PHYSICS

BOOKS - CAREER POINT

UNIT TEST 6

Physics

1. A charge q is placed at the centre of the line joining two equal charges Q. The system of the three charges will be in equilibrium if q is equal to:

A. $-\frac{Q}{2}$

B. $-\frac{Q}{4}$

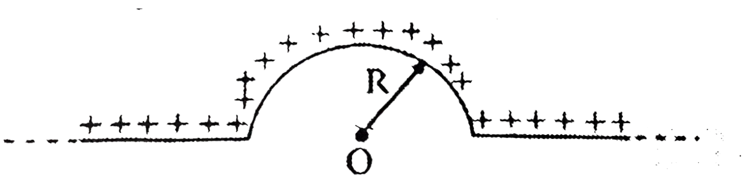
C. $-4Q$

D. $+\frac{Q}{2}$

Answer: B

Watch Video Solution

2. The electric field intensity due to a thin infinity long straight wire of uniform linear charge density λ at O is-



A. $\dfrac{\lambda}{2\pi\varepsilon_0 R}$

B. $\dfrac{\lambda\sqrt{2}}{2\pi\varepsilon_0 R}$

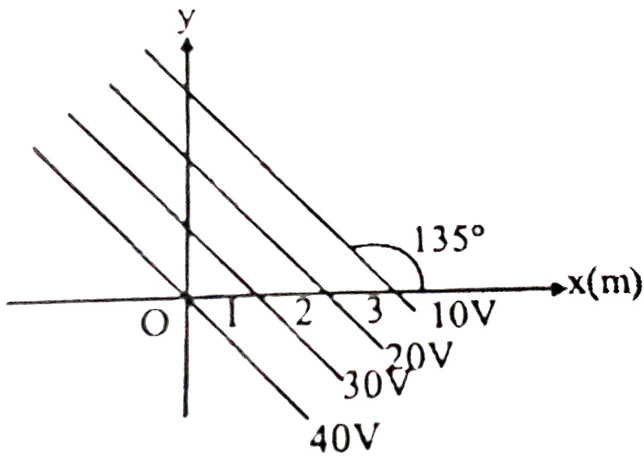
C. $\dfrac{\lambda\sqrt{5}}{2\pi\varepsilon_0 R}$

D. zero

Answer: A

Watch Video Solution

3. Figure shows a set of equipotential surfaces. The magnitude and direction of electric field that exists in the region is-



A. $10\sqrt{2}V/m$ at 45° with x-axis

B. $10\sqrt{2}V/m$ at 135° with x-axis

C. $5\sqrt{2}V/m$ at 45° with x-axis

D. $5\sqrt{2}V/m$ at 135° with x-axis

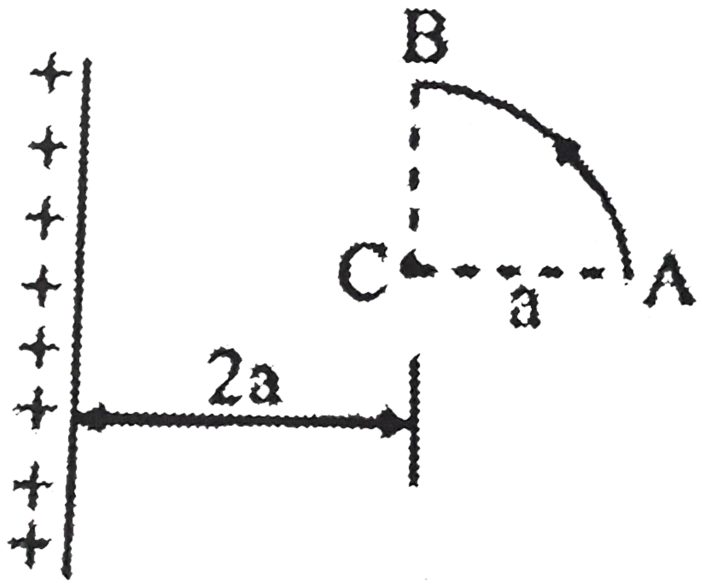
Answer: A

Watch Video Solution

4. The are AB with the centre C and infinitely long wire having linear charge density λ are lying in the same plane. The minium amount of work to be done to move a point charge q_0

