PHYSICS

BOOKS - DISHA PUBLICATION PHYSICS (HINGLISH)

ELECTRIC CHARGES AND FIELDS

Jee Main 5 Years At A Glance

1. Two identical conducting spheres A and B, carry equal charge. They are separated by a

distance much larger than their diameters, and the force between them is F. A third identical conducting spheres, C,is uncharged. Sphere C is first touched to A, then to B, and then removed. As a result, the force between A and B would be equal to :

A. $\frac{3F}{4}$

B. $\frac{F}{2}$

C. F

D. $\frac{3F}{8}$

Answer: D

Watch Video Solution

2. A solid ball of radius R has a charge density ρ given by $\rho = \rho_0\left(1 - \frac{r}{R}\right)f$ or $0 \leq r \leq R$

The electric field outside the ball is :

A. $\frac{\rho_0 R^3}{\varepsilon_0 r^2}$

B. $\frac{2\rho_0 R^3}{3\varepsilon_0 r^2}$

C. $\frac{3\rho_0 R^3}{4\varepsilon_0 r^2}$

D. $\frac{\rho_0 R^2}{12\varepsilon_0 r^2}$

Answer: D

Watch Video Solution

3. An electric dipole has a fixed dipole moment $\vec{p}$, which makes angle θ with respect to x-aixs. When subjected to an electric field $\vec{E}_1 = E\hat{i}$, it experiences a torque $\vec{T}_1 = \tau\hat{k}$. When subjected to another electric field $\vec{E}_2 = \sqrt{3}E\hat{j}$ it experiences a torque $\vec{T}_2 = -\vec{T}_1$. The angle θ is

A. 60°

B. 90°

C. 30°

D. 45°

Answer: A

 Watch Video Solution

4. The magnitude of the average electric field normally present in the earth's atmosphere just above the surface of the earth is about 150 N/C, directed downward. What is surface charge density of the earth? [Assume that the

earth is a conductor having uniform surface charge density.]

A. $+670kC$

B. $-670kC$

C. $-680kC$

D. $+680kC$

Answer: C

Watch Video Solution

Exercise 1 Concept Builder Topicwise

1. Two identical metallic spheres A and B of exactly equal masses are given equal positive and negative charges respectively. Then

A. remains unaffected

B. mass of $A >$ mass of B

C. mass of A $<$ mass of B

D. Nothing can be side

Answer: C

 Watch Video Solution

2. A positive point charge Q is bruought mear an isolated metal cube.

A. the cube becomes negatively charged

B. the cube becomes positively charged

C. the interior becomes positively charged and the surface becomes negatively charged .

D. the interior remains charge free and the surface gets nonuniform charge

distribution .

Answer: A

Watch Video Solution

3. If "$q_1 + q_2 = q$" ,then the value of the ratio "$\frac{q_1}{q}$" ,for which the force between q_1 and "q_2" is maximum is

A. 0.25

B. 0.75

C. 1

D. 0.5

Answer: D

Watch Video Solution

4. Four charges equal to $-Q$ are placed at the four corners of a square and a charge q is at its centre. If the system is in equilibrium the value of q is

A. $-\frac{Q}{4}(1+2\sqrt{2})$

B. $\frac{Q}{4}(1+2\sqrt{2})$

C. $-\frac{Q}{4}(1+2\sqrt{2})$

D. $\frac{Q}{2}(1+2\sqrt{2})$

Answer: B

Watch Video Solution

5. Two small balls having equal positive charge Q,C each are supended by two insulating strings of equal length L meter form a hook

fixed to a stand . The whole set up is taken to a satellite in space where there is no gravity.Calculate the angle between the two strings and the tension in each string.

A. $180^\circ, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{(2L)^2}$

B. $90^\circ, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{L^2}$

C. $180^\circ, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{2L^2}$

D. $180^\circ, \frac{1}{4\pi\varepsilon_0}\frac{Q^2}{L^2}$

Answer: A

Watch Video Solution

6. Two pith balls carrying equal charges are suspended from a common point by strings of equal length. The equilibrium separation between them is r. Now the strings are rigidly clamped at half the height . The equilibrium separation between the balls now become .

