Sri Pratyangira Institute

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Class - 12th

Electric Charges and Fields

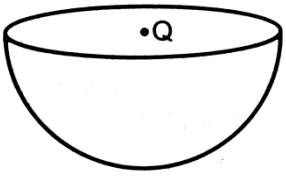
DPP – 08

1. If $\vec{E} = 6\hat{\imath} + 3\hat{\jmath} + 4\hat{k}$, calculate the electric flux through a surface of area 20 units in $\mathrm{Y} - \mathrm{Z}$ plane.
2. If the electric field is given by $\vec{E} = 8\hat{\imath} + 4\hat{\jmath} + 3\hat{k}\ \mathrm{NC}^{-1}$, calculate the electric flux through a surface of area $100\ m^2$ lying in the X-Y plane.
3. The electric field in a certain region of space is $\left(5\hat{\imath} + 4\hat{\jmath} - 4\hat{k}\right) \times 10^5\ \mathrm{NC}^{-1}$. Calculate the electric flux due to this field over an area of $(2\hat{\imath} - \hat{\jmath}) \times 10^{-2}\ m^2$.
4. Consider a uniform electric field $\vec{E} = 3 \times 10^3 \hat{\imath}\ \mathrm{NC}^{-1}$. Calculate the flux of this field through a square surface of area $10\ cm^2$ when

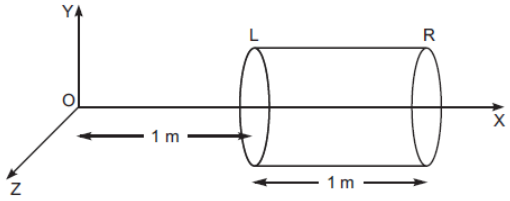
(a) Its plane is parallel to the y-z plane, and

(b) The normal to its plane makes a $60°$ angle with the x-axis.

5. Given a uniform electric field $\vec{E} = 5 \times 10^3\ \hat{\imath}\ \mathrm{NC}^{-1}$, find the flux of this field through a square of $10\ cm$ on a side whose plane is parallel to the Y-Z plane. What would be the flux through the same square if the plane makes a $30°$ angle with the X-axis?
6. A circular plane sheet of radius $10\ cm$ is placed in a uniform electric field of $5 \times 10^5\ \mathrm{NC}^{-1}$, making an angle of $60°$ with the field. Calculate the electric flux through the sheet.
7. A point charge of $17.7\ \mu\mathrm{C}$ is located at the centre of a cube of side $0.03\ m$. Find the electric flux through each face of the cube.
8. A spherical Gaussian surface encloses a charge of 8.85×10^{-8} C. (i) Calculate the electric flux passing through the surface. (ii) If the radius of the Gaussian surface is doubled, how would the flux change?
9. A positive charge of $17.7\ \mu\mathrm{C}$ is placed at the centre of a hollow sphere of radius $0.5\ m$. Calculate the flux density through the surface of the sphere.
10. Calculate the electric flux through each of the six faces of a closed cube of length l, if a charge q is placed (a) at its centre and (b) at one of its vertices.
11. A cylinder is placed in a uniform electric field $\vec{E}$ with its axis parallel to the field. Show that the total electric flux through the cylinder is zero.
12. A charge q is situated at the centre of an imaginary hemispherical surface, as shown in figure. Using Gauss's theorem and symmetry considerations, determine the electric flux due to this charge through the hemispherical surface.



13. A hollow cylindrical box of length $1\ m$ and area of cross-section $25\ cm^2$ is placed in a three dimensional coordinate system as shown in figure. The electric field in the region is given by $\vec{E} = 50x\ \hat{\imath}$, where E is in NC^{-1} and x is in metres.



Find

(a) Net flux through the cylinder.

(b) Charge enclosed by the cylinder.

14. The electric field in a region is given by $\vec{E} = \frac{E_0 x}{b}\hat{\imath}$. Find the charge contained in the cubical volume bounded by the surfaces $x = 0, x = a, y = 0, y = a, z = 0$ and $z = a$. Take $E_0 = 5 \times 10^3\ \text{NC}^{-1}, a = 1\ cm$ and $b = 2\ cm$.

15. The electric field components due to a charge inside the cube of side $0.1\ m$ are as shown.

$$E_x = \alpha x, \text{where } \alpha = 100\ \text{N/C} - \text{m}$$

$$E_y = 0, E_z = 0.$$