Physics

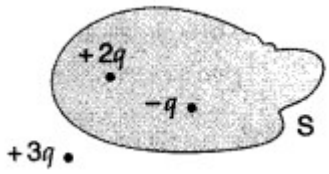
Board – CBSE	Class – 12th	Chapter – ELECTRIC CHARGES AND FIELD

Q.1. Define the term electric dipole moment of a dipole. State its S.I. unit

Q.2. In which orientation, a dipole placed in a uniform electric field is in

- stable,
- unstable equilibrium?

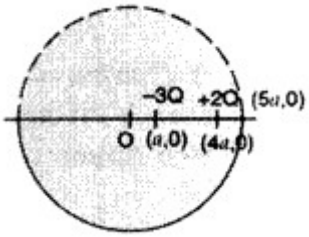
Q.3. Figure shows three-point charges, +2q, -q and + 3q. Two charges +2q and -q are enclosed within a surface 'S'. What is the electric flux due to this configuration through the surface 'S'?



Q.4. A charge 'q' is placed at the center of a cube of side I. What is the electric flux passing through each face of the cube?

Q.5. Why do the electric field lines not form closed loops?

Q.6. 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 center at the origin?



Q.7. 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.

Q.8. Why do the electric field lines never cross each other?

Q.9. Why are electric field lines perpendicular at a point on an equipotential surface of a conductor?

Q.10. Draw a plot showing variation of electric field with distance from the center of a solid conducting sphere of radius R, having a charge of +Q on its surface.

Q.11. 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, if Q is?

(i) positive

(ii) negative

Q.12. An electric dipole is held in a uniform electric field.

(i) Show that the net force acting on it is zero.

(ii) The dipole is aligned parallel to the field.

Find the work done in rotating it through the angle of 180°.

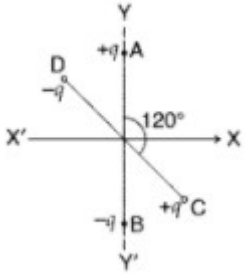
Q.13. Two-point charges q_1 and q_2 are located at $\vec{r}_1$ and $\vec{r}_2$ respectively in an external electric field $\vec{E}$. Obtain the expression for the total work done in assembling this configuration.

Q.14. A dipole with its charge - q and +q located at the points $(0,-b,0)$ and (0,+5, 0) is present in a uniform electric field E. The equipotential surfaces of this field are planes parallel to the YZ -plane.

(i) What is the direction of the electric field E?

(ii) How much torque would the dipole experience in this field?

Q.15. Two small identical electrical dipoles AB and CD, each of dipole moment 'p' are kept at an angle of 120° as shown in the figure. What X ' is



the resultant dipole moment of this combination? If this system is subjected to electric field(E) directed along $+X$ direction, what will be the magnitude and direction of the torque acting on this?

Q.16. An electric dipole of length $4\,cm$, when placed with its axis making an angle of 60° with a uniform electric field, experiences a torque of $4\sqrt{3}\,Nm$. Calculate the potential energy of the dipole if it has charge $\pm 8\,nC$.

Q.17. If the radius of the Gaussian surface enclosing a charge is halved, how does the electric flux through the Gaussian surface change?

Q.18. Why should electrostatic field be zero inside a conductor?

Q.19. A spherical conducting shell of inner radius rx and outer radius $r\,2$ 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.

Q.20. Show that the electric field at the surface of a charged conductor is given by

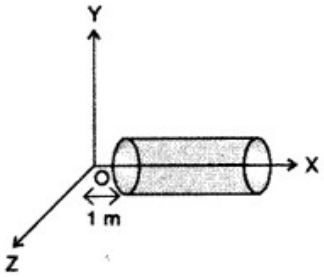
$\vec{E}=\frac{\sigma}{\varepsilon_0}n\hat{}$, where σ is the surface charge density and h is a unit vector normal to the surface in the outward direction.

Q.21. 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.

Q.22. Plot a graph showing the variation of coulomb force (F) versus $\left(\frac{1}{r^2}\right)$, where r is the distance between the two charges of each pair of charges: $(1\mu C, 2\mu C)$ and $(2\mu C, -3\mu C)$. Interpret the graphs obtained.

Q.23. 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 the figure. The electric field in the region is given by $\vec{E}=50xi\hat{}$ where E is in NC^{-1} and x is in metres. Find



(i) Net flux through the cylinder.

(ii) Charge enclosed by the cylinder.

Q.24. Given a uniform electric field $\vec{E}=5\times10^3 i\hat{}\,N/C$, 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?

Q.25. An electric dipole is placed in a uniform electric field E with its dipole moment $\vec{p}$ parallel to the field. Find

(i) the work done in turning the dipole till its dipole moment points in the direction opposite to $\vec{E}$.

(ii) the orientation of the dipole for which the torque acting on it becomes maximum.