A. $\left(\frac{r}{3\sqrt{2}}\right)$

B. $\left(\frac{2r}{\sqrt{3}}\right)$

C. $\left(\frac{2r}{3}\right)$

D. $\left(\frac{r}{\sqrt{2}}\right)^2$

Answer: A

View Text Solution

7. A large nonconducting sheet M is given a uniform charge density . Two uncharged small metal rods A and B are placed near the sheet as shown in figure . Then

A. M attracts A

B. M attracts B

C. A attracts B

D. All of the above

Answer: D

View Text Solution

8. The identical metal spheres A and B are supported on insulating stands and placed in contact . What kind of charges will A and B

develop when a negatively charged ebonite rod is brought near A ?

A. A will hae a positive charge and B will have a negative charge

B. A will have a negative charge and B will have a positive charge

C. Both A and B will have positive charges

D. Both A and B will have negative charge

Answer: A

Watch Video Solution

9. The force between two charges 0.06m apart is 5N. If each charge is moved towards the other by 0.04 m, then the force between them will become

A. 7 . 20 N

B. 11 . 25 N

C. 22 . 50 N

D. 45 . 00 N

Answer: B

Watch Video Solution

10. The equal point charges each of $3\mu C$ are separated by a centain distance in metres. If they are located at $\left(\hat{i}+\hat{j}+\hat{k}\right)$ and $\left(2\hat{i}+3\hat{j}+\hat{k}\right)$, then the electrostatic force between them is .

A. 9×10^3 N

B. $16 \times 10^{-3} N$

C. 10^{-3} N

D. $9 \times 10^{-2} N$

Answer: B

Watch Video Solution

11. A total charge Q is broken in two parts Q_1 and Q_2 and they are placed at a distance R from each other. The maximum force of repulsion between them will occur, when

A. $Q_2 = \frac{Q}{R}, Q_1 = Q = \frac{Q}{R}$

B. $Q_2 = \frac{Q}{4}, Q_1 = Q - \frac{2Q}{3}$

C. $Q_2 = \frac{Q}{4}, Q_1 = \frac{3Q}{3}$

D. $Q_1 = \frac{Q}{2}, Q_2 = \frac{Q}{2}$

Answer: D

Watch Video Solution

12. Two particles A and B having equal charges are placed at distance d apart. A third charged particle placed on the perpendicular bisector

at a distance x will experience the maximum Coulomb's force when :

A. $x = \frac{d}{\sqrt{2}}$

B. $x = \frac{d}{2}$

C. $x = \frac{d}{2\sqrt{2}}$

D. $x = \frac{d}{3\sqrt{2}}$

Answer: C

Watch Video Solution

13. Two charges are at a distance d apart. If a copper plate (conducting medium) of thickness $d/2$ is placed between them , the effictive force will be

A. $F/2$

B. zero

C. 2F

D. $\sqrt{2}F$

Answer: B

Watch Video Solution

Watch video solution

14. The ratio of electric force between two electrons to two protons separated by the same distance in air is .

A. 10^0

B. 10^6

C. 10^4

D. None of these

Answer: A

Watch Video Solution

15. An isolated charge q_1 of mass m is suspended freely by a thread of length l . Another charge q_2 is brought near it $(r > > l)$. When q_1 is in equilibrium, tension in thread will be

A. mg

B. $> mg$

C. $< mg$

D. None of these

Answer: B

View Text Solution

16. Three charges $+q, +2q$ and $+4q$ are connected by strings as shown in the figure. What is ratio of tensions in the strings AB and BC

A. $1:2$

B. $1:3$

C. $2:1$

D. $3:1$

Answer: B

View Text Solution

17. Force between two identical charges placed at a distance of r in vacuum is F.Now a slab of dielectric constant 4 is inserted between these two charges . If the thickness of the slab is

$r/2$, then the force between the charges will becomes

A. F

B. $\frac{3}{5}F$

C. $\frac{4}{9}F$

D. $\frac{F}{2}$

Answer: C

Watch Video Solution

18. If an electron has an initial velocity in a direction different from that of an electric field, then the path of the electron is

A. a straight line

B. a circle

C. an cllipse

D. a parabola

Answer: D

Watch Video Solution

19. A charged oil drop is suspended in uniform field of $3 \times 10^4 Vm^{-1}$ so that it neither falls nor rises. The charge on the drop will be

A. $1.6 \times 10^{-18} C$

B. $3.2 \times 10^{-18} C$

C. $3.3 \times 10^{-18} C$

D. $4.8 \times 10^{-18} C$

Answer: C

Watch Video Solution

20. An electron and a proton are in uniform electic field. The ratio of their acceleration will be

A. zero

B. unity

C. ratio of masses of proton and electron

D. ratio of masses of electron and proton

Answer: C

Watch Video Solution

21. Two large parallel plane sheets have uniform charge densities $+\sigma$ and $-\sigma$. Determine the electric field (i) between the sheets, and (ii) outside the sheets.