from point A to B through a circular path AB

of radius a is equal to



A. $\frac{q_0^2}{2\pi\varepsilon_0}\log\left(\frac{2}{3}\right)$

B. $\frac{q_0\lambda}{2\pi\varepsilon_0}\log\left(\frac{3}{2}\right)$

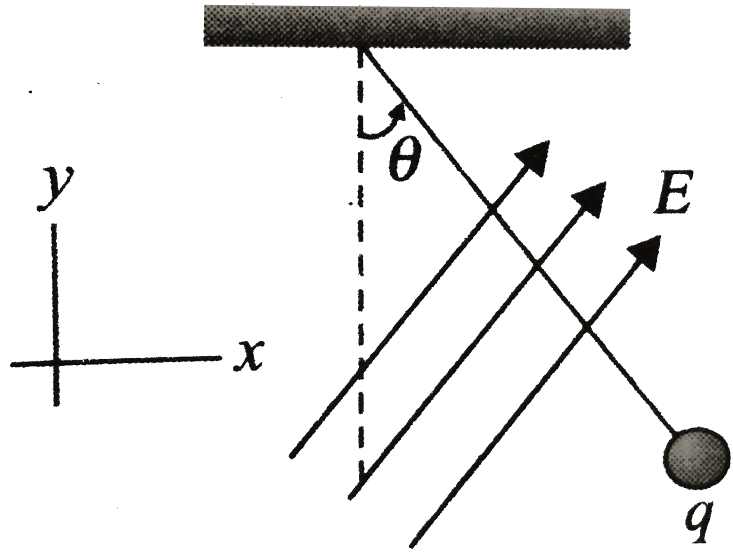
C. $\frac{q_0\lambda}{2\pi\varepsilon_0}\log\left(\frac{2}{3}\right)$

D. $q_0\lambda / \sqrt{2}\pi\varepsilon_0$

Answer: B

Watch Video Solution

5. A charged cork ball of mass m is suspended on a light string in the presence of a uniform electric field as shown in fig. When $E = \left(A\hat{i} + B\hat{j}\right)NC^{-1}$, Where A and B positive numbers, the ball is in equilibrium at θ. Find (a) the charge on the ball and (b) the tension in the string.



A. $q = \dfrac{mg}{A + B\tan\theta}$

B. $q = \dfrac{mg\tan\theta}{A + B}$

C. $q = \dfrac{mg\tan\theta}{A + B\tan\theta}$

D. $q = \dfrac{Amg}{A + B}$

Answer: C

Watch Video Solution

6. An electric field is expressed as $E = 2\hat{i} + 3\hat{j}$. Find the potential difference $(V_A - V_B)$ between two points A and B whose position vectors are given by $r_A = \hat{i} + 2\hat{j}$ and $r_B = \hat{j} + 3\hat{k}$

A. $-1V$

B. $1V$

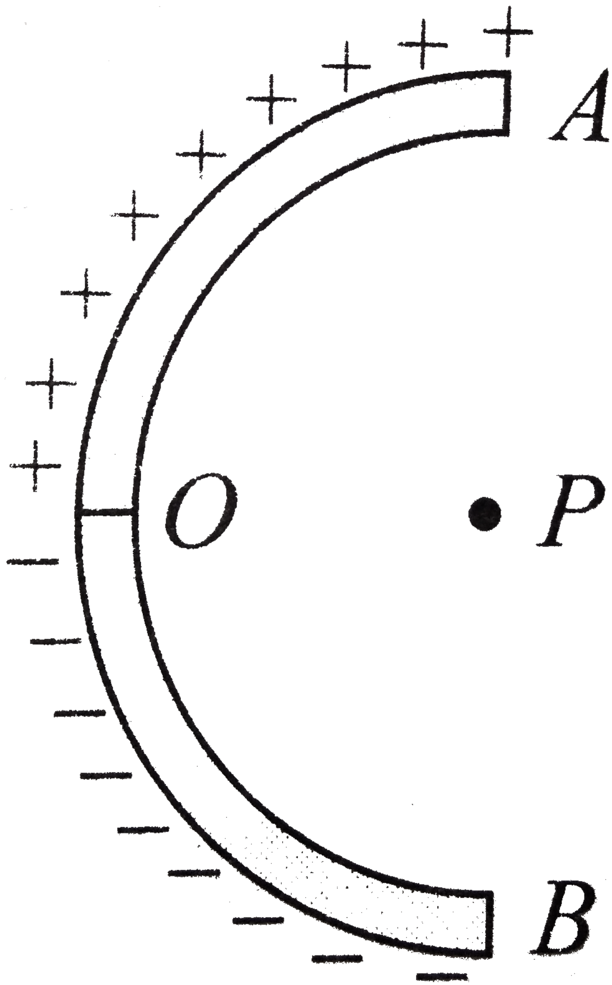
C. $2V$

D. $3V$

Answer: A

Watch Video Solution

7. A thin glass rod is bent into a semicircle of radius r. A charge +Q is uniformly distributed along the upper half and a charge -Q is uniformly distributed along the lower half, as shown in fig. The electric field E at P, the center of the semicircle, is



