PHYSICS

BOOKS - DISHA PHYSICS (HINGLISH)

ELECTRIC CHARGE AND FIELDS

Physics

1. The surface charge density of a thin charged disc of radius R is σ. The value of the electric field at the centre of the disc is $\frac{\sigma}{2 \in_o}$. With

respect to the field at the centre, the electric field along the axis at a distance R from the centre of the disc reduces by

A. 70.7%

B. 29.3%

C. 9.7%

D. 14.6%

Answer:

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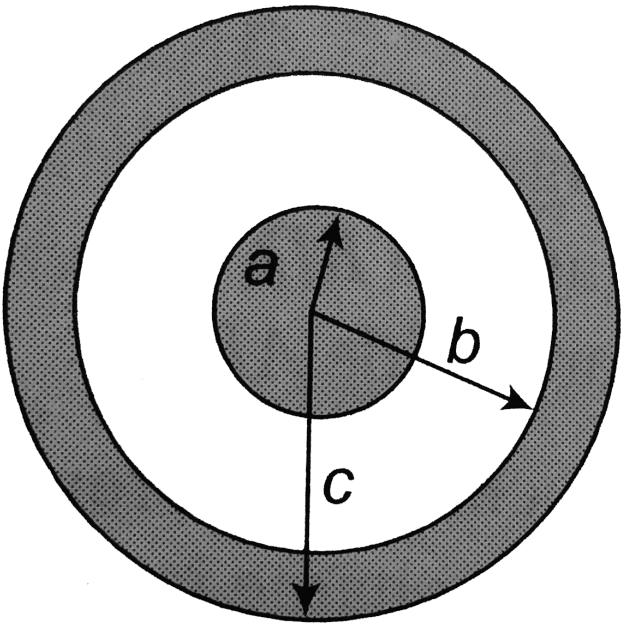
2. A solid conducting sphere of radius a has a net positive charge $2Q$. A conducting spherical shell of inner radius b and outer radius c is concentric with the solid sphere and has a net charge $-Q$. The surface charge density on the inner and outer surfaces of the spherical shell

will be



A. $-\frac{2Q}{4\pi b^2}, \frac{Q}{4\pi c^2}$

B. $-\frac{Q}{4\pi b^2}, \frac{Q}{4\pi c^2}$

C. $0, \frac{Q}{4\pi c^2}$

D. $\frac{Q}{4\pi c^2}, 0$

Answer:

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3. Two equally charged, indentical metal spheres A and B repel each other with a force F. The spheres are kept fixed with a distance r between them. A third identical, but uncharged sphere C is brought in contact with A and The magnitude of the net electric force on C is

A. F

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

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

D. $\frac{F}{4}$

Answer:

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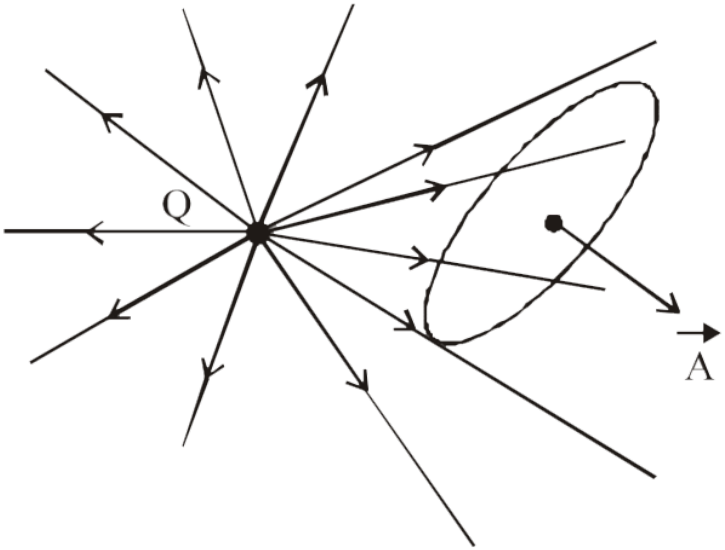
4. In the figure, the net electric flux through the area A is $\phi = \vec{E} . \vec{A}$ when the system is in air. On immersing the system in water the net

electric flux through the area



A. becomes zero

B. remains same

C. increases

D. decreases

Answer:

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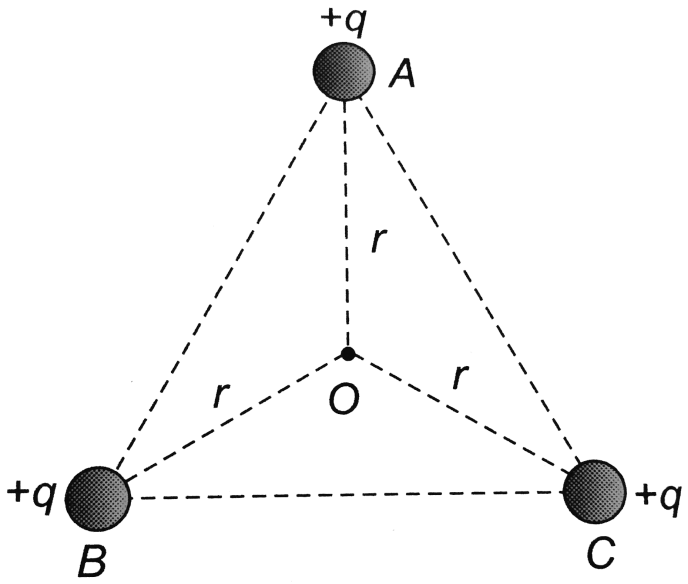
5. ABC is an equilateral triangle. Charges $+q$ are placed at each corner. The electric intensity at O will be



A. $\frac{1}{4\pi \in_0} \frac{q}{r}$

B. $\frac{1}{4\pi \in_0} \frac{q}{r^2}$

C. $\frac{1}{4\pi \in_0} \frac{3q}{r^1}$

D. zero

Answer:

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6. An electric dipole is placed in a uniform electric field. The dipole will experience

A. a force that will displace it in the direction of the field

B. a force that will displace it in a direction opposite to the field.

C. a torque which will rotate it without displacement

D. a torque which will rotate it and a force that will displace it

Answer:

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7. An uniform electric field E exists along positive x-axis. The work done in moving a charge 0.5 C through a distance 2 m along a direction making an angle 60° with x-axis is 10 J. Then the magnitude of electric field is

A. $5Vm^{-1}$

B. $2Vm^{-1}$

C. $\sqrt{5}Vm^{-1}$

D. $20Vm^{-1}$

Answer:

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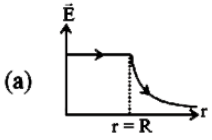
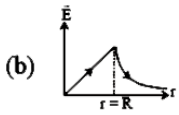
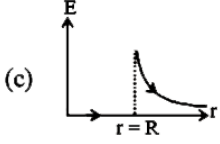
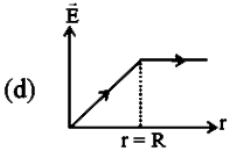
8. Which one of the following graphs represents the variation of electric field with distance r from the centre of a charged spherical conductor of radius R?

A. 

B. 

C. 

D. 