A. σ / ε_0

B. $\sigma / 2\varepsilon_0$

C. $2\sigma / \varepsilon_0$

D. zero

Answer: A

Watch Video Solution

22. In a region with uniform electric field, the number of lines of force per unit area is E. If a spherical metallic conductor is placed in this region, the number of lines of force per unit area inside the conductor will be

A. zero

B. E

C. more than E

D. less than E

Answer: A

Watch Video Solution

23. When a charge is moved against the Coulomb's force of an electric field, then

A. work is done by the electric field

B. energy is used from some outside source

C. strength of field decreases

D. energy of the system is decreased

Answer: A

Watch Video Solution

24. The electric field strength at a distance r from a charge q is E. What will be electric field strength if the distance of the observation point is increased to 2r (A) $\frac{E}{2}$ (B) $\frac{E}{4}$ (C) $\frac{E}{6}$ (D) none of the above

A. E/2

B. E/4

C. E/6

D. None of these

Answer: B

Watch Video Solution

25. The spatial distribution of electric field due to charges (A,B) is shown in figure. Which one of the following statements is correct ?

A. $Ais + ve$ and $B - ve, |A| > |B|$

B. $Ais - ve$ and $B + ve, |A| = |B|$

C. Both are $+ vebut A > B$

D. Both are $- vebut A > B$

Answer: A

View Text Solution

26. An oil drop of 12 excess electrons is held stationary under a constant electric field of $2.55 \times 10^4 NC^{-1}$ in Millikan's oil drop

experiment. The density of the oil is $1.26 \times 10^3 kgm^{-3}$. Estimate the radius of the drop $\left(g = 9.81ms^{-2}, e = 1.60 \times 10^{-19}C\right)$.

A. $4.3 \times 10^{-7}m$

B. $7.8 \times 10^{-7}m$

C. $0.078 \times 10^{-7}m$

D. $3.4 \times 10^{-7}m$

Answer: B

Watch Video Solution

27. An electric dipole is kept in non-unifrom electric field. It experiences

A. a force ad a torque

B. a force , but no torque

C. a torque but no force

D. neither a force nor a torque

Answer: C

Watch Video Solution

28. Two point dipoles of dipole moment $\overrightarrow{p}_1$ and $\overrightarrow{p}_2$ are at a distance x from each other and $\overrightarrow{p}_1 \mid\mid \overrightarrow{p}_2$. The force between the dipoles is :

A. $\frac{1}{4\pi\varepsilon_0}\frac{4p_1p_2}{x^4}$

B. $\frac{1}{4\pi\varepsilon_0}\frac{3p_1p_2}{x^3}$

C. $\frac{1}{4\pi\varepsilon_0}\frac{6p_1p_2}{x^4}$

D. $\frac{1}{4\pi\varepsilon_0}\frac{8p_1p_2}{x^4}$

Answer: B

Watch Video Solution

Watch Video Solution

29. Three poistive charges of equal value q are placed at the vertices of an equilateral triangle. The resulting lines of force should be sketched as in

A. 

B. 

C. 

D. 

Answer: C

Watch Video Solution

30. Let $P(r) = \frac{Q}{\pi R^4} r$ be the charge density distribution for a solid sphere of radius R and total charge Q. For a point 'p' inside the sphere at distance r_1 from the centre of the sphere, the magnitude of electric field is:

A. $\frac{Q}{4\pi \in_0 r_1^2}$

B. $\frac{Qr_1^2}{4\pi \in_0 R^4}$

C. $\frac{Qr_1^2}{3\pi \in_0 R^4}$

D. 0

Answer: B

Watch Video Solution

31. An electric line of forces in the x-y plane is given by the equation $x^2 + y^2 = 1$. A particle with unit poistive charge, initially at rest at the point $x = 1, y = 0$ in the x-y plane, will move along the circular line of force.