A. $\dfrac{Q}{\pi^2 \varepsilon_0 r^2}$

B. $\dfrac{2Q}{\pi^2\varepsilon_0 r^2}$

C. $\dfrac{4Q}{\pi^2\varepsilon_0 r^2}$

D. $\dfrac{Q}{4\pi^2\varepsilon_0 r^2}$

Answer: A

Watch Video Solution

8. A particle having charge that of an electron and mass 1.6×10^{-30}kg is projected with an initial speed u at the angle 45° to the horizontal from the lower plate of a parallel-plate capacitor as shown in fig. The plates are sufficiently long and have a separation of 2 cm, find the maximum value of the velocity of he particle so that it does not hit the upper plate. Take the electric field between the plates as $10^3 V m^{-1}$ directed upward.

A. $2 \times 10^6 m/s$

B. $2\sqrt{2} \times 10^6 m/s$

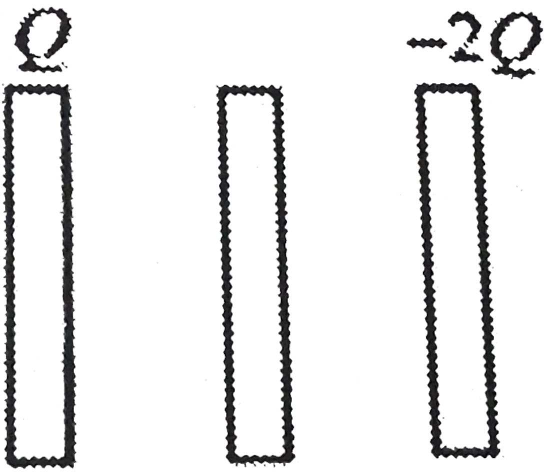
C. $\sqrt{2} \times 10^6 m/s$

D. $\frac{1}{\sqrt{2}} \times 10^6 m/s$

Answer: B

Watch Video Solution

9. Three identical metal plates with large surface areas are kept parallel to each other as shown. The left most is given a charge Q, the right most part a charge $-2Q$ and the middle one remains neutral. Then which is wrong-



A. The charge appearing on outer surface of right most plate is $-\frac{Q}{2}$

B. The charge appearing on outer surface of left most plate is $-\frac{Q}{2}$

C. The charge appearing on left surface of middle plate is $-\frac{3Q}{2}$

D. The charge appearing on right surface of middle plate is $\frac{3Q}{4}$

Answer: D

Watch Video Solution

10. Three concentric spherical shells have radii a,b and $c(a < b < c)$ and have surface charge densities $\sigma, -\sigma$ and σ respectively. If V_A, v_B

and V_c denote the potentials of the three shells, then, for $V_A = V_C$, we get-

A. $c = \frac{a+b}{2}$

B. $c = b - a$

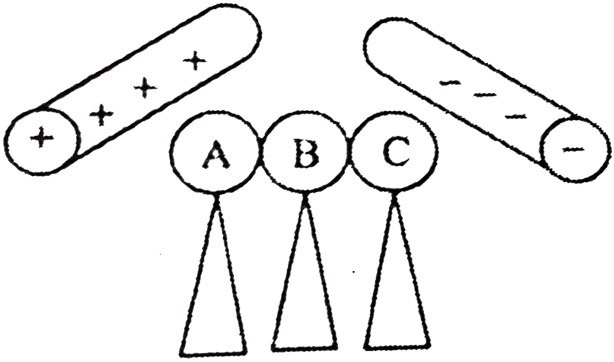
C. $c = 2(a+b)$

D. $c = a + b$

Answer: D

Watch Video Solution

11. Three metal spheres A,B and C are mounted on insulating stands. The spheres are touching one another, as shown in the diagram A strong positively charged object it brought near sphere A and a strong negative charge is brought near sphere C. While the charged objects remains near spheres A anc C, sphere B is removed by means of its insulating stand. After the charged objects are removed, sphere B is first touched to sphere A and then to sphere C. The resulting charge on B would be-



A. the same sign but $1/2$ the magnitude as originally on sphere A.

B. the opposite sign but $1/2$ the magnitude as originally on sphere A.

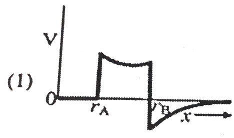
C. the opposite sign but $1/4$ the magnitude as originally on sphere A