Answer:

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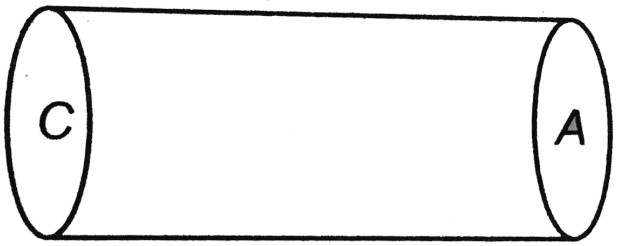
9. A hollow cylinder has a charge qC within it. If ϕ is the electric flux in unit of voltmeter associated with the curved surface B the flux linked with the plance surface A in unit of

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:

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10. If E_a be the electric field strength of a short dipole at a point on its axial line and E_e that on the equatorial line at the same distance, then

A. $E_e = 2E_a$

B. $E_a = 2E(e)$

C. $E_a = E_e$

D. None of the above

Answer:

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11. 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. (a) 

B. (b) 

C. (c) 

D. (d) 

Answer:

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12. Three point charges Q_1, Q_2, Q_3 in the order are placed equally spaced along a straight line. Q_2 andQ_3 are equal in magnitude but opposite in sign. If the net force on Q_3 is zero. The value of Q_1 is

A. $Q_1 = 4(Q_3)$

B. $Q = (Q_3)$

C. $Q_1 = \sqrt{2}(Q^3)$

D. $Q_1 = |Q^3|$

Answer:

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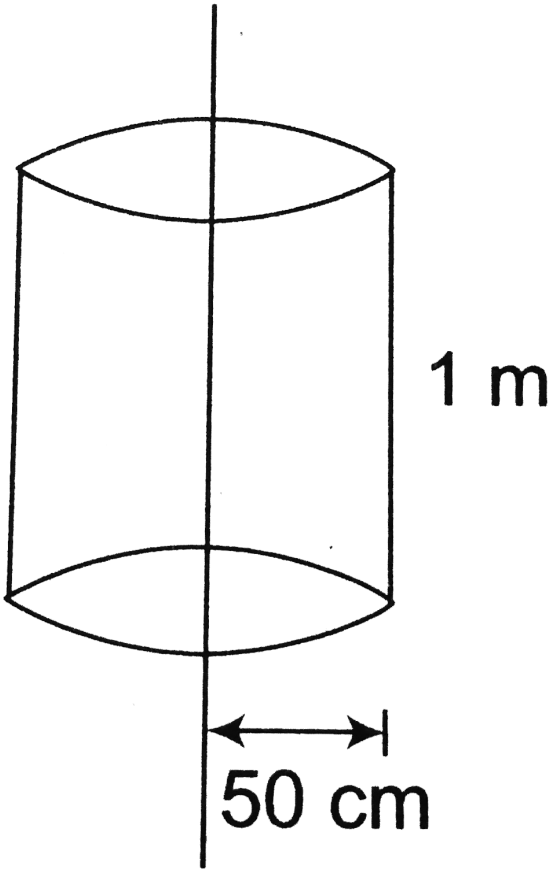
13. Electric charge is uniformly distributed along a along straight wire of radius $1mm$. The charge per centimeter length of the wire

is Q coulomb. Another cyclindrical surface of radius $50cm$ and length $1m$ symmetrically enclose the wire ask shown in figure. The total electric flux passing through the cyclindrical

surface is



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

B. $\frac{100Q}{\varepsilon_0}$

C. $\frac{10Q}{\pi\varepsilon_0}$

D. $\frac{100Q}{\pi\varepsilon_0}$

Answer:

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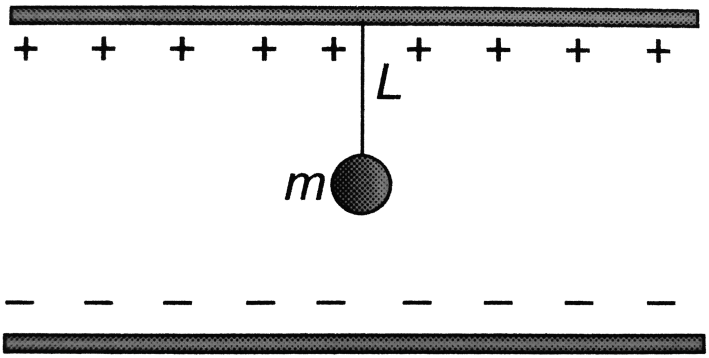
14. A small sphere carrying a charge q is hanging in between two parallel plates by a string of length L. Time period of pendulum is T_0. When parallel plates are charged, the time period changes to T. The ratio T/T_0 is equal

