SINGLE CORRECT OPTION TYPE

1. A particle of mass (m) and charge (+q) is thrown with velocity (μ) at an angle (θ) with horizontal. If in space on Electric field of strength $\vec{E}$ exist in vertical direction downward. Find horizontal range of this projectile.

(A) $\frac{u^2 \sin 2\theta}{g+\frac{Eq}{m}}$ (B) $\frac{u^2 \cos 2\theta}{g+\frac{Eq}{m}}$ (C) $\frac{u^2 \sin 2\theta}{g-\frac{Eq}{m}}$ (D) $\frac{u^2 \sin 2\theta}{-g+\frac{Eq}{m}}$

2. On a horizontal table, four particles each of charge (+q) fixed at the corners of a square of side (a). Another particle of charge (q_1) is suspended in equilibrium at a height (h) above the centre of square. Determine mass of suspended particle.

(A) $\frac{qq_1h}{\pi\varepsilon_0 g\left(h^2-\frac{a^2}{2}\right)^{3/2}}$ (B) $\frac{qq_1h}{\pi\varepsilon_0 g\left(h^2+\frac{a^2}{2}\right)^{1/2}}$

(C) $\frac{qq_1h}{g\pi\varepsilon_0\left(h^2+\frac{a^2}{2}\right)^{3/2}}$ (D) $\frac{qq_1h}{\pi\varepsilon_0 g\left(h^2+\frac{a^2}{4}\right)^{3/2}}$

3. Two electric charges q and –2q are placed at $(0,0)$ and $(6,0)$ points. Find the locus of zero potential points in this coordinate system.

(A) circle of radius 4 units and centre $(-2,0)$ (B) circle of radius 8 units and centre $(-2,0)$

(C) circle of radius 4 units and centre $(-4,0)$ (D) circle of radius 8 units and centre $(-4,0)$

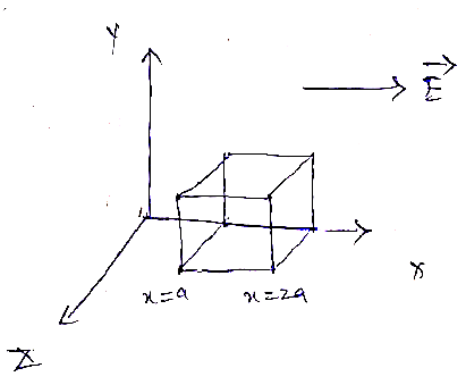
4. The isolated metal spheres of radii R and 2R are charged such that both have equal charge densities $\left(\sigma \text{ccl}/m^2\right)$. The spheres are located for away from each other. If the two spheres are connected by a wires find final charge density on bigger sphere.

(A) $\frac{3\sigma}{2}$ (B) $\frac{3\sigma}{4}$ (C) $\frac{5\sigma}{6}$ (D) $\frac{5\sigma}{4}$

5. Two mutually perpendicular long straight conductors having carrying uniformly distributed charges of linear charge densities λ_1 and λ_2 positional at a distance (a) from each other. Find the interaction force between rods.

(A) $\frac{\lambda_1\lambda_2}{2\varepsilon_0}$ (B) $\frac{\lambda_1\lambda_2}{4\varepsilon_0}$ (C) $\frac{\lambda_1\lambda_2}{6\varepsilon_0}$ (D) $\frac{\lambda_1\lambda_2}{8\varepsilon_0}$

6. Figure shows a cubical volume of edge (a) in region where an electric field which depends on x-coordinate as $E(x)=\left(ax^2+\frac{b}{2}\right)v/m$. Find the amount of charge enclosed in it.



(A) $q_{enclosed}=3\varepsilon_0 a^3$

(B) $q_{enclosed}=3\varepsilon_0 a^5$

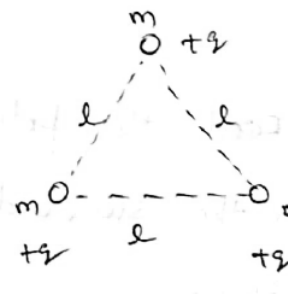
(C) $q_{enclosed}=3\varepsilon_0 a^6$

(D) $q_{enclosed}=3\varepsilon_0 a^7$

7. In a region volume charge density is filled which varies with the radial distance (r) from the centre of region as $p = \frac{b}{r} col/m^3$ b (the constant). The electric field strength in region as a function of distance (r) is _____ .

