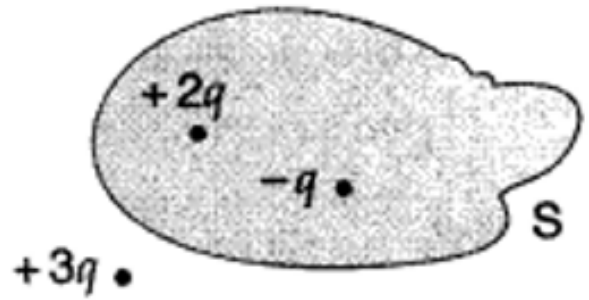
DAV PUBLIC SCHOOL THERMAL COLONY, PANIPAT

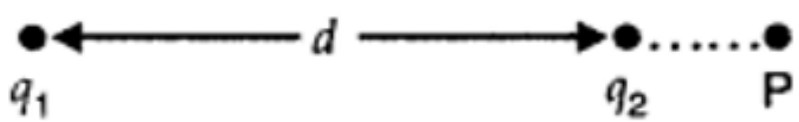
Class 12 Physics Assignment

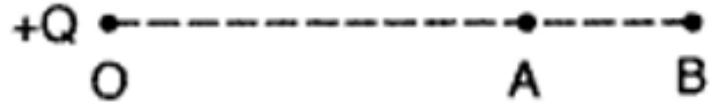
Chapter 1 - Electric Charges and Fields

1	Which orientation of an electric dipole in a uniform electric field would correspond to stable equilibrium ?
2	If the radius of the Gaussian surface enclosing a charge is halved, how does the electric flux through the Gaussian surface change ?
3	Define the term electric dipole moment of a dipole. State its S.I. unit.
4	In which orientation, a dipole placed in a uniform electric field is in Stable & Unstable equilibrium ?

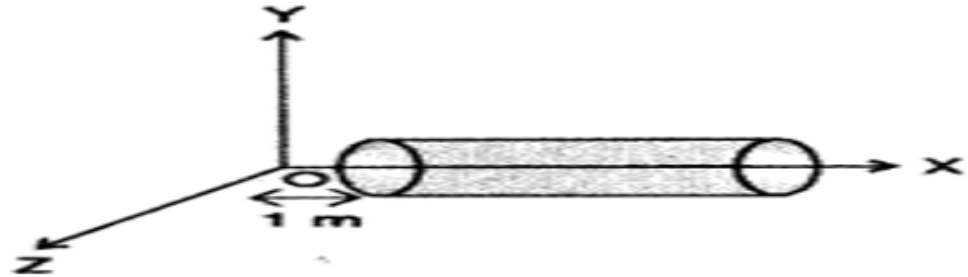
5	Figure shows three point charges, +2q, -q and + 3q. Two charges +2q and -q are enclosed within a surface 'S'. What is the electric flux due to this configuration through the surface 'S'? 
6	Name the physical quantity whose S.I. unit is JC^{-1}. Is it a scalar or a vector quantity?
7	Why should electrostatic field be zero inside a conductor?
8	Why must electrostatic field be normal to the surface at every point of a charged conductor?
9	A charge 'q' is placed at the centre of a cube of side l. What is the electric flux passing through each face of the cube?

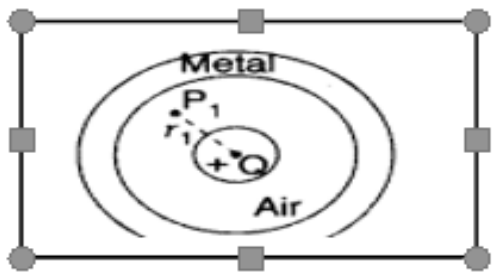
10	A charge ‘q’ is placed at the centre of a cube of side l. What is the electric flux passing through two opposite faces of the cube?
11	What is the direction of the electric field at the surface of a charged conductor having charge density $\sigma < 0$?
12	Why do the electric field lines not form closed loops?
13	Is the electric field due to a charge configuration with total charge zero, necessarily zero? Justify.
14	Two charges of magnitudes – 2Q and + Q are located at points (a, 0) and (4a,0) respectively. What is the electric flux due to these charges through a sphere of radius ‘3a’ with its centre at the origin?
15	Two charges of magnitudes -3Q and + 2Q are located at points (a, 0) and (4a, 0) respectively. What is the electric flux due to these charges through a sphere of radius ‘5a’ with its centre at the origin?