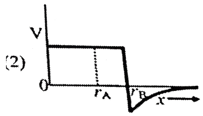
D. the same sign but $1/2$ the magnitude as originally on sphere C

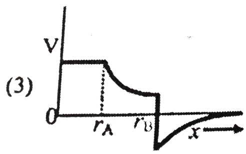
Answer: C

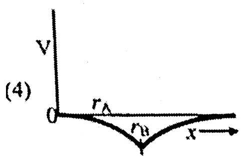
Watch Video Solution

12. Two concentric conducting thin spherical shells A andB having radii rA and $r8(r_8 > r_A)$ are charged to Q_A and $-Q_B(|Q_B| > |Q_A|)$. The electric field strength along a line passing through the centre varies with the distance x as :

A. 

B. 

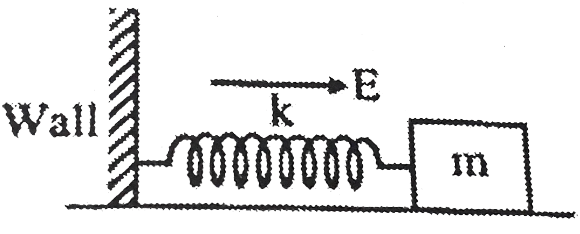
C. 

D. 

Answer: C

Watch Video Solution

13. A point mass m and charge q is connected with massless spring of natural length L. Initially spring is in its natural length. If a horizontal uniform electric field E is switched on as shown in figure, then the maximum separation between the point mass and the wall is: (Assume all surface are frictionless)



A. $L + \frac{2qE}{K}$

B. $L+\frac{qE}{K}$

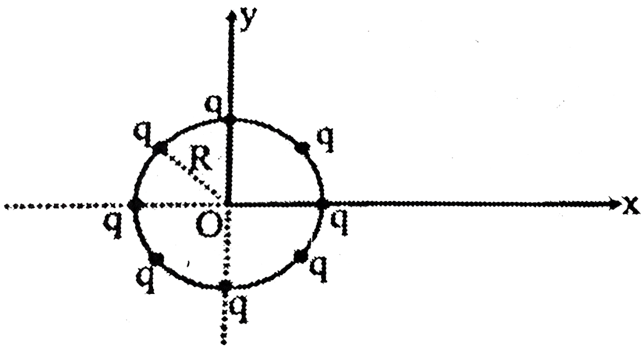
C. L

D. None of these

Answer: A

Watch Video Solution

14. Eight charges each of value q each are placed on a ring of radius R placed in x-y plane with origin at centre -q charge having mass m is projected from $z=\infty$ towards the centre of the ring with velocity v. The velocity of -q when it reaches the centre of ring is (neglect gravity)-



A. $\sqrt{\frac{8kq^2}{mR}}$

B. $\sqrt{\frac{8kq^2}{mR} + v}$

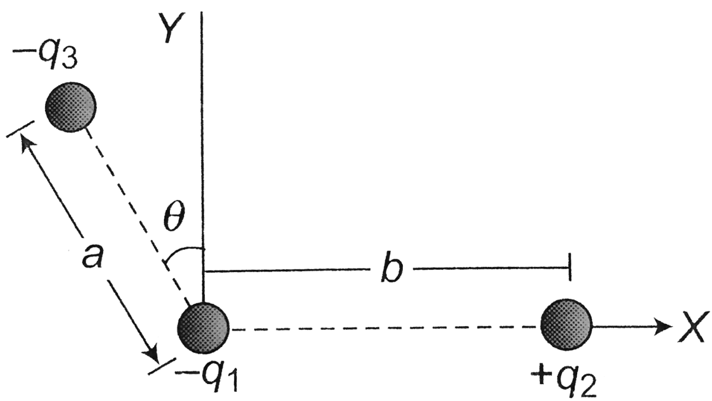
C. $\sqrt{\frac{16kq^2}{mR} + v^2}$

D. $\sqrt{\frac{16kq^2}{mR} + v}$

Answer: C

Watch Video Solution

15. Three charges $-q_1, +q_2$ and $-q_3$ are placed as shown in the figure. The x-component of the force on $-q_1$ is proportional to