A. not move at all

B. will move along straight line

C. will move along the circular line of force

D. information is insufficient to draw any conclusion

Answer: C

 Watch Video Solution

32. Three infinitely long charge sheets are placed as shown in figure . The electric field at point P is

A. $\frac{2\sigma}{\varepsilon_0}\hat{k}$

B. $\frac{4\sigma}{\varepsilon_0}\hat{k}$

C. $-\frac{2\sigma}{\varepsilon_0}\hat{k}$

D. $-\frac{4\sigma}{\varepsilon_0}\hat{k}$

Answer: C

View Text Solution

View Text Solution

33. The electric intensity due to a dipole of length $10cm$ and having a charge of $500\mu C$, at a point on the axis at a distance $20cm$ from one of the charges in air is

A. $6.25 \times 10^7 N/C$

B. $9.28 \times 10^7 N/C$

C. $13.1 \times 10^{11} N/C$

D. $20.5 \times 10^7 N/C$

Answer: A

Watch Video Solution

34. An electric dipole consisting of two opposite charges of $2 \times 10^{-6} C$ each separated by a distance of $3cm$ is placed in an electirc field of $2 \times 10^5 N/C$. The maximum torque on the dipole is will be

A. $12 \times 10^{-1} N - m$

B. $12 \times 10^{-2} N - m$

C. $12 \times 10^{-3} N - m$

D. $12 \times 10^{-4} N - m$

Answer: C

Watch Video Solution

35. Two parallel large thin metal sheets have equal surface charge densities $\left(\sigma = 26.4 \times 10^{-12} C / m^2\right)$ of opposite signs. The electric field between these sheets is

A. 1 . 5 N/C

B. 1.5×10^{-10} N/C

C. 3 N/C

D. 3×10^{-10} N/C

Answer: C

Watch Video Solution

36. Point charge q moves from point P to point S along the path PQRS (as shown in fig.) in a uniform electric field E pointing co-parallel to

the positive direction of X - axis . The coordinates of the points P, Q, R and S are (a, b, 0), (2a, 0, 0), (a, -b, 0) and (0, 0, 0) respectively .

The workdone by the field in the above case is given by the the expression

A. q E A

B. $-qEA$

C. $qEA\sqrt{2}$

D. $qE\sqrt{\left[(2a)^2+b^2\right]}$

Answer: B

View Text Solution

37. Figure shows the electric lines of force 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. $E_A = \frac{E_B}{r^2}$

Answer: A

View Text Solution

38. An electric dipole is placed at an angle of 30° with an electric field intensity $2 \times 10^5 N/C$. It experiences a torque equal to

$4Nm$. The charge on the dipole, if the dipole is length is $2cm$, is

A. 8 m C

B. 4 m C

C. $8\mu C$

D. 2 m C

Answer: D

Watch Video Solution

39. An electric dipole of dipole moment 4×10^{-5} Cm is placed in a uniform electric field of $10^{-3} N/C$ making an angle of 30° with the direction of the field. Determine the torque exerted by the electric field on the dipole.

A. 7.7×10^{-13} Nm

B. 3.855×10^{-13} Nm

C. 3.855×10^{-15} Nm

D. 7.7×10^{-15} Nm

Answer: B

Watch Video Solution

40. A woden block performs SHM on a frictionless surface with frequencey , v_0 . The block carries a charge +Q on its surface. If now a uniform electric field $\vec{E}$ is switched - on as shown, then the SHM of the block will be

A. of the same frequency and with shifted mean position.

B. of the same frequency and with the same mean position

C. of changed frequecy and with shifted mean position.

D. of changed frequency and with the same mean position.

Answer: C

View Text Solution

41. Two point dipoles $p\hat{k}$ and $\frac{P}{2}\hat{k}$ are located at (0, 0, 0) and (1m, 0, 2m) respectively. Find the resultant electric field due to the two dipoles at the point M(1m, 0, 0)

$$\left[-\left(\frac{7P}{32\pi \in_0}\right)\hat{k}\right]$$

A. $\frac{9p}{32\pi \in_0}\hat{k}$

B. $\frac{-7p}{32\pi \in_0}\hat{k}$

C. $\frac{7p}{32\pi \in_0}\hat{k}$

D. None of these

Answer: B

Watch Video Solution

42. In the figure the electric lines on the right have twice the separation of those on the left. If a charge particle takes time t to move a distance x in left region, then it will take time to travel the same distance in the right side region is :