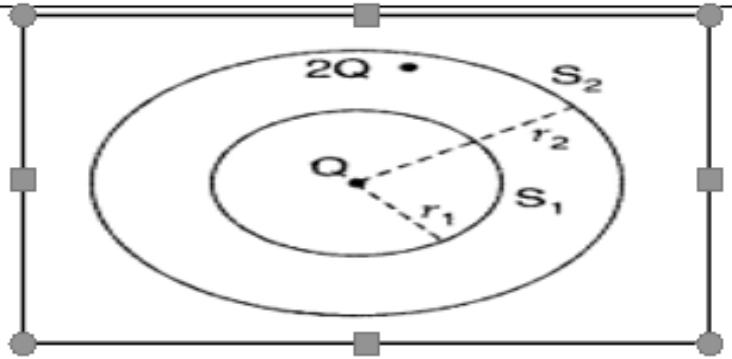
16	Write the expression for the work done on an electric dipole of dipole moment p in turning it from its position of stable equilibrium to a position of unstable equilibrium in a uniform electric field E.
17	**Two point charges 'q_1' and 'q_2' are placed at a distance 'd' apart**  as shown in the figure. The electric field intensity is zero at a point 'P' on the line joining them . Write two conclusions that you can draw from this.
18	What is the electric flux through a cube of side 1 cm which encloses an electric dipole?
19	Why are electric field lines perpendicular at a point on an equipotential surface of a conductor?

20	**A point charge +Q is placed at point O as shown in the figure.**  Is the potential difference $V_A - V_B$ positive, negative or zero?
21	How does the electric flux due to a point charge enclosed by a spherical Gaussian surface get affected when its radius is increased?
22	Show on a plot the nature of variation of the Electric field (E) and potential (V), of a (small) electric dipole with the distance (r) of the field point from the centre of the dipole.
23	Does the charge given to a metallic sphere depend on whether it is hollow or solid? Give reason for your answer
24	Draw a plot showing variation of electric field with distance from the centre of a solid conducting sphere of radius R, having a charge of +Q on its surface.

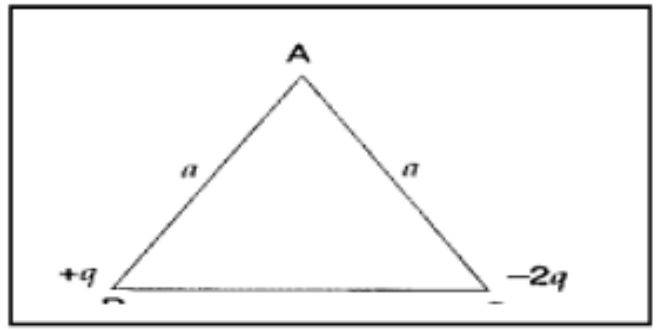
25	A point charge +Q is placed in the vicinity of a conducting surface. Draw the electric field lines between the surface and the charge.
26	Derive an expression for the torque experienced by an electric dipole kept in a uniform electric field.
27	Define electric flux. Write its S.I. unit. A charge q is enclosed by a spherical surface of radius R. If the radius is reduced to half, how would the electric flux through the surface change?
28	A spherical conducting shell of inner radius rx and outer radius r2 has a charge 'Q'. A charge 'q' is placed at the centre of the shell. (a) What is the surface charge density on the (i) inner surface, (ii) outer surface of the shell? (b) Write the expression for the electric field at a point x > r_2 from the centre of the shell.
29	A thin straight infinitely long conducting wire having charge density X is enclosed by a cylindrical surface of radius r and length l, its axis coinciding with the length of the wire. Find the expression for the electric flux through the surface of the cylinder.

30	Plot a graph showing the variation of coulomb force (F) versus $(1r2)$, where r is the distance between the two charges of each pair of charges : (1μC, 2μC) and (2μC, – 3μC). Interpret the graphs obtained.
31	A hollow cylindrical box of length 1m and area of cross-section 25 cm^2 is placed in a three dimensional coordinate system as shown in the figure.  The electric field in the region is given by $\mathbf{E}=50x\mathbf{i}$ where E is in NC^{-1} and x is in meters. Find Net flux through the cylinder Charge enclosed by the cylinder.
32	Given a uniform electric field $\vec{\mathbf{E}} = 5 \times 10^3 \ \hat{i}$ N/C, 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?