(A) $E = \frac{b}{2\varepsilon_0}$ (B) $E = \frac{b}{3\varepsilon_0}$ (C) $E = \frac{b}{4\varepsilon_0}$ (D) $E = \frac{b}{5\varepsilon_0}$

8. Three balls each of mass (m) and charge $(+q)$ are placed equidistant from each other as shown. The speeds of balls when separation between them becomes (2l)



(A) $v = \sqrt{\frac{kq^2}{2mL}}$ (B) $v = \sqrt{\frac{kq}{2mL}}$

(C) $v = \sqrt{\frac{kq^2}{3mL}}$ (D) $v = \sqrt{\frac{kq^2}{mL}}$

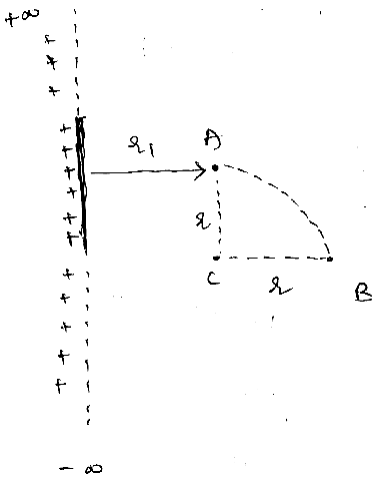
9. The electric potential in a region depends an the location of a point as $V = -Cxy$, where C is a constant. Find magnitude of acceleration of a particle of mass (m) and charge (q) placed at (1, 2).

(A) $\frac{\sqrt{3}cq}{2m}$ (B) $\frac{\sqrt{3}cq}{5m}$ (C) $\frac{\sqrt{3}cq}{4m}$ (D) $\frac{\sqrt{5}cq}{m}$

10. In a region electric field depends on x-coordinate as $\vec{E} = 5x^2\hat{i}$ v/m . If electric potential at origin is taken as zero. Find potential at (3, 1)

(A) 45 volts (B) – 45 volts (C) 35 volts (D) – 35 volts

11. Find the potential difference between A and B in the surrounding of a long uniformly charged thread as shown.



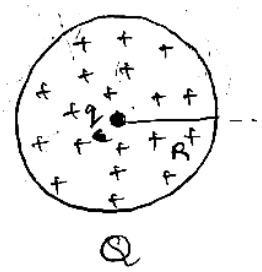
(A) $v_A - v_B = 2k\lambda \ln\left(\frac{r_1 - r}{r_1}\right)$

(B) $v_A - v_B = 2k\lambda \ln\left(\frac{r_1 + r}{r_1}\right)$

(C) $v_A - v_B = 2k\lambda \ln\left(\frac{r_1 - r}{r}\right)$

(D) $v_A - v_B = 2k\lambda \ln\left(\frac{r_1 + r}{r}\right)$

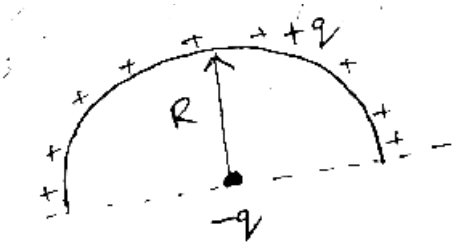
12. A small particle of charge (q) is displaced from the centre of a uniformly charged solid sphere of radius (R) and charge $(+Q)$ to a outside point at a distance (R) from the surface of a sphere. The work required in this process is



(A) $\frac{-kqQ}{R}$ (B) $\frac{kqQ}{2R}$

(C) $\frac{-kqQ}{2R}$ (D) $\frac{kqQ}{3R}$

13. Find the dipole moment of a system on which $(+q)$ charge is uniformly distributed over a semi circular ring (R) and $(-q)$ charge placed at the centre as shown.



(A) $\left(\frac{2R}{\pi}\right)q$ (B) $\frac{3R}{\pi}q$ (C) $\frac{4R}{\pi}q$ (D) $\frac{5R}{\pi}q$

14. (n) small drops of same size, charged to a potential (v) each. If these drops coalesce to form a single drop, then potential of this single drop is
(r – radius of small drop)

(A) $\frac{n^{1/2}kq}{r}$ (B) $\frac{n^{1/3}kq}{r}$ (C) $\frac{n^{2/3}kq}{r}$ (D) $\frac{n^{2/3}kq}{2r}$

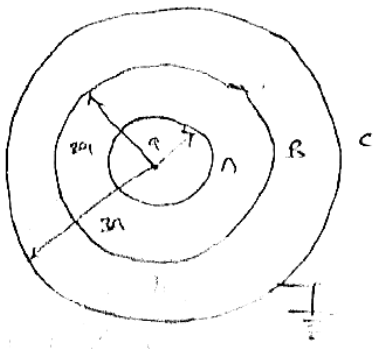
15. A short dipole is situated at origin as shown. It is found that the magnitude of electric field and electric potential due to dipole are equal at a point distance $\left(\sqrt{5}m\right)$ from origin. Position vector of this point is ____

(A) $\frac{\sqrt{5}}{\sqrt{2}}\left(\hat{i}+\hat{j}\right)$ (B) $\frac{\sqrt{5}}{5}\left(\hat{i}+\hat{j}\right)$ (C) $\sqrt{5}\left(\hat{i}+\hat{j}\right)$ (D) $\sqrt{5}\left(2\hat{i}+2\hat{j}\right)$

16. A dipole of dipole moment $(\vec{p})$ is placed at a distance (r) along radial direction from a long uniformly charged thread of linear charge density $(r\ col/m)$ as shown. The direction of force experienced by dipole due to thread is

(A) along positive x-axis (B) along negative x-axis
(C) along positive y-axis (D) along negative y-axis

17. A, B and C are three concentric metal shells of radii a, 2a and 3a. Shell A is the innermost and Shell C is outermost. Shell A is given a charge (q) and (c) is earthed. Find potential of Shell (B).