A. $\frac{q_2}{b^2} - \frac{q_3}{a^2}\sin\theta$

B. $\frac{q_2}{b^2} - \frac{q_3}{a^2}\cos\theta$

C. $\frac{q_2}{b^2} + \frac{q_3}{a^2}\sin\theta$

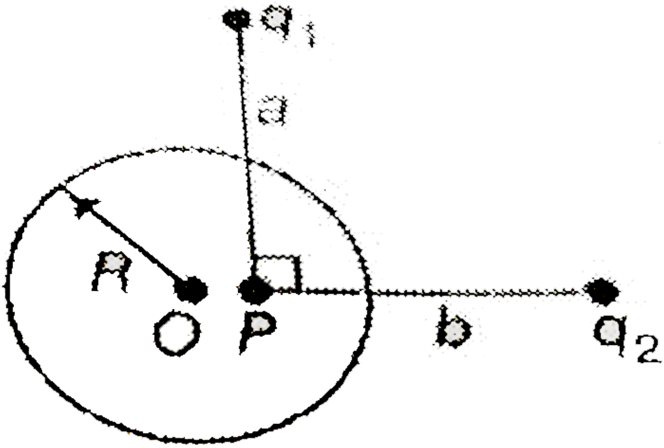
D. $\frac{q_2}{b^2} + \frac{q_3}{a^2}\cos\theta$

Answer: A

Watch Video Solution

16. In the given figure, two point chrges q_1 and q_2 are placed at distances a and b from centre of a metallic sphere having charge

Q.Find electric felds due to the metallic sphere at the point P.



A. $\frac{1}{4\pi\varepsilon_0}\sqrt{\left(\frac{q_1}{a}\right)^2+\left(\frac{q_2}{b^2}\right)^2}$

B. $\frac{1}{4\pi\varepsilon_0}\frac{Q}{R^2}$

C. $\frac{1}{4\pi\varepsilon_0}\sqrt{\left(\frac{Q}{R^2}\right)^2+\left(\frac{q_1}{a^2}+\frac{q_2}{b^2}\right)^2}$

D. None of the above

Answer: A

Watch Video Solution

17. Let there be a spherically symmetric charge distribution with charge density varying as $\rho(r) = \rho\left(\frac{5}{4} - \frac{r}{R}\right)$ upto $r = R$, and $\rho(r) = 0$ for $r > R$, where r is the distance from the origin. The electric field at a distance r(rltR) from the origin is given by

A. $\frac{\rho_0 r}{4\varepsilon_0}\left(\frac{5}{4} - \frac{r}{R}\right)$

B. $\frac{4\pi\rho_0 r}{3\varepsilon_0}\left(\frac{5}{3}-\frac{r}{R}\right)$

C. $\frac{\rho_0 r}{4\varepsilon_0}\left(\frac{5}{3}-\frac{r}{R}\right)$

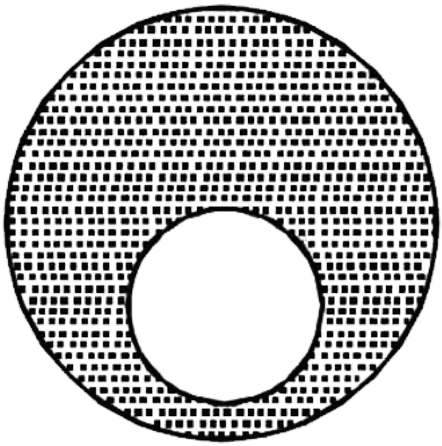
D. $\frac{4\rho_0 r}{3\varepsilon_0}\left(\frac{5}{4}-\frac{r}{R}\right)$

Answer: C

Watch Video Solution

18. A spherical portion has been removed from a solid sphere having a charge distributed uniformly in its volume as shown in the figure.

The electric field inisde the emptied space is



A. zero everywhere

B. nonzero and uniform

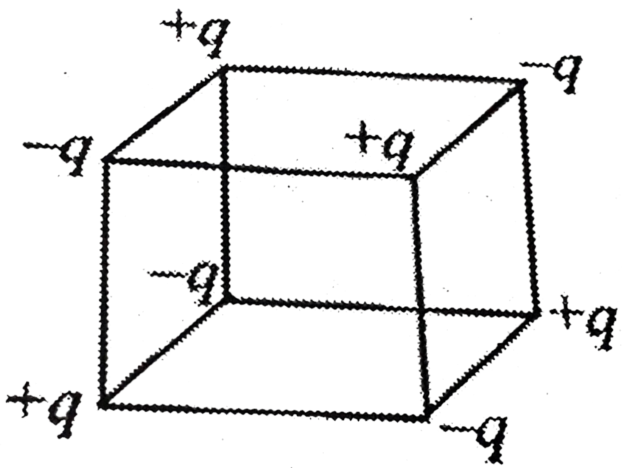
C. non-uniform

D. zero only at its centre

Answer: B

Watch Video Solution

19. Eight point charges are placed at the corners of a cube of edge a as shown in figure. The work done in disassembling this system of charges will be-



