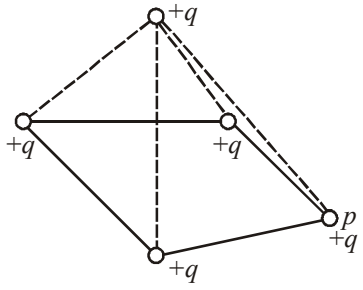
15 Electric Charges and Fields

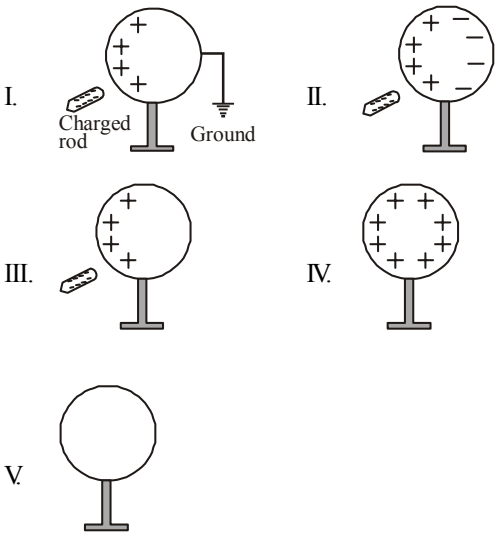
Diagram Based Questions :

1. The figure shows a charge + q at point P held in equilibrium in air with the help of four + q charges situated at the vertices of a square. The net electrostatic force on p is given by



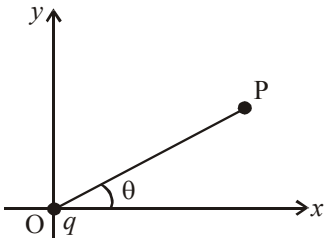
(a) Gauss's law
(b) Coulomb's law
(c) Principle of superposition
(d) net electric flux out the position of $+q$.

2. A metal sphere is being charged by induction using a charged rod, but the sequence of diagrams showing the process misplaced.



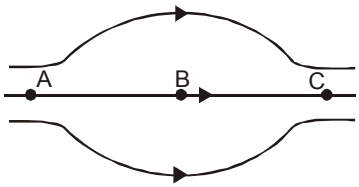
Correct order of charging is
(a) I → II → III → IV → V
(b) V → II → III → I → IV
(c) V → II → I → III → IV
(d) IV → II → III → I → V

3. In the figure, charge q is placed at origin O. When the charge q is displaced from its position the electric field at point P changes



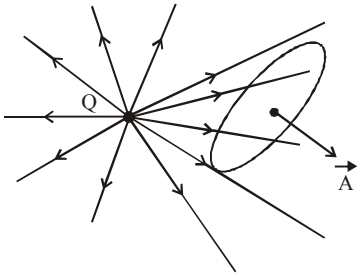
(a) at the same time when q is displaced.
(b) at a time after $\frac{OP}{c}$ where c is the speed of light.
(c) at a time after $\frac{OP\cos\theta}{c}$.
(d) at a time after $\frac{OP\sin\theta}{c}$

4. Figure shows some of the electric field lines corresponding to an electric field. The figure suggests that



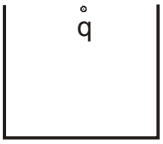
(a) $E_A > E_B > E_C$
(b) $E_A = E_B = E_C$
(c) $E_A = E_C > E_B$
(d) $E_A = E_C < E_B$

5. In the figure the net electric flux through the area A is $\phi = \vec{E} \cdot \vec{A}$ when the system is in air. On immersing the system in water the net electric flux through the area



(a) becomes zero (b) remains same
(c) increases (d) decreases

6. A charge q is placed at the centre of the open end of a cylindrical vessel. The flux of the electric field through the surface of the vessel is



(a) zero (b) q/ε_o
(c) $q/2\varepsilon_o$ (d) $2q/\varepsilon_o$

Solution

1. **(c)** The weight mg of the charge hold in air is in equillibrium with net electrostatic force exerted by the four charges situated at the corners. The net electrostatic force is given by the vector sum of the individual forces exerted by the charges at the corners. This is principle of superposition.

2. **(c)** When charged rod is brought near uncharged conductor near end of conductor has opposite charge.When for end of this conductor is connected is ground (i.e., earthed), charge of far end flows down to ground when for end connection and rod are removed charge on conductor spreads uniformly on surface.

3. **(b)** The electric field around a charge propagates with the speed of light away from the charge. Therefore the required time = $\frac{\text{distance}}{\text{speed}} = \frac{OP}{c}$.

4. **(c)**

5. **(d)** Since electric field $\vec{E}$ decreases inside water, therefore flux $\phi = \vec{E}.\vec{A}$ also decreases.

6. **(a)** The flux is zero according to Gauss' Law because it is a open surface which enclosed a charge q.