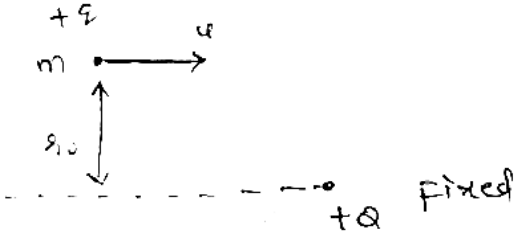


(A) $\frac{kq}{3a}$ (B) $\frac{kq}{6a}$
(C) $\frac{kq}{7a}$ (D) $\frac{kq}{8a}$

18. From the surface of a large uniformly charged sheet of surface charge density $\left(\sigma/m^2\right)$ an electron is projected at an angle (45°) from the surface of sheet from point (A) at speed (u). If it hits the sheet at point (B). Calculate distance AB. (Neglect gravity).

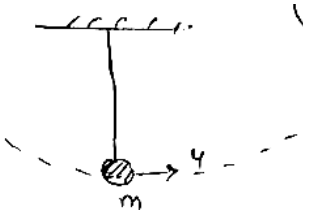
(A) $\frac{2\varepsilon_0 mu^2}{e\sigma}$ (B) $\frac{2\varepsilon_0 mu^2}{3e\sigma}$ (C) $\frac{3\varepsilon_0 mu^2}{e\sigma}$ (D) $\frac{5\varepsilon_0 mu^2}{e\sigma}$

19. Figure shows a fixed $(+Q)$ charge. Another particle of mass (m) and charge (q) is projected towards this charge with an impact parameter (r_0). Determine velocity of $(+q)$ charge at distance of closest approach (r_m - distance of closest approach)



(A) $\frac{4r_0}{3r_m}$ (B) $\frac{4r_0}{r_m}$ (C) $\frac{3r_0}{r_m}$ (D) $\frac{3r_0}{2r_m}$

20. A simple pendulum is suspended in a region where a (E) exist in vertically downward. Bob is given a charge (q). find with what minimum speed the Bob is to be projected in horizontal direction so that it starts completing vertical circular motion



(A) $u_{min} = \sqrt{6\left(g + \frac{Eq}{m}\right)l}$

(B) $u_{min} = \sqrt{5\left(g + \frac{Eq}{m}\right)l}$

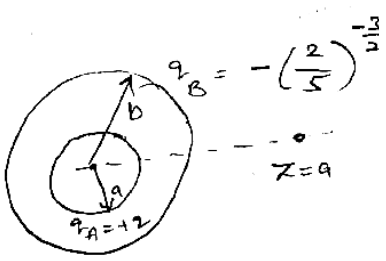
(C) $u_{min} = \sqrt{\frac{5}{2}\left(g + \frac{Eq}{m}\right)l}$

(D) $u_{min} = \sqrt{3\left(g + \frac{Eq}{m}\right)l}$

NUMBERICAL BASED

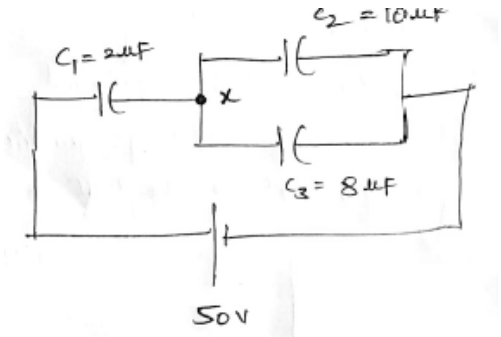
21. An electric field is given by $\vec{E} = \left(y\hat{i} + xj\right)N/C$. Find the work done in (J) by electric field in moving a 1C charge from $\vec{r}_A = \left(2\hat{i} + 2\hat{j}\right)m$ to $\vec{r}_B = \left(4\hat{i} + \hat{j}\right)m$

22. Two concentric rings, one of radius (a) and the other of radius (b) have the charges (+2) and $-\left(\frac{2}{5}\right)^{-3/2} q$, respectively as shown. Find the ratio $\frac{b}{a}$ if charge particle placed on the axis at $z = a$ is in equilibrium.



23. There is an electric field E in the positive direction. If workdone by electric field in moving a charge 0.2 C through a distance of 2m along a line making an angle of 60° with x-axis is (1J). What is the value of E in N/C ?

24. Two particles of masses (m) and (2m) having same charges (q) each are placed in a uniform electric field E and allowed to move for the same time. Find the ratio of kinetic energies.

25. 

Potential at node x. $V_x =$ _____

KEY

1.	A	**2.**	C	**3.**	A	**4.**	C	**5.**	A
6.	B	**7.**	A	**8.**	D	**9.**	A	**10.**	B
11.	B	**12.**	A	**13.**	A	**14.**	C	**15.**	A
16.	B	**17.**	B	**18.**	A	**19.**	B	**20.**	B
21.	0	**22.**	2	**23.**	5	**24.**	2	**25.**	2

✻ *Wish You all the Best* ✻