A. $\frac{q^2}{4\pi\varepsilon_0 a}$

B. $\frac{q^2\sqrt{3}}{4\pi\varepsilon_0 a}$

C. $\frac{12q^2}{4\pi\varepsilon_0 a}$

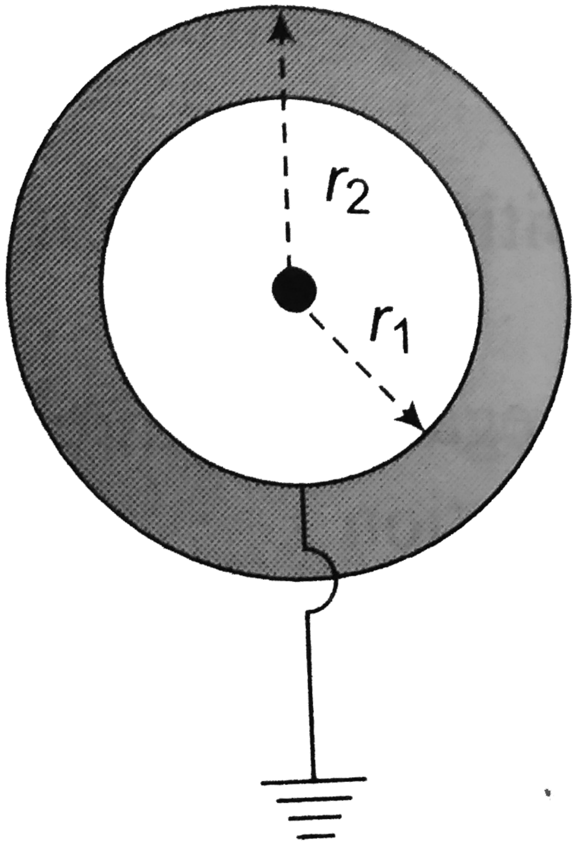
D. $\frac{5.824q^2}{4\pi\varepsilon_0 a}$

Answer: D

Watch Video Solution

20. Charge on the outer sphere is q, and the inner sphere is grounded. Then the charge q' on the inner sphere is q', for

$(r_2 > r_1)$



A. zero

B. $q' = q$

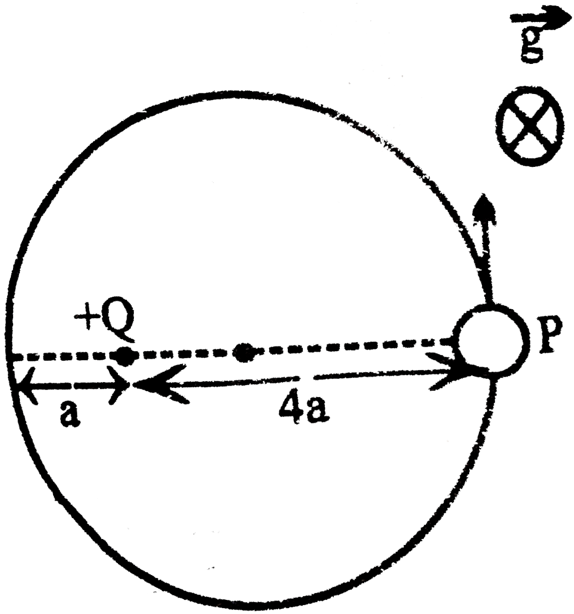
C. $q' = -\frac{r_1}{r_2} q$

D. $q' = \frac{r_1}{r_2} = q$

Answer: C

Watch Video Solution

21. The diagram show a small bead of mass m carrying charge q. The bead can freely move on the smooth fixed ring placed on a smooth horizontal plane . In the same pane a charge $+Q$ has also been fixed as shown. The potential at the point P due to $+Q$ is V . The velocity which the bead should projected from the point P so that it can complete a circle should be greater than .



A. $\sqrt{\dfrac{6qV}{m}}$

B. $\sqrt{\dfrac{qV}{m}}$

C. $\sqrt{\frac{3qV}{m}}$

D. None of these

Answer: A

Watch Video Solution

22. Four point charge $q, -q, 2Q$ and Q are placed in order at the corners A, B, C and D of a square. If the field at the midpoint of CD is zero then the value of q/Q is $\frac{5\sqrt{5}}{x}$. Find the value of x.