A. $\frac{t}{2}$

B. t

C. $\sqrt{2}t$

D. 2 t

Answer: C

View Text Solution

43. Two conducting spheres of radii r_1 and r_2 are charged to the same surface charge

density . The ratio of electric field near their surface is

A. r_1^2 / r_2^2

B. r_2^2 / r_1^2

C. r_1 / r_2

D. $1:1$

Answer: D

Watch Video Solution

44. A particle of mass m and charge q is placed at rest in a uniform electric field E and then released, the kinetic energy attained by the particle after moving a distance y will be

A. qEy^2

B. qE^2

C. q E y

D. q^2Ey

Answer: C

Watch Video Solution

Watch Video Solution

45. The firgure shows three non conducting rods, one circular and two straight, Each has a uniform charge of magnitude Q along its top half and another along its bottom half. Which of them correctly represents the direction of field at point P :

A. I

B. II

C. III

D. I and II

Answer: A

View Text Solution

46. An uncharged sphere of metal is placed in between charged plates as shown . The lines of force look like .

A. A

B. B

C. C

D. D

Answer: C

View Text Solution

47. An electric dipole has the magnitude of its charge as q and its dipole moment is p. It is placed in a uniform electric field E. If its dipole

moment is along the direction of the field, the force on it and its potential energy are respectively

A. q . E and max.

B. 2 q. E and min.

C. q . E and min.

D. zero and min.

Answer: D

Watch Video Solution

48. A charge q is placed at the centre of the open end of a cylindrical vessel. The flux of the electric field through the surface of the vessel is

A. zero

B. q/ε_0

C. $q/2\varepsilon_0$

D. $2q/\varepsilon_0$

Answer: A

View Text Solution

49. A cylinder of radius R and length L is placed in a uniform electric field E parallel to the axis. The total flux for the surface of the cylinder is given by

A. $2\pi R^2 E$

B. $\pi R^2 / E$

C. $\left(\pi R^2 / \pi R\right) / E$

D. Zero

Answer: D

Watch Video Solution

50. In the figure the net electric flux through the area A is $\phi = \vec{E} \cdot \vec{A}$ when the system is in air. On immersing the system in water the net electric flux through the area

A. becomes zero

B. remains same

C. increases

D. decreases

Answer: D

View Text Solution

51. The inward annd outward electric flux from a closed surface are respectively 8×10^3 and 4×10^3 units. Then the net charge inside the closed surface is

A. $\varepsilon_0 \times 10^6$

B. $-\varepsilon_0 \times 10^6$

C. $-2\varepsilon_0 \times 10^6$

D. $3\varepsilon_0 \times 10^6$

Answer: D

Watch Video Solution

52. A conducting sphere S_1 intersects a closed surface S_2 as shown in the figure . A positive charge q is placed at a point P . What is the

value of electric flux through the surface S_2 ?

A. 0

B. $\frac{q}{\in_0}$

C. $< \frac{q}{\in_0}$

D. $> \frac{q}{\in_0}$

Answer: B

View Text Solution

53. Flux passing through the shaded surface of a sphere when a point charge q is placed at the center is (radius of the sphere is R)

A. q/ε_0

B. $q/2\varepsilon_0$

C. $q/4\varepsilon_0$

D. zero

Answer: C

View Text Solution

View Text Solution

54. A circular loop of diameter d is rotated in a uniform electric field until the position of maximum electric flux is found. The flux in this position is measured to be ϕ .What is the electric field strength?

A. $\frac{4\phi}{\pi d^2}$

B. $\frac{2\phi}{\pi d^2}$

C. $\frac{\phi}{\pi d^2}$

D. $\frac{\pi\phi d^2}{4}$

Answer: A

Watch Video Solution

55. A point charge + Q is positioned at the center of the base of square pyramid as shown . The flux through one of the four identical upper faces of the pyramid is

A. $\frac{Q}{16\varepsilon_0}$

B. $\frac{Q}{4\varepsilon_0}$

C. $\frac{Q}{8\varepsilon_0}$

D. None of these

Answer: C

View Text Solution

56. 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. $\frac{\left(-4 \times 10^3\right)}{\varepsilon} C$

