PHYSICS

BOOKS - A2Z PHYSICS (HINGLISH)

ELECTRIC CHARGE, FIELD & FLUX

Coulumb'S Law

1. If a body is charged by rubbing it. Its weight

A. always decreases slightly

B. always increases slightly

C. may increase slightly or may decrease slightly

D. remains precisely the same

Answer: C

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2. In a general, metallic ropes are suspended on the carries which take inflammable material. The reason is

A. There speed is controlled

B. To keep the center of gravity of the carrier nearer to the earth

C. To keep the body of the carrier in contact with the earth

D. Nothing should be placed under the carrier

Answer: C

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3. Four metal conductors having different shapes

1. A sphere 2. Cylindrical

3.Pear 4.Lightning conductor

Are mounted on insulating stands and charged. The one which is best suited to retain the charges for a longer time is

A. 1

B. 2

C. 3

D. 4

Answer: A

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4. What is the amount of charge possessed by $1kg$ of electrons

A. $6.25 \times 10^{10} C$

B. $1.76 \times 10^{11} C$

C. $1.76 \times 10^{10} C$

D. $1.25 \times 10^{10} C$

Answer: B

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5. A polythene piece rubbed with wool is found to have negative charge of $3.6 \times 10^{-7} C$. Calculate the number of electrons transferred from wool to polythene. If an electron has a mass $9.1 \times 10^{-31} kg$, find the mass transferred to polythene.

A. $2.25 \times 10^{10} kg$

B. $6.25 \times 10^{-18} kg$

C. $2.05 \times 10^{-18} kg$

D. $4.15 \times 10^{-18} kg$

Answer: C

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6. There are two metallic spheres of same radii but one is solid and the other is hollow, then

A. Solid sphere can be given more charge

B. Hollow sphere can be given more charge

C. They can be charged equally

D. None of the above

Answer: C

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7. When a body is earth connected, electrons from the earth flow into the body. This means the body was ....

A. Unchanged

B. Charge positively

C. Charge negatively

D. an insulator

Answer: B

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8. A positively charged insulator is brought near(but does not touch) two metallic sphere that are in contact. The metallic spheres are then separated. The sphere which was initially farthest from the insulator will have:

A. no net charge

B. a negative charge

C. a positive charge

D. either a negative or a positive charge.

Answer: C

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9. Suppose we have large number of identical particles, very small in size. Any of them at $10cm$ separation repel with a force of $3 \times 10^{-10} N$. If one of them is at $10cm$ from a group of n others, how strongly do you expect it to be repelled?

A. $3 \times 10^{-10} N$

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

C. $\frac{3 \times 10^{-10}}{n} N$

D. Can not be calculated

Answer: B

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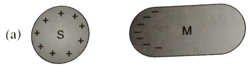
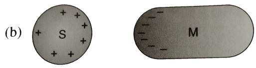
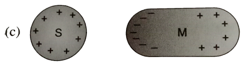
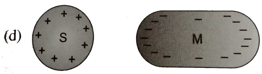
10. An uncharged metal object M is insulated from its surroundings. A positively charged metal sphere S is then brought neat to M. Which diagram best illustrates the resultant distributions of charge on S and M

A. 

B. 

C. 

D. 

Answer: D

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11. Five balls numbered 1,2,3,4,and 5 are suspended using separated threads. The balls (1,2),(2,4) and (4,1) show electrostatic attraction while balls (2,3) and (4,5) show repulsion. Therefore, ball 1 must be

A. Positively charged

B. Negatively charged

C. Neutral

D. Made of metal

Answer: c

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12. A point charge $+q$ is placed at a distance d from an isolated conducting plane. The field at a point P

on the other side of plane is

A. directed perpendicular to the plane away from the plane

B. directed perpendicular to the plane but towards the plane

C. directed radially away from the point charge

D. directed radially towards the point charge

Answer: A

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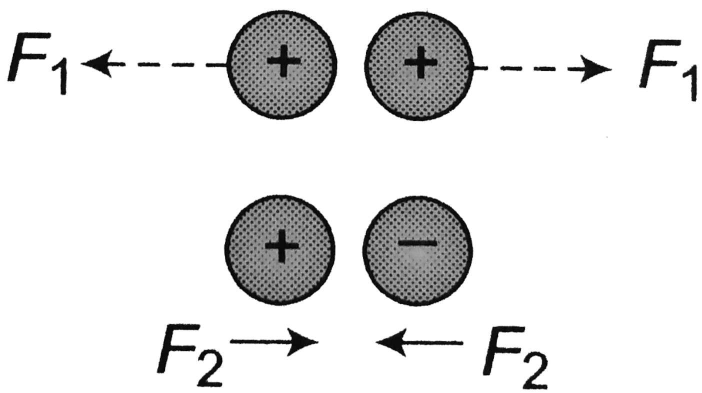
13. In two cases, two identical conducting sphere are given equal charges, in one case of the same type whereas in another case of opposite type. The distance between the spheres is not large comparing with the diameter. Let F_1 and F_2 be the magnitudes of the force of interaction between the spheres, as shown, then



A. $F_1 > F_2$

B. $F_1 = F_2$

C. $F_1 < F_2$

D. information is not sufficient to draw the conclusion

Answer: C

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