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JEE (Course)

1. A positively charged thin metal ring of radius R is fixed in x – y plane with its centre at the origin O. A negatively charged particle P is released from rest at the point (0, 0, Z_0). Then the motion of P is -

   (a) periodic for all values of Z_0. (b) SHM for all values of Z_0 satisfying $0 < Z_0 < R$

   (c) approximately SHM, provided $Z >> R$ (d) cannot be determined.

2. Two spherical conductors A and B of radii 1 mm and 2 mm are separated by a distance of 5 cm 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 -

   (a) 1 : 4 (b) 4 : 1 (c) 1 :2 (d) 2 : 1

3. The electric field intensity at a point at a distance 2 m from a charge q is E. The amount of work done in bringing a charge of 2 coulomb from infinity to this point will be -

   (a) 2E J (b) 4E J (c) $\frac{E}{2}$ J (d) $\frac{E}{4}$ J

4. A simple pendulum of length l has a bob of mass m, with a charge q on it. A vertical sheet of charge, with surface charge density σ passes through the point of suspension. At equilibrium, the string makes an angle θ with the vertical, then

   (a) $\tan\theta = \frac{\sigma q}{2\varepsilon_0 mg}$ (b) $\tan\theta = \frac{\sigma q}{\varepsilon_0 mg}$ (c) $\cot\theta = \frac{\sigma q}{2\varepsilon_0 mg}$ (d) $\cot\theta = \frac{\sigma q}{\varepsilon_0 mg}$

5. A charged particle of mass m and charge q is released from rest in an electric field of constant magnitude E. The kinetic energy of the particle after time t will be

   (a) $\frac{2E^2t^2}{mq}$ (b) $\frac{Eq^2m}{2t^2}$ (c) $\frac{E^2q^2t^2}{2m}$ (d) $\frac{Eqm}{2t}$

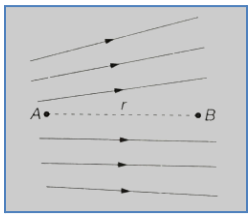
6. There is an electric field E in x-direction. If work done in moving a charge 0.2 C through a distance of 2 m along a line making an angle of 60° with x-axis is 4.0 J. The value of E is

   (a) $\sqrt{3}$ N / C (b) 4 N/C (c) 5 N/C (d) 20 N/C

7. The electric potential V is given as a function of distance x (metre) by $V = (5x^2 + 10x - 9)$ v. Magnitude of electric field at x = 1 is

   (a) 20 V/m (b) 6 V/m (c) 11 V/m (d) –23 V/m

8. The figure shows the electric lines of force emerging emerging from a charged body. If the electric field at A and B are E_A and E_B, respectively, and if the displacement between A and B is r then



   (a) $E_A > E_B$ (b) $E_A < E_B$ (c) $E_A = \frac{E_B}{r}$ (d) $E_A = \frac{E_B}{r^2}$

9. The magnitude of electric field intensity E is such that, an electron of mass m and charge e placed in it would experience an electrical force equal to its weight is given by

(a) mge (b) $\frac{mg}{e}$ (c) $\frac{e}{mg}$ (d) $\frac{e^2}{m^2}g$

10. ABC is an equilateral triangle. Charges +q are placed at each corner. The electric field intensity at centroid O will be

(a) $\frac{1}{2\pi\varepsilon_0}\times\frac{q}{r^2}$ (b) $\frac{1}{2\pi\varepsilon_0}\times\frac{3q}{r^2}$ (c) $\frac{1}{2\pi\varepsilon_0}\times\frac{\sqrt{3}q}{r^2}$ (d) Zero

11. A charged particle of mass m and charge q is released from rest in an electric field of constant magnitude E. The kinetic energy of the particle after a time t is

(a) $\frac{E^2q^2t^2}{m}$ (b) $\frac{2E^2q^2t^2}{m}$ (c) $\frac{E^2q^2t^2}{2m}$ (d) $\frac{4E^2q^2t^2}{2m}$

12. An electron moves in a circular orbit at a distance from a proton with kinetic energy E. To escape to infinity, the energy which must be supplied to the electron is