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

Answer: D

Watch Video Solution

57. A surface has the area vector $\vec{A} = \left(2\hat{i} + 3\hat{j}\right) m^2$. The flux of an electric

field through it if the field is $\vec{E} = 4\hat{i}\frac{V}{m}$:

A. 8 V - m

B. 12 V - m

C. 20 V - m

D. zero

Answer: A

Watch Video Solution

58. Electric charges are distributed in a small volume.The flux of the electric field through a spherical surface of radius 1m surrounding the total charge is $100V - m$.The flux over the concentric sphere of radius 2m will be:

A. 25 V - m

B. 50 V - m

C. 100 V - m

D. 200 V - m

Answer: C

Watch Video Solution

Exercise 2 Concept Applicator

1. Three charge q, Q and $-4q$ are placed in a straight line , line of length Lat points distant $0, L/2$ and L respectively from one end. In order to make the net force on q zero, the charge Q must be equal to

A. $-q$

B. $-2q$

C. $\frac{-q}{2}$

D. q

Answer: A

Watch Video Solution

2. Two very long line charges of uniform charge density $+\lambda$ and $-\lambda$ are placed along same line with the separation between the nearest ends being 2a, as shown in figure. The

electric field intensity at point O is

A. $\frac{-\lambda}{2\pi\varepsilon_0 a}$

B. 0

C. $\frac{\lambda}{\pi\varepsilon_0 a}$

D. $\frac{\lambda}{\pi\varepsilon_0 a}$

Answer: A

View Text Solution

3. A particle of charge $-q$ and mass m moves in a circular orbits of radius r about a fixed charge $+Q$.The relation between the radius of the orbit r and the time period T is

A. $r = \dfrac{Qq}{16\pi^2 \in_0 m} T^2$

B. $r^3 = \dfrac{Qq}{16\pi^3 \in_0 m} T^2$

C. $r^2 = \dfrac{Qq}{16\pi^3 \in_0 M} T^3$

D. $r^2 = \dfrac{Qq}{4\pi^3 \in_0 M} T^3$

Answer: B

Watch Video Solution

Watch video solution

4. Among two discs A and B, first have radius 10 cm and charge $10^{-6} - \mu$C and second have radius 30 cm and charge 10^{-5}- C. When they are touched, charge on both q_A andq_B respectively will, be

A. $q_A = 2.75\mu C, q_B = 3.15\mu C$

B. $q_A = 1.09\mu C, qB = 1.53\mu C$

C. $q_A = q_B = 5.5\mu C$

D. None of these

Answer: C

Watch Video Solution

5. Two identical metallic blocks resting on a frictionless horizontal surface are connected by a light metallic spring having the spring constant 100 N/m and an unstretched length of 0.2m, as shown in figure 1 . A total charge Q is slowly placed on the system, causing the spring to stretch to an equilibrium length of 0.3 m, as shown in figure 2. The value of charge

Q, assuming that all the charge resides on the blocks and that the blocks are like point charges , is

A. $10\mu C$

B. $15\mu C$

C. $20\mu C$

D. $30\mu C$

Answer: C

View Text Solution

6. A solid sphere of radius R_1 and volume charge density $\rho = \frac{\rho_0}{r}$ is enclosed by a hollow sphere of radius R_2 with negative surface charge density σ, such that the total charge in the system is zero . ρ_0 is positive constant and r is the distance from the centre of the sphere . The ratio R_2 / R_1 is

A. $\frac{\sigma}{\rho_0}$

B. $\sqrt{\frac{2\sigma}{\rho_0}}$

C. $\sqrt{\frac{\rho_0}{2\sigma}}$

D. $\frac{\rho_0}{\sigma}$

Answer: C

Watch Video Solution

7. The point charges $+q, -2q$ and $+q$ are placed at point $(x=0, y=a, z=0), (x=0, y=0, z=0)$ and $(x=a, y=0, z=0)$, repectively. The magnitude and direction of the electric dipole moment vector of this charge assembly are

A. $\sqrt{2}qa$ along the line joining points (x = 0, y = 0, z = 0) and (x = a, y = a, z = a)

B. qa along the line joining points (x = 0, y = 0, z = 0) and (x = a, y = a, z = 0)

C. $\sqrt{2}qa$ along + ve x direction

D. $\sqrt{2}qa$ along + ve y direction

Answer: A

Watch Video Solution

8. Two thin flat metal plates having large surface area are charge separately to acquire charge densities + σ and $-\sigma$. The plates are then brought near to each other and held parallel to each other (Fig.) : If E_A, E_B and E_C denote the electric fields at the points A, B and C respectively , then which of the following wiii be true :

