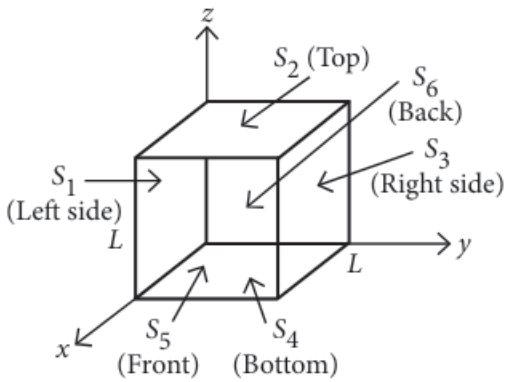
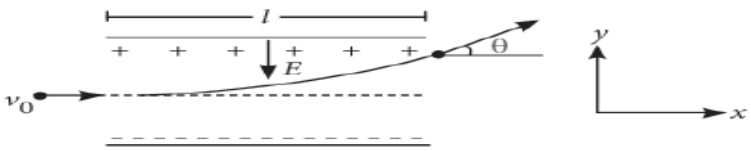
ELECTRIC CHARGES AND FIELDS

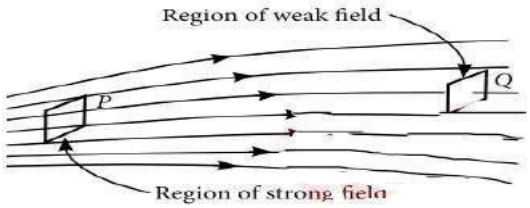
	CASE STUDY QUESTIONS (4 MARKS EACH)
1.	Observe the figure, read the data given below and answer the following questions



The cube as shown in Fig. has sides of length L=10.0 cm. The electric field is uniform, has a magnitude $E=4.00\times10^{3}NC^{-1}$, and is parallel to the xy−plane at an angle of 37° measured from the +x−axis towards the +y−axis.

	(i) Electric flux passing through surface S6 is (a) $-24\ Nm^2C^{-1}$ (b) $24\ Nm^2C^{-1}$ (c) $32\ Nm^2C^{-1}$ (d) $-32\ Nm^2C^{-1}$ (ii) The dimensional formula of surface integral $\int \mathbf{E}\cdot d\mathbf{S}$ of an electric field is (a) $[M\ L^2\ T^{-2}\ A^{-1}]$ (b) $[M\ L^3\ T^{-3}\ A^{-1}]$ (c) $[M^{-1}\ L^3\ T^{-3}\ A]$ (d) $[M\ L^{-3}\ T^{-3}\ A^{-1}]$ (iii) The surfaces that have zero flux are (a) S1 and S3 (b) S4 and S6 (c) S2 and S4 (d) S1 and S (iv) The total net electric flux through all faces of the cube is (a) $8\ N\ m^2C^{-1}$ (b) $-8\ N\ m^2C^{-1}$ (c) $24\ N\ m^2C^{-1}$ (d) zero
Ans.	(i) d (ii) b (iii) b (iv) d
2.	When a charged particle is placed in an electric field, it experiences an electrical force. If this is the only force on the particle, it must be the net force. The net force will cause the particle to accelerate according to Newton's second law. So, **F**=q**E**= m**a.**  If **E** is uniform, then **a** is constant and **a**= q **E** /m . If the particle has a positive charge, its acceleration is in the direction of the field. If the particle has a negative charge, its acceleration is in the direction opposite to the electric field. Since the acceleration is constant, the kinematic equations can be used. **(i)** An electron of mass m, charge e falls through a distance h metre in a uniform electric field E. then time of fall, (a) $t=\sqrt{\frac{2hm}{eE}}$ (b) $t=\frac{2hm}{eE}$ (c) $t=\sqrt{\frac{2eE}{hm}}$ (d) $t=\frac{2eE}{hm}$ (ii) The electric flux through a closed surface area S enclosing charge Q is f. If the surface area is doubled, then the flux is (a) 2ϕ (b) $\phi/2$ (c) $\phi/4$ (d) ϕ (iii)A Gaussian surface encloses a dipole. The electric flux through this surface is (a) $\frac{q}{\varepsilon_0}$ (b) $\frac{2q}{\varepsilon_0}$ (c) $\frac{q}{2\varepsilon_0}$ (d) zero (iv) In an electric field directed upwards, an electron will experience a force directed (a) Downward force of magnitude e E (b)Upward force of magnitude e E (c)Downward force of magnitude e/E (d)Upward force of magnitude e/E
Ans.	(i) a (ii) d (iii) d (iv) a

3.	Electric field strength is proportional to the density of lines of force i.e., electric field strength at a point is proportional to the number of lines of force cutting a unit area element placed normal to the field at that point. As illustrated in the given figure, the electric field at P is stronger that at Q.



(i) Electric lines of force about a positive point charge are

(a) radially outwards

(b) circular clockwise

(c) radially inwards

(d) parallel straight lines.

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(ii) Which of the following is false for electric lines of force?

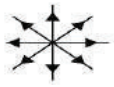
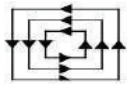
(a) They always start from positive charges and terminate on negative charges.

(b) They are always perpendicular to the surface of a charged conductor.

(c) They always form closed loops.

(d) They are parallel and equally spaced in a region of uniform electric field.

(iii) Which one of the following patterns of electric line of force in not possible in filed due to stationary charges?

(a)  (b)  (c)  (d) 

(iv)The figure below shows the electric field lines due to two positive charges. The magnitudes EA, EB and EC of the electric fields at points A, B and C respectively are related as

(a) $E_A > E_B > E_C$ (b) $E_B > E_A > E_C$ (c) $E_A = E_B > E_C$ (d) $E_A > E_B = E_C$

Ans.	(i) a (ii) c (iii) c (iv) a