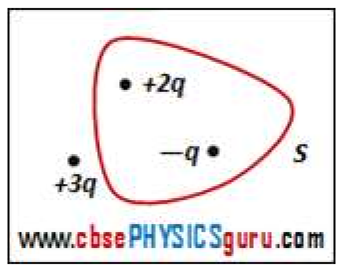
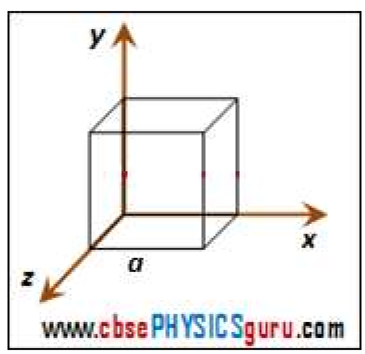
ELECTRIC FLUX, GAUSS'S THEOREM AND ITS APPLICATIONS

1. In a region of space the electric field is given by $\vec{E} = 5\hat{\imath} + 6\hat{\jmath} + 9\hat{k}$. The electric flux through a surface of area of 50 units in x - z plane is:
(a) 800 units **(b)** 300 units (c) 400 units (d) 600 units
2. Consider a uniform electric field $\vec{E} = 4 \times 10^3 \hat{\imath}$ N/C. What is the flux of this field through a square of side 5 cm if the normal to its plane makes a 60° angle with the x-axis?
(a) 5 $NC^{-1}m^2$ (b) 15 $NC^{-1}m^2$ (c) 20 $NC^{-1}m^2$ (d) 25 $NC^{-1}m^2$
3. The electric field in a region is given by $\vec{E} = a\hat{\imath} + b\hat{\jmath}$, where *a* and *b* are constants. The net electric flux passing through a square area of side L parallel to y-z plane is:
(a) a^2L^2 (b) abL^2 (c) bL^2 **(d)** aL^2
4. Two infinite plane parallel sheets, separated by a distance d have equal and opposite uniform charge densities σ. Electric field at a point between the sheets is:
(a) depends upon location of the point **(b)** σ/ε_0 (c) $\sigma/2\varepsilon_0$ (d) zero
5. Force acting on a charged particle kept between the pair of plates, having equal and opposite charge, is F. If one of the plates is removed, the force acting on the same particle will be:
(a) F (b) 2F (c) 4F **(d)** F/2
6. Two parallel infinite line charges +λ and -λ are placed with a separation distance *a* in free space. The net electric field exactly mid-way between the two line charges is:
(a) $\frac{\lambda}{4\pi\varepsilon_0 a}$ **(b)** $\frac{2\lambda}{\pi\varepsilon_0 a}$ (c) $\frac{\lambda}{\pi\varepsilon_0 a}$ (d) zero
7. Electric flux associated with a closed surface is ϕ. If 6 μC charge is added to it, the flux becomes 4ϕ. What was the initial charge inside the surface?
(a) 2 μC (b) 3 μC (c) 4 μC (d) 6 μC
8. Figure shows three point charges, +2q, —q and +3q. Two charges + 2g and —q are enclosed within a surface S. What is the electric flux clue to this configuration through the surface S?
(a) $\frac{q}{\varepsilon_0}$ (b) $\frac{2q}{\varepsilon_0}$ (c) $\frac{3q}{\varepsilon_0}$ (d) zero



9. Eight dipoles of charges of magnitude *e* are placed inside a cube. The total electric flux coming out of the cube will be:
(a) $\frac{e}{\varepsilon_0}$ (b) $\frac{8e}{\varepsilon_0}$ (c) $\frac{e}{6\varepsilon_0}$ **(d)** zero
10. Given the electric field in the region $\vec{E} = 2x\hat{\imath}$. The net electric flux through the cube is:
(a) $2a^3$ (b) a^3 (c) $4a^3$ (d) $6a^3$



11. A point charge +Q is at a distance d/2 directly above the centre of a square of side *d*. The magnitude of electrostatic flux through the square is:
(a) $\frac{Q}{6\varepsilon_0}$ (b) $\frac{Qd^2}{6\varepsilon_0}$ (c) $\frac{6Q}{\varepsilon_0}$ (d) $\frac{Q}{\varepsilon_0}$
12. Assuming that a positive charge Q is uniformly distributed over the surface of a shell, the field at a distance r from the centre of the shell where r = 3R (R being the radius the shell), is:
(a) $E = \frac{Q}{4\pi\varepsilon_0 R^2}$ (b) $E = \frac{Q}{4\pi\varepsilon_0 (2R)^2}$ **(c)** $E = \frac{Q}{4\pi\varepsilon_0 (3R)^2}$ (d) zero

13. Electric charge is uniformly distributed along a long straight wire of radius 1 mm. The charge per cm length of the wire is λ coulomb. Another cylindrical surface of radius 50 cm and length 1 m symmetrically encloses the wire. The total electric flux passing through the cylindrical surface is:
(a) $\frac{50\lambda}{\varepsilon_0}$ **(b)** $\frac{100\lambda}{\varepsilon_0}$ (c) $\frac{\lambda}{\varepsilon_0}$ (d) $\frac{\lambda}{100\ {}_0}$
14. The total electric flux emanating from a closed surface enclosing an α-particle in terms at e (electronic charge) is:
(a) $\frac{2e}{\varepsilon_0}$ (b) $\frac{3e}{\varepsilon_0}$ (c) $\frac{e}{\varepsilon_0}$ (d) $\frac{e}{2\varepsilon_0}$
15. Gauss's law of electrostatics would be invalid if:
(a) there were magnetic monopoles (b) the speed of light was not a universal constant **(c)** the inverse square law was not exactly true (d) the electrical charge was not quantized
16. The electric field due to an infinitely long straight uniformly charged wire at a distance r is directly proportional to:
(a) r (b) r^2 **(c)** 1/r (d) $1/r^2$
17. An electric charge of 8.85×10^{-13} C is placed at the centre of a sphere of radius 1 m. The electric flux through the sphere is:
(a) 10 $NC^{-1}m^2$ **(b)** 0.1 $NC^{-1}m^2$ (c) 0.2 $NC^{-1}m^2$ (d) 0.02 $NC^{-1}m^2$