A. $E_A = E_C = \frac{\sigma}{\varepsilon_0}$

B. $E_A = E_B = E_C = \frac{\sigma}{\varepsilon_0}$

C. $E_A = E_C = 0, E_B = \frac{\sigma}{\varepsilon_0}$

D. $E_A = E_C = 0, E_B = \frac{2\sigma}{\varepsilon_0}$

Answer: C

View Text Solution

9. Charge on an originally uncharged conductor, is separated by holding a positively charged rod very closely nearby, as shown in Fig. 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. $-q/\varepsilon_0$

D. None of these

Answer: B

View Text Solution

10. An insulating solid sphere of the radius R is carged in a non - uniform manner such that the volume charge density $\rho = \frac{A}{r}$, where A is a positive constant and r is the distance from the centre. The potential difference between the centre and surface of the sphere is

A. $\pi R^2 \alpha$

B. $4\pi R^2 \alpha$

C. $2\pi R^2 \alpha$

D. $3\pi R^2 \alpha / 4$

Answer: C

Watch Video Solution

11. Figure shows a uniformaly charged hemisphere of radius R . It has a volume charge density ρ . If the electric field at a point 2R , above its centre is E, then what is the electric field at the point 2R below its centre ?

A. $\rho R/6\varepsilon_0 + E$

B. $\rho R / 12\varepsilon_0 - E$

C. $-\rho R / 6\varepsilon_0 + E$

D. $\rho R / 12\varepsilon_0 + E$

Answer: B

View Text Solution

12. A block of mass m fitted with a light spring of stiffness k and natural length l_0 kept on a smooth radial groove made on a disc rotaing with a constant angular axis . If the block is

released slowly . Find the maximum elongation of the spring

A. $2l_0\sqrt{4\pi\varepsilon_0 k(l_0+x)}$

B. $2x\sqrt{4\pi\varepsilon_0 k(l_0+x)}$

C. $2(l_0+x)\sqrt{4\pi\varepsilon_0 kx}$

D. $(l_0+x)\sqrt{4\pi\varepsilon_0 kx}$

Answer: C

Watch Video Solution

13. In fig., two equal positive point charges $q_1 = q_2 = 2.0\mu C$ interact with a third point charge $Q = 4.0\mu C$. The magnitude, as well as direction, of the net force on Q is

A. 0 . 23 N in the + x - direction

B. 0 . 46 N in the + x - direction

C. 0 . 23 N in the - x - direction

D. 0 . 46 N in the - x - direction

Answer: B

View Text Solution

14. Two small balls having the same mass and charge and located on the same vertical at heights h_1 and h_2 are thrown in the same direction along the horizontal at the same velocity v. The first ball touches the ground at a horizontal distance R from the initial vertical position. At what height h_2 will the second ball be at this instant? Neglect any frictional resistance of air and the effect of any induced charge on the ground.

A. $h_1 + h_2 - g\left(\frac{l}{v}\right)^2$

B. $h_1 - h_2 - g\left(\frac{l}{v}\right)^2$

C. $h_1 + h_2 - g\left(\frac{l}{v}\right)^{1/2}$

D. $\frac{h_1 + h_2}{2} - g\left(\frac{l}{v}\right)^2$

Answer: A

Watch Video Solution

15. Six charges of equal magnitude, 3 positive and 3 negative are to be placed on PQRSTU

corners of a regular hexagon, such that field at the centre is double that of what it would have been it only one + ve charge is placed at R . Which of the following arrangement of charge is possible for P, Q, R, S, T and U respectively

A. $+, +, +, -, -, -$

B. $-, +, +, +, -, -$

C. $-, +, +, -, +, -$

D. $+, -, +, -, +, -$

Answer: C

View Text Solution

16. Four point + ve charges of same magnitude (Q) are placed at four corners of a rigid square frame as shown in figure. The plane of the frame is perpendicular to z- axis , If a - ve point charge is placed at a distance z away from the above frame $(z < \ < L)$ then

A. – ve charge oscillates along the z - axis

.