33	Given a uniform electric field $\mathbf{E} = 2 \times 10^3\ \mathbf{i}$ N/ C, find the flux of this field through a square of side 20 cm, whose plane is parallel to the y-z plane. What would be the flux through the same square, if the plane makes an angle of 30° with the x-axis?
34	Given a uniform electric field $\mathbf{E}=4\times10^3\mathbf{i}$ N/C. Find the flux of this field through a square of 5 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?
35	A small metal sphere carrying charge +Q is located at the centre of a spherical cavity in a large uncharged metallic spherical shell. Write the charges on the inner and outer surfaces of the shell. Write the expression for the electric field at the point P_1 . 

36	An electric dipole is placed in a uniform electric field $\mathbf{E}$ with its dipole moment $\mathbf{p}$ parallel to the field. Find (i) the work done in turning the dipole till its dipole moment points in the direction opposite to $\mathbf{E}$. (ii) the orientation of the dipole for which the torque acting on it becomes maximum.
37	A sphere S_1 of radius r_1 encloses a net charge Q. If there is another concentric sphere S_2 of radius r_2 ($r_2 > r$,) enclosing charge 2Q, find the ratio of the electric flux through S_1 and S_2. How will the electric flux through sphere S_1 change if a medium of dielectric constant K is introduced in the space inside S_2 in place of air? 
38	Define the term 'electric flux'. Write its S.I. units. What is the flux due to electric field $\mathbf{E}=3\times10^3\mathbf{i}$ N/C through a square of side 10 cm, when it is held normal to if?

39	A thin conducting spherical shell of radius R has charge Q spread uniformly over its surface. Using Gauss's law, derive an expression for an electric field at a point outside the shell. Draw a graph of electric field E(r) with distance r from the centre of the shell for $0 \leq r \leq \infty$
40	A positive point charge (+ q) is kept in the vicinity of an uncharged conducting plate. Sketch electric field lines originating from the point on to the surface of the plate.
41	Use Gauss's law to derive the expression for the electric field between two uniformly charged large parallel sheets with surface charge densities a and -a respectively
42	(a) Define electric flux. Write its S.I. units. (b) Consider a uniform electric field $\mathbf{E} = 3 \times 10^3\ \mathbf{i}$ N/C. Calculate the flux of this field through a square surface of area 10 cm^2 when (i) its plane is parallel to the y-z plane, and (ii) the normal to its plane makes a 60° angle with the x-axis

43	Two charged spherical conductors of radii R_1 and R_2 when connected by a conducting wire acquire charges q_1 and q_2 respectively. Find the ratio of their surface charge densities in terms of their radii.
44	Two point charges + q and -2q are placed at the vertices 'B' and 'C' of an equilateral triangle ABC of side as given in the figure Obtain the expression for (i) the magnitude and (ii) the direction of the resultant electric field at the vertex A due to these two charges. 
45	An electric dipole of dipole moment $\mathbf{p}$ is placed in a uniform electric field $\mathbf{E}$?. Obtain the expression for the torque $\boldsymbol{\tau}$ experienced by the dipole. Identify two pairs of perpendicular vectors in the expression

46	A charge is distributed uniformly over a ring of radius ‘a’. Obtain an expression for the electric intensity E at a point on the axis of the ring. Hence show that for points at large distances from the ring, it behaves like a point charge.
47	Two thin concentric and coplanar spherical shells, of radii a and b (b > a) carry charges, q and Q, respectively. Find the magnitude of the electric field, at a point distant x, from their common centre for (i) $0 < x < a$ (ii) $a \leq x < b$ (iii) $b \leq x < \infty$
48	A charge +Q, is uniformly distributed within a sphere of radius R. Find the electric field, due to this charge distribution, at a point distant r from the centre of the sphere where : (i) $0 < r < R$ and (ii) $r > R$

49	(i) Derive the expression for electric field at a point on the equatorial line of an electric dipole. (ii) Depict the orientation of the dipole in (a) stable, & (b) unstable equilibrium in a uniform electric field
50	(i) Obtain the expression for the torque $\vec{\tau}$ experienced by an electric dipole of dipole moment $\vec{p}$ in a uniform electric $\mathbf{E}$? (ii) What will happen if the field were not uniform?