A. 1

B. 2

C. $\frac{2\sqrt{2}}{5}$

D. $\frac{5\sqrt{5}}{2}$

Answer: D

Watch Video Solution

23. Three charges $+Q_1$, $+Q_2$ and q are placed on a straight line such that q is somewhere in between $+Q_1$and Q_2. If this system of charges is in equilibrium what should be the magnitude and sign of charge q?

A. $\frac{Q_1Q_2}{\left(\sqrt{Q_1}+\sqrt{Q_2}\right)}$, positive

B. $\frac{Q_1Q_2}{2}$, positive

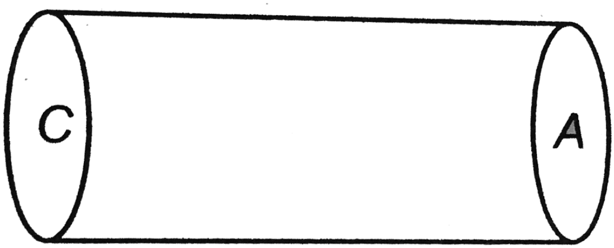
C. $\frac{Q_1Q_2}{\left(\sqrt{Q_1}+\sqrt{Q_2}\right)^2}$, negative

D. $\frac{Q_1+Q_2}{2}$, negative

Answer: C

Watch Video Solution

24. A hollow cylinder has a charge qC within it. If ϕ is the electric flux in unit of voltmeter associated with the curved surface B the flux linked with the plance surface A in unit of voltmeter will be



A. $\frac{q}{2\varepsilon_0}$

B. $\frac{\phi}{3}$

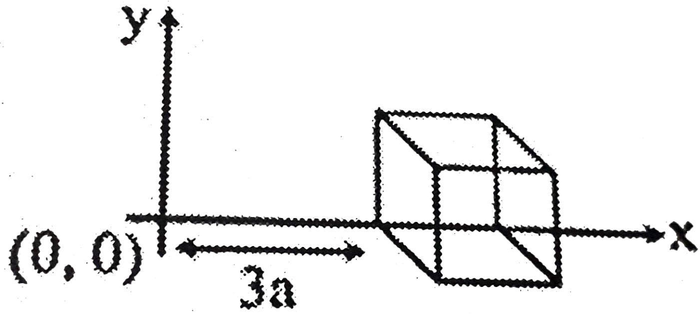
C. $\frac{q}{\varepsilon_0} - \phi$

D. $\frac{1}{2}\left(\frac{q}{\varepsilon_0} - \phi\right)$

Answer: D

Watch Video Solution

25. A cube of edge a is kept on x-axis in a region where electric field varies with distance as $E = kx\hat{i}$. Total electric flux associated with the cube is-



A. ka^3

B. $-3ka^3$

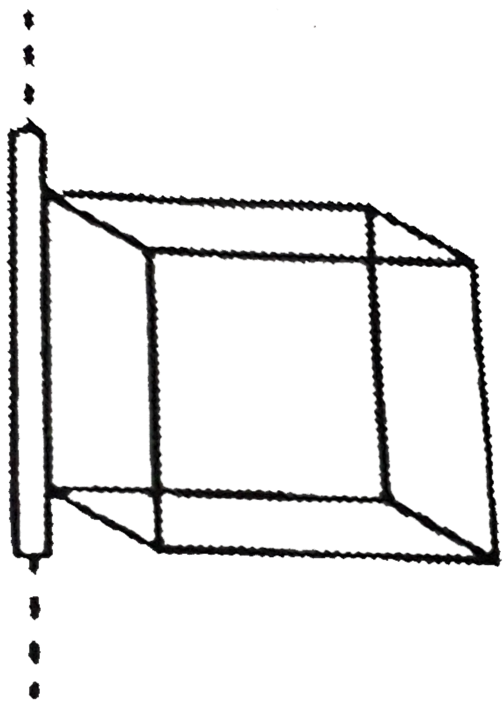
C. $4ka^3$

D. zero

Answer: A

Watch Video Solution

26. An infinite wire having charge density λ passes through one of the edges of a cube having length l. find the total flux passing through the cube



