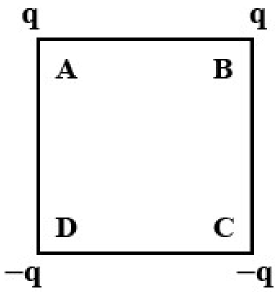
PHYSICS

ELECTROSTATICS

11. Charges are placed on the vertices of a square as shown. Let E be the electric field and V be the potential at the centre. If the charges on A and B are interchanged with those on D and C respectively, then



(1) E remains unchanged, V changes
(2) Both E and V change
(3) E and V remain unchanged
(4) E changes, V remains unchanged

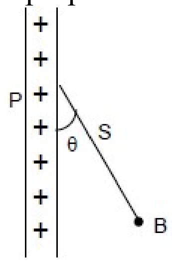
12. Two spherical conductors A and B of radii 1mmand 2mm are separated by a distance of 5cm and are uniformly charged. If the spheres are connected by a conducting wire then in equilibrium condition, the ratio of the magnitude of the electric fields at the surface of spheres A and B is

(1) 4 : 1 (2) 1 : 2
(3) 2 : 1 (4) 1 : 4

13. An electric dipole is placed at an angle of 30° to a non-uniform electric field. The dipole will experience

(1) a translational force only in the direction of the field
(2) a translational force only in the direction normal to the direction of the field
(3) a torque as well as a translational force
(4) a torque only

14. A charged ball B hangs from a silk thread S, which makes an angle θ with a large charged conducting sheet P, as shown in the figure. The surface charge density σ of the sheet is proportional to



(1) cos θ (2) cot θ
(3) sin θ (4) tan θ

15. If the electric flux entering and leaving an enclosed surface respectively is ϕ_1 and ϕ_2, the electric charge inside the surface will be

(1) $(\phi_2 - \phi_1)\varepsilon_0$ (2) $\frac{(\phi_1 + \phi_2)}{\varepsilon_0}$
(3) $\frac{(\phi_2 - \phi_1)}{\varepsilon_0}$ (4) $(\phi_1 - \phi_2)\varepsilon_0$

16. A thin spherical conducting shell of radius R has a charge q. Another charge Q is placed at the centre of the shell. The electrostatic potential at a point P at a distance $\frac{R}{2}$ from the centre of the shell is

(1) $\frac{2Q}{4\pi\varepsilon_0 R}$
(2) $\frac{2Q}{4\pi\varepsilon_0 R} - \frac{2q}{4\pi\varepsilon_0 R}$
(3) $\frac{2Q}{4\pi\varepsilon_0 R} + \frac{q}{4\pi\varepsilon_0 R}$
(4) $\frac{(q+Q)}{4\pi\varepsilon_0}\frac{2}{R}$

17. On moving a charge of 20 C by 2 cm, 2 J of work is done, then the potential difference between the points is
(1) 0.1 V (2) 8 V
(3) 2 V (4) 0.5 V

18. An electron of mass m_e, initially at rest, moves through a certain distance in a uniform electric field in time t_1. A proton of mass m_p, also, initially at rest, takes time t_2 to move through an equal distance in this uniform electric field. Neglecting the effect of gravity, the ratio $\frac{t_2}{t_1}$ is nearly equal to
(1) 1 (2) $\left(\frac{m_p}{m_e}\right)^{\frac{1}{2}}$
(3) $\left(\frac{m_e}{m_p}\right)^{\frac{1}{2}}$ (4) 1836

19. A non-conducting solid sphere of radius R is uniformly charged. The magnitude of the electric field due to the sphere at a distance r from its centre
(1) increases as r increases for r < R
(2) decreases as r increases for $0 < r < \infty$
(3) increases as r increases for $R < r < \infty$
(4) is discontinuous at r = R

20. A uniform electric field pointing in positive x-direction exists in a region. Let A be the origin, B be the point on the x-axis at x = +1 cm and C be the point on the y-axis at y = +1 cm. Then the potentials at the points A, B and C satisfy
(1) $V_A < V_B$ (2) $V_A > V_B$
(3) $V_A < V_C$ (4) $V_A > V_C$