarization.

In elliptical polarization, the electric field vector traces an elliptical path in the plane perpendicular to the direction of propagation.