B. it moves away from the frame

C. it moves slowly towards the frame and stays in the plane of t he frame

D. it passes through the frame only once .

Answer: A

View Text Solution

17. A large sheet carries uniform surface density σ . A rod of length 2 l has a linear charge density λ on one half and $-\lambda$ on the second half. The rod is hinged at the midpoint O and makes an angle θ with the normal to the sheet . The torque experienced by the rod is

A. 0

B. $\frac{\sigma\lambda l^2}{2\varepsilon_0}\sin\theta$

C. $\frac{\sigma\lambda l^2}{\varepsilon_0}\sin\theta$

D. $\frac{\sigma\lambda l}{2\varepsilon_0}\sin\theta$

Answer: B

View Text Solution

18. The flat base of a hemisphere of radius a with no charge inside it lies in a horizontal plane . A uniform electric field $\overrightarrow{E}$ is applied at an angle $\frac{\pi}{4}$ with the vertical direction. The electric flux through the curved surface of the

hemisphere is

A. $\pi a^2 E$

B. $\frac{\pi a^2 E}{\sqrt{2}}$

C. $\frac{\pi a^2 E}{2\sqrt{2}}$

D. $\frac{(\pi+2)a^2 E}{\left(2\sqrt{2^2}\right)}$

Answer: B

View Text Solution

19. Find the force experienced by a semicircular rod having a charge q as shown in Fig. Radius of the wire is R, and the line of charge with linear charge density λ passes through its centre and is perpendicular to the plane of wire .

A. $\frac{\lambda q}{2\pi^2\varepsilon_0 R}$

B. $\frac{\lambda q}{\pi^2\varepsilon_0 R}$

C. $\frac{\lambda q}{4\pi^2\varepsilon_0 R}$

D. $\frac{\lambda q}{4\pi\varepsilon_0 R}$

Answer: B

View Text Solution

20. A particle of charge - q and mass m moves in a circular orbit of radius r around an infinitely long line charge of linear charge density $+\lambda$. Then time period will be

A. $T = 2\pi r\sqrt{\frac{m}{2k\lambda q}}$

B. $T^2 = \frac{4\pi^2 m}{2k\lambda q} r^3$

C. $T = \frac{1}{2\pi r}\sqrt{\frac{2k\lambda q}{m}}$

D. $T = \frac{1}{2\pi r}\sqrt{\frac{R}{2k\lambda q}}$

Answer: A

View Text Solution

21. A uniformly charged and infinitely long line having a linear charge density λ is placed at a normal distance y from a point O . Consider an imaginary sphere of radius R with O as centre

and $R > y$. Electric flux through the surface of the sphere is

A. zero

B. $\frac{2\lambda R}{\varepsilon_0}$

C. $\frac{2\lambda\sqrt{R^2 - y^2}}{\varepsilon_0}$

D. $\frac{\lambda\sqrt{R^2 + Y^2}}{\varepsilon_0}$

Answer: C

View Text Solution

22. Which of the following graphs shows the correct behaviour of electric flux through the surface S when it is rotated by an angle 90° clockwise in a uniform electric field ?

A. 

B. 

C. 

D. 

Answer: A

View Text Solution

23. Figure shows an electric quadrupole, with quadrupole moment $\left(Q = 2ql^2\right)$. The electric field at a distance from its centre at the axis of the quadrupole is given by

A. $\left(\frac{1}{4\pi \in_0}\right)\frac{Q}{r^4}$

B. $\left(\frac{1}{4\pi \in_0}\right)\frac{2Q}{r^4}$

C. $\left(\frac{1}{4\pi \in_0}\right)\frac{3Q}{r^4}$

D. None of these

Answer: C

View Text Solution

24. An electric dipole of moment $\vec{P}$ is placed in a uniform electric field $\vec{E}$ such that $\vec{P}$ points along $\vec{E}$. If the dipole is slightly rotated about an axis perpendicular to the plane containing $\vec{E}$ and $\vec{P}$ and passing through the centre of the dipole, the dipole executes simple harmonic motion. Consider I to be the moment of inertia of the dipole

about the axis of rotation. What is the time period of such oscillation ?

A. $\sqrt{(PE/I)}$

B. $2\pi\sqrt{(I/PE)}$

C. $2\pi\sqrt{(I/2PE)}$

D. None of these

Answer: B

Watch Video Solution