to



A. $\left(\frac{g+\frac{qE}{m}}{g}\right)^{1/2}$

B. $\left(\frac{g}{g+\frac{qE}{m}}\right)^{3/5}$

C. $\left(\frac{g}{g+\frac{qE}{m}}\right)^{1/2}$

D. $\left(\frac{g}{g+\frac{qE}{m}}\right)^{5/2}$

Answer:

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15. 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. $12 \times 10^{-13} N - m$

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

Answer:

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16. The electric field in a certain region is acting radially outwards and is given by $E = Ar$. A charge contained in a sphere of radius $'a'$ centred at the origin of the field, will given by

A. $A\varepsilon_0 a^2$

B. $4\pi\varepsilon_0 A a^3$

C. $\varepsilon_0 A a^3$

D. $4\pi\varepsilon_0 A a^2$

Answer:

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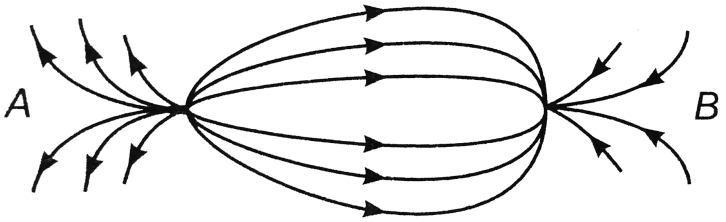
17. The spatial distribution of the electric field due to charges (A, B) is shown in figure.

Which of the following statements is correct?



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

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

C. Both are $+ve$ but $A > B$

D. Both are $-ve$ but $A > B$

Answer:

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18. Point charges $+4q, -q$ are kept on the x-axis at points $x = 0, x = a$ and $X = 2a$ respectively, then

A. only – q is in stable equilibrium

B. none of the charges is in equilibrium

C. all the charges are in unstable equilibrium

D. all the charges are in stable equilibrium

Answer:

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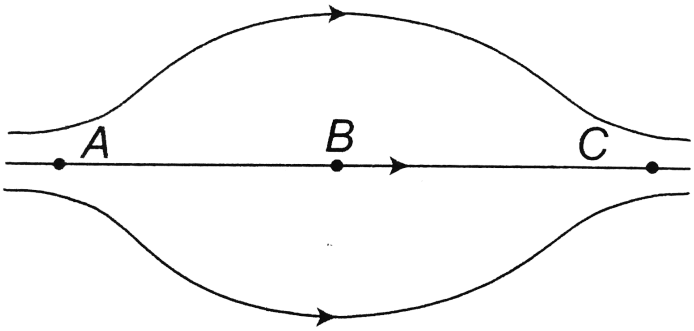
19. The figure shows some of the electric field lines corresponding to an electric field. The figure suggests



A. $E > (A) > E_B > E_C$

B. $E_A = E_B = E_C$

C. $E_A = E_B > E_C$

D. $E_A = E_B < E_C$

Answer:

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20. For distance far away from centre of dipole the change in magnitude of electric field with change in distance from the centre of dipole is

A. zero

B. same in equatorial plane as well as axis of dipole

C. more in case of equatorial plane of dipole as compared to axis of dipole

D. more in case of axis of dipole as compared to equatorial plane of dipole.

Answer:

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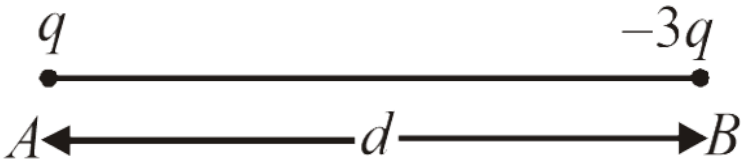
21. Two charge q and $-3q$ are placed fixed on x–axis separated by distance d. Where should a third charge$2q$ be placed such that it will not experience any force ?