(a) E (b) 2 E (c) 0.5 E (d) $\sqrt{2}$ E

13. Charge Q is given a displacement $\vec{r} = a\hat{i} + b\hat{j}$ in an electric field $\vec{E} = E_1\hat{i} + E_2\hat{j}$. The work done is

(a) $Q(E_1a + E_2b)$ (b) $Q\sqrt{(E_1a)^2 + (E_2b)^2}$ (c) $Q(E_1 + E_2)\sqrt{a^2 + b^2}$ (d) $Q\sqrt{E_1^2 + E_2^2}\sqrt{a^2 + b^2}$

14. A non-conducting ring of radius R has charge Q distributed uniformly over it. If it rotates with an angular velocity ω, the equivalent current will be

(a) Zero (b) Qω (c) $Q\frac{\omega}{2\pi}$ (d) $Q\frac{\omega}{2\pi R}$

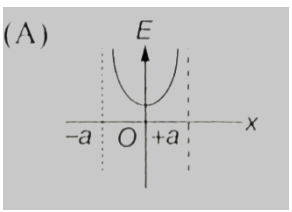
15. In a regular polygon of n sides, each corner is at a distance r from the centre. Identical charges of magnitude Q are placed at (n –1) corners. The field at the centre is

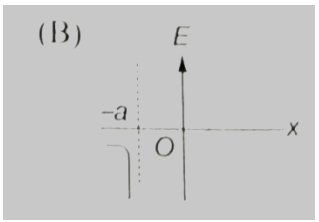
(a) $k\frac{Q}{r^2}$ (b) $(n-1)k\frac{Q}{r^2}$ (c) $\frac{n}{n-1}k\frac{Q}{r^2}$ (d) $\frac{n-1}{n}k\frac{Q}{r^2}$

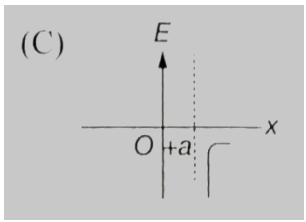
16. Seven point charges each of charge q is placed at the seven corners of a cube of side a (one corner is empty). Find the magnitude of electric field at centre of cube.

(a) Zero (b) $\frac{1}{4\pi\varepsilon_0}\frac{q}{a^2}$ (c) $\frac{1}{3\pi\varepsilon_0}\frac{q}{a^2}$ (d) $\frac{1}{4\pi\varepsilon_0}\frac{7q}{a^2}$

17. A point charge q and a charge q are placed at x = –a and x = +a, respectively. Which of the following represents a part of E-x graph?

(A) 

(B) 

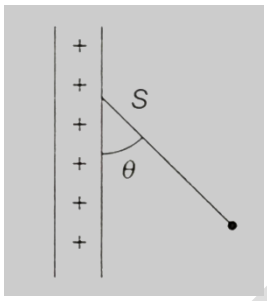
(C) 

(D) All of these

18. The charge per unit length for a very long straight wire is λ. The electric field at points near the wire (but outside it) and far from the ends varies with distance r as

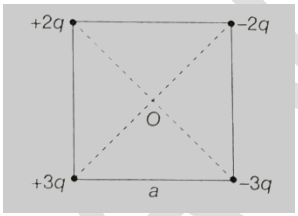
(a) r (b) 1/r (c) $1/r^2$ (d) $1/r^3$

19. A charged ball hangs from a silk thread of length l. It 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



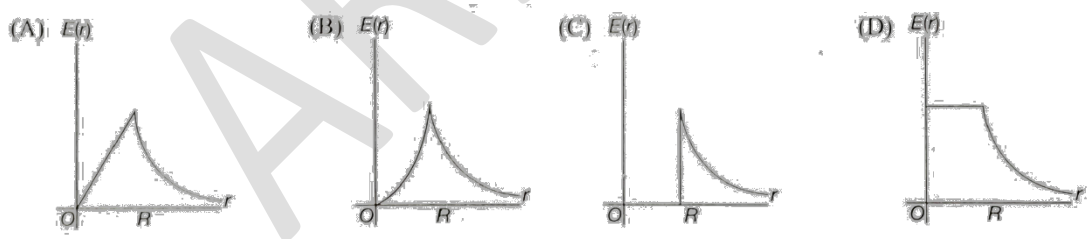
(a) cos θ (b) cot θ (c) sin θ (d) tan θ

20. Four charges +2q, –2q, –3g, and +3q are kept in the corners of a square of side a. The total field at the centre O is,



