PHYSICS

ELECTROSTATICS

1. The bob of a simple pendulum has mass 2 g and a charge of 5.0 μC. It is at rest in a uniform horizontal electric field of intensity 2000 V m^{-1}. At equilibrium, the angle that the pendulum makes with the vertical is (take g = 10 ms^{-2})

(1) $\tan^{-1}(2.0)$ (2) $\tan^{-1}(0.2)$

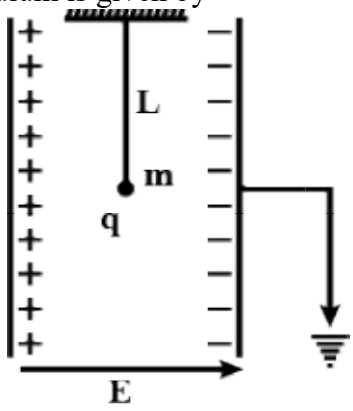
(3) $\tan^{-1}(5.0)$ (4) $\tan^{-1}(0.5)$

2. An electric dipole is formed by two equal and opposite charge q with separation d. The charges have same mass m. It is kept in a uniform electric field E. If it is slightly rotated from its equilibrium orientation, then its angular frequency ω is

(1) $\sqrt{\frac{2qE}{md}}$ (2) $\sqrt{\frac{qE}{2md}}$

(3) $2\sqrt{\frac{qE}{md}}$ (4) $\sqrt{\frac{qE}{md}}$

3. A simple pendulum of length L is placed between the plates of a parallel plate capacitor having electric field E, as shown in figure. Its bob has mass m and charge q. The time period of the pendulum is given by



(1) $2\pi\sqrt{\frac{L}{\sqrt{g^2+\left(\frac{qE}{m}\right)^2}}}$

(2) $2\pi\sqrt{\frac{L}{\sqrt{g^2-\frac{q^2E^2}{m^2}}}}$

(3) $2\pi\sqrt{\frac{L}{\left(g+\frac{qE}{m}\right)}}$

(4) $2\pi\sqrt{\frac{L}{\left(g-\frac{qE}{m}\right)}}$

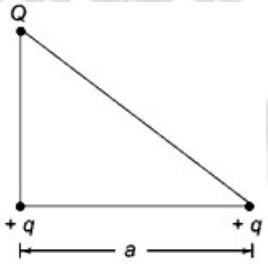
4. Three charges Q, +q and +q are placed at the vertices of a right angle isosceles triangle as shown below. The net electrostatic energy of the configuration is zero, if the value of Q is

(1) −2q

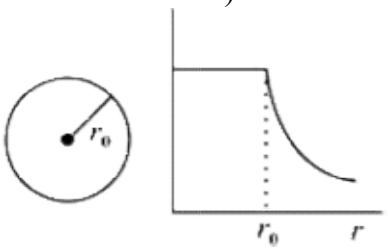
(2) $\frac{-q}{1+\sqrt{2}}$

(3) +q

(4) $\frac{-\sqrt{2}q}{\sqrt{2}+1}$



5. The given graph shows variation (with distance r from centre) of



(1) Electric field of a uniformly charged spherical shell

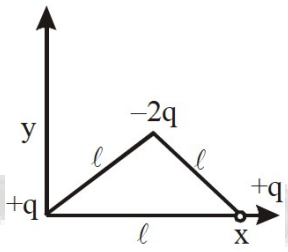
(2) Potential of a uniformly charged spherical shell

(3) Electric field of a uniformly charged sphere

(4) Potential of a uniformly charged sphere.

6. An electric field of 1000 V m^{-1} is applied to an electric dipole at angle of 45º. The value of electric dipole moment is 10^{-29} C-m. What is the potential energy of the electric dipole?
(1) -9×10^{-20} J
(2) -10×10^{-29} J
(3) -20×10^{-18} J
(4) -7×10^{-27} J

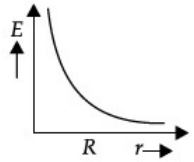
7. Determine the electric dipole moment of the system of three charges,placed on the vertices of an equilateral triangle,as shown in the figure

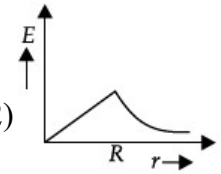


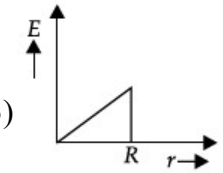
(1) $\sqrt{3}ql\dfrac{\hat{i}-\hat{i}}{\sqrt{2}}$
(2) $2ql\hat{j}$
(3) $-\sqrt{3}ql\hat{j}$
(4) $(ql)\dfrac{\hat{i}+\hat{j}}{\sqrt{2}}$

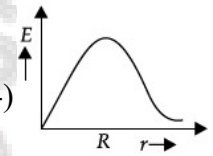
8. Assume that an electric field $E = 30x^2\hat{i}$ exists in space. Then the potential difference $V_A - V_O$, where V_O is the potential at the origin and V_A the potential at x = 2 m, is
(1) 120 J (2) −120 J
(3) −80 J (4) 80J

9. In a uniformly charged sphere of total charge Q and radius R the electric field E is plotted as a function of distance from the centre. The graph which would correspond to the above will be

(1) 

(2) 

(3) 

(4) 

10. A charge Q is placed at each of the opposite corners of a square. A charge q is placed at each of the other two corners. If the net electrical force on Q is zero, then the $\dfrac{Q}{q}$ equals
(1) $-2\sqrt{2}$ (2) −1
(3) 1 (4) $-\dfrac{1}{\sqrt{2}}$