A. $\frac{d-\sqrt{3}d}{2}$

B. $\frac{d+\sqrt{3}d}{2}$

C. $\frac{d+3d}{2}$

D. $\frac{d-3d}{2}$

Answer:

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22. A charge Q is place 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 Q/q equals:

A. -1

B. 1

C. $-\frac{1}{\sqrt{2}}$

D. $-2\sqrt{2}$

Answer:

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23. Coulomb 's law correctly describe the electric force is that (pick the wrong statement)

A. binds the electrons of an atom to its nucleus

B. binds the protons and neutrons in the nucleus of an atom

C. binds atoms together to form molecules

D. binds atoms and molecules together to form solids

Answer:

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24. An oil drop of radius r and density r is held stationary in a uniform vertically upwards electric field 'E'. If $p_0 = (\ < p)$ is the density of air and e is quanta of charge, then the drop has–

A. $\frac{4\pi r^3(p-p_0)}{3eE}$ excess electrons

B. $\frac{4\pi r^2(p-p_0)}{eE}$ excess electrons

C. deficiency of $\frac{4\pi r^3(p-p_0)g}{3eE}$ electrons

D. deficiency of $\frac{4\pi r^2(p-p_0)g}{eE}$ electrons

Answer:

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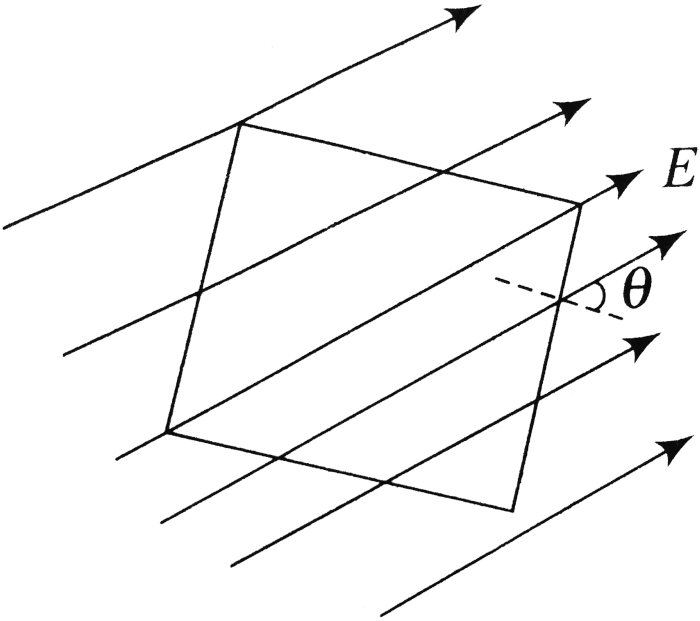
25. A square surface of side L metre in the plane of the paper is placed in a uniform electric field $E(\text{volt}/m)$ acting along the same place at an anlge θ with the horizontal side of the square as shown in figure. The electric flux linked to the surface in uint of

$V - m$ is



A. EL^2

B. $EL^2 \cos\theta$

C. $EL^2 \sin\theta$

D. zero

Answer:

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26. An electric dipole when placed in a uniform electric field E will have minimum potential energy, if the positive direction of dipole moment makes the following angle with E

A. zero

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

C. π

D. $\frac{3\pi}{2}$

Answer:

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27. Which of the following statements is incorrect?