(a) Zero (b) $\frac{2\sqrt{2}\,q}{4\pi\varepsilon_0 a^2}$ (c) $\frac{\sqrt{2}\,q}{4\pi\varepsilon_0 a^2}$ (d) $\frac{10\sqrt{2}\,q}{4\pi\varepsilon_0 a^2}$

21. A thin spherical shell of radius R has charge Q spread uniformly over its surface. Which of the following graphs most closely represents the electric field E (r) produced by the shell in the range q $0 \le r < \infty$, where r is the distance from the centre of the shell? [2008]



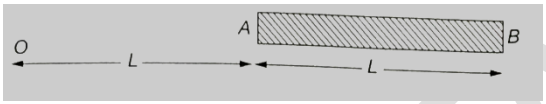
22. For a uniformly charged ring of radius R, the electric field on its axis has the largest magnitude at a distance h from its centre. The value of h is: [2019]

(a) R (b) $R\sqrt{2}$ (c) $\frac{R}{\sqrt{2}}$ (d) $\frac{R}{\sqrt{3}}$

23. Two charges, each equal to q, are kept at x = –a and x = a on the x-axis. A particle of mass in and charge $q_0 = \frac{q}{2}$ is placed at the origin. If charge q_0 is given a small displacement (y << a) along the y-axis, the net force acting on the particle is proportional to [2013]

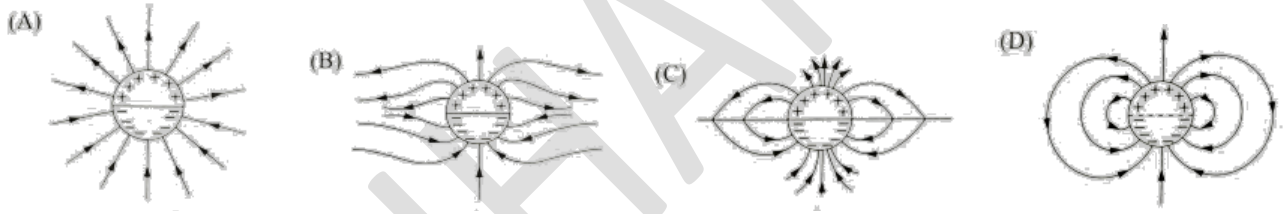
(a) –y (b) $\frac{1}{y}$ (c) $-\frac{1}{y}$ (d) y

24. A charge Q is uniformly distributed over a long rod AB of length L as shown in the figure. The electric potential at the point O lying at a distance L from the end A is [2013]

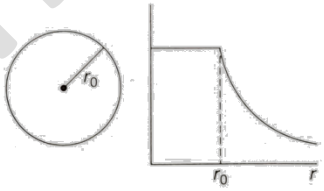


(a) $\frac{3Q}{4\pi\varepsilon_0 L}$ (b) $\frac{Q}{4\pi\varepsilon_0 L \ln_2}$ (c) $\frac{Q\ln 2}{4\pi\varepsilon_0 L}$ (d) $\frac{Q}{8\pi\varepsilon_0 L}$

25. A long cylindrical shell carries positive surface charge σ in the upper half and negative surface charge σ in the lower half. The electric field lines around the electric field lines around the cylinder will look like as follows
(Figures are schematic and not drawn to scale.) [2015]



26. The given graph shows variation (with distance r from centre) of: [2019]



(a) Potential of a uniformly charged spherical shell
(b) Potential of a uniformly charge sphere
(c) Electric field of a uniformly charged spherical shell
(d) Electric field of a uniformly charge sphere

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1	a	**2**	d	**3**	b	**4**	a	**5**	c	**6**	d	**7**	a
8	b	**9**	b	**10**	d	**11**	c	**12**	a	**13**	a	**14**	c
15	a	**16**	c	**17**	d	**18**	b	**19**	d	**20**	d	**21**	c
22	c	**23**	d	**24**	c	**25**	d	**26**	a				