A. $\frac{\lambda l}{\varepsilon_0}$

B. $\frac{\lambda l}{4\varepsilon_0}$

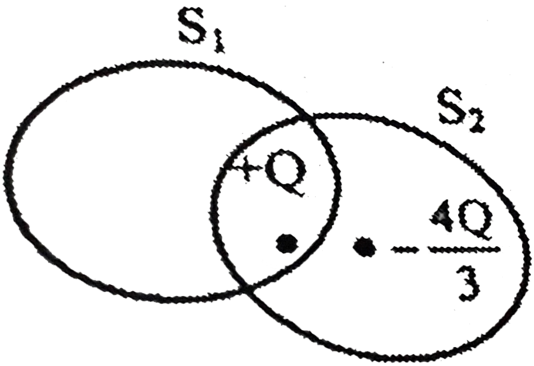
C. $\frac{\lambda l}{6\varepsilon_0}$

D. None of these

Answer: B

Watch Video Solution

27. The ratio of ψ_ε passing through the surfaces S_1 and S_2 is-



A. $1:1$

B. $-2:1$

C. $-3:1$

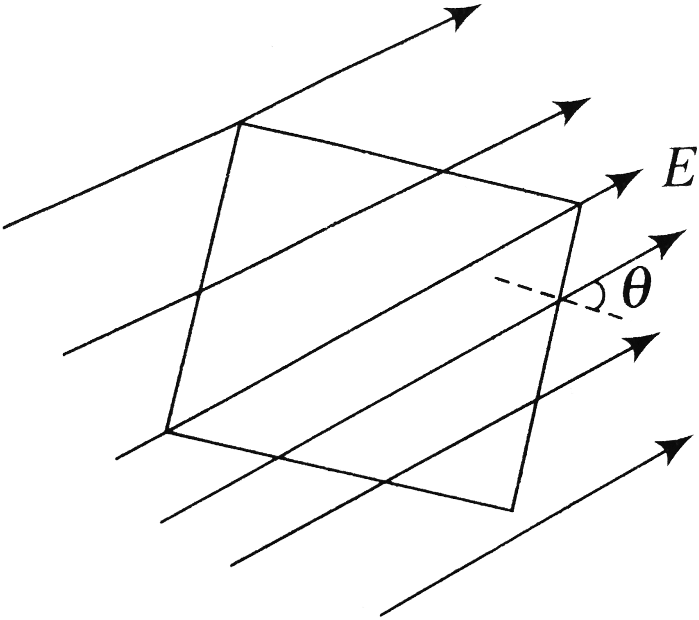
D. $-1:3$

Answer: C

Watch Video Solution

28. A square surface of side L metre in the plane of the paper is placed in a uniform electric field $E(\text{volt} / m)$ acting along the same place at an anlge θ with the horizontal side of the square as shown in figure. The electric flux linked to the surface in uint of

$V - m$ is



A. EL^2

B. $EL^2 \cos\theta$

C. $EL^2 \sin\theta$

D. zero

Answer: D

Watch Video Solution

29. The inward and outward electric flux for a closed surface unit of $N - m^2 / C$ are respectively 8×10^3 and 4×10^3. Then the total charge inside the surface is [where $\varepsilon_0 =$ permittivity constant]

A. $4 \times 10^3 C$

B. $-4 \times 10^3 C$

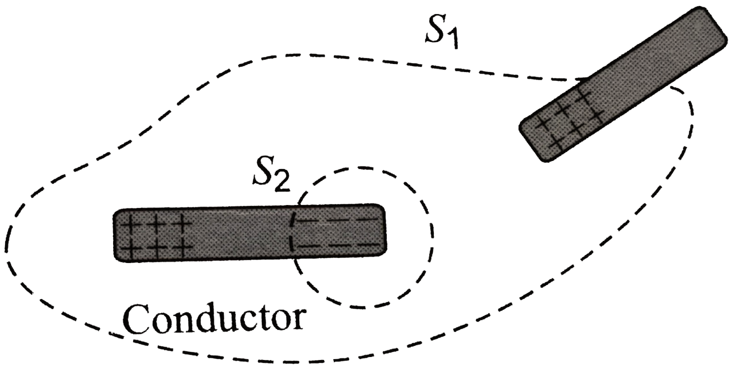
C. $\frac{(-4 \times 10^3)}{\varepsilon_0}C$

D. $-4 \times 10^3 \varepsilon_0 C$

Answer: D

Watch Video Solution

30. Charge on an originally uncharged conductor is separated by holding a positively charged rod very closely nearby, as shown in figure. Assume that the induced negative charge on the conductor is equal to the positive charge q on the rod. Then the flux through surface S_1 is



A. zero

B. q / ε_0

C. $-e / \varepsilon_0$

D. none of these

Answer: B

Watch Video Solution