A. The charge q on a body is always given by $q = ne$, where n is any integer, positive or negative.

B. By convention, the charge on an electron is taken to be negative.

C. The fact that electric charge is always an integral multiple of e is termed as quantisation of charge.

D. The quatisation of charge was experimentally demonstrated by Newton in 1912.

Answer:

28. Two positive ions , each carrying a charge q , are separated by a distance d.If F is the force of repulsion between the ions , the number of electrons missing from each ion will be (e being the charge on an electron)

A. $\frac{4\pi\varepsilon^0 Fd^2}{e^2}$

B. $\sqrt{\frac{4\pi\varepsilon^0 Fd^2}{e^2}}$

C. $\sqrt{\frac{4\pi\varepsilon_0 Fd^2}{e^2}}$

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

Answer:

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29. The electric field intensity just sufficient to balance the earth's gravitational attraction on an electron will be: (given mass and charge of an electron respectively are $9.1 \times 10^{-31} kg$ and $1. \times 10^{-19} C$)

A. $-5.6 \times 10^{-11} N/C$

B. $-4.8 \times 10^{-15} N/C$

C. $-4.8 \times 10^{-15} N/C$

D. $-3.2 \times 10^{-15} N/C$

Answer:

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30. 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 mC

B. 4 mC

C. 8 mC

D. 2 mC

Answer:

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31. A particle of mass m and charge q is released from rest in uniform electric field of intensity E. Calculate the kinetic energy it

attains after moving a distance x between the plates.

A. qEy^2

B. qE^2y

C. qEy

D. q^2Ey

Answer:

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32. Three is an electric field E in the x - direction. If the work done by the electric field in moving a charge of $0.2C$ through a distance of $2m$ along a line making an angle 60° with the x- axis is $4J$, then what is the value of E ?

A. $3N/C$

B. $4N/C$

C. $5N/C$

D. $20N/C$

Answer:

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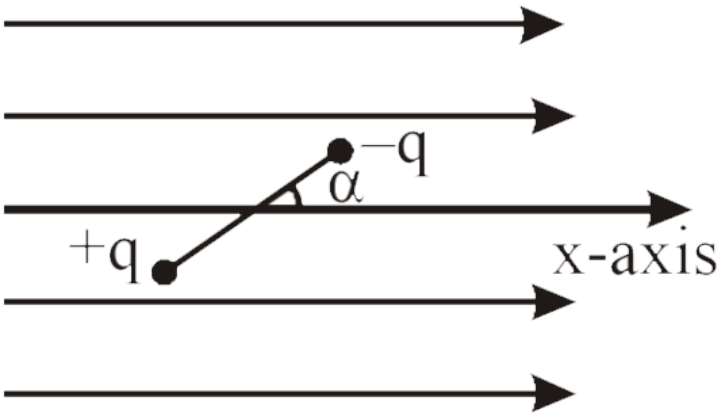
33. There exists a non!-uniform electric field along x-axis as shown in the figure below. The field increases at a uniform rate along +ve x-axis. A dipole is placed inside the field as shown. Which one of the following is correct for the dipole?



A. Dipole moves along positive x-axis and undergoes a clockwise rotation

B. Dipole moves along negative x-axis and undergoes a clockwise rotation

C. Dipole moves along positive x-axis and undergoes a anticlockwise rotation

D. Dipole moves along negative x-axis and undergoes a anticlockwise rotation

Answer:

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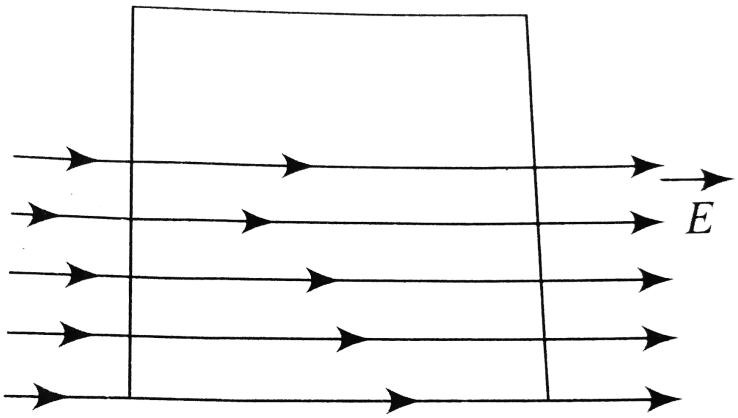
34. A square surface of side Lm is in the plane of the paper. A uniform electric field $\overrightarrow{E}\,(V/m)$, also in the plane of the paper, is limited only to the lower half of the square surface (see figure). The electric flux in SI units associated with the surface is:



A. $EL2/2$

B. zero

C. EL^2

D. $EL^2/(2\varepsilon_0)$

Answer:

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35. Among two discs A and B, first have radius 10 cm and charge 10^{-6} -μC and second have radius 30 cm and charge 10^{-5}- μC. 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. $q_A = 1.09\mu C, q_b = 1.53\mu C$

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

D. None of these

Answer:

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36. The total electric flux emanating from a closed surface enclosing an alpha particale (e = electronic chage) is

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

B. $\frac{e}{\varepsilon_0}$

C. $e\varepsilon_0$

D. $\frac{\varepsilon_0 e}{4}$

Answer:

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37. Which of the following is a wrong statement?

A. The charge of an isolated system is conserved

B. It is not possible to create or destroy charged particles

C. It is possible to create or destroy charged particles

D. It is not possible to create or destroy net charge

Answer:

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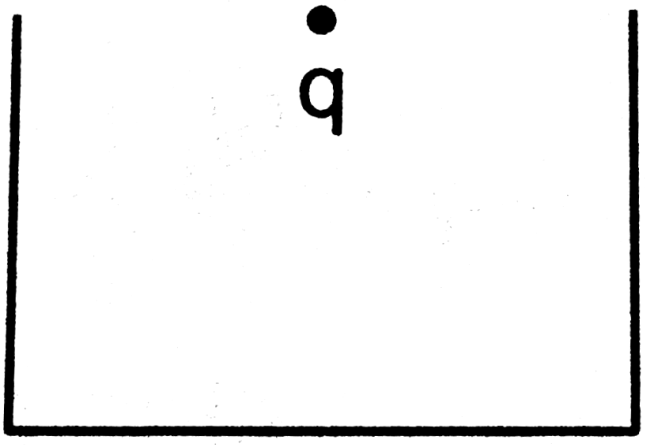
38. A charge q is placed at the centre of the open end of a cylindrical vessel . The flux of the electric field through the surface of the vessel

is



A. zero

B. q/ε_o

C. $q/2\varepsilon_0$

D. $2q/\varepsilon_0$

Answer:

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39. Two particle of equal mass m and charge q are placed at a distance of 16 cm. They do not experience any force. The value of $\frac{q}{m}$ is

A. 1

B. $= \sqrt{\frac{\pi\varepsilon_0}{G}}$

C. $= \sqrt{\frac{G}{4\pi\varepsilon_0}}$

D. $\sqrt{4\pi\varepsilon_0 G}$

Answer:

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40. A rod of length 2.4 m and radius 4.6 mm carries a negative charge of 4.2×10^{-7}C spread uniformly over it surface. The electric field near the mid-point of the rod, at a point on its surface is

A. $-8.6 \times 10^{5} NC^{-1}$

B. $8.6 \times 10^{4} NC^{-1}$

C. $-6.7 \times 10^5 NC^{-1}$

D. $6.7 \times 10^4 NC^{-1}$

Answer:

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41. A hollow insulated conducting sphere is given a positive charge of $10\mu C$. What will be the electric field at the centre of the sphere it is radius is 2 metres ?

A. Zero

B. $5\mu Cm^{-2}$

C. $20\mu Cm^{-2}$

D. $8\mu Cm^{-2}$

Answer:

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42. A charge Q is enclosed by a Gaussian spherical surface of radius R. If the radius is doubled, then the outward electric flux will

A. increase four times

B. be reduced to half

C. remain the same

D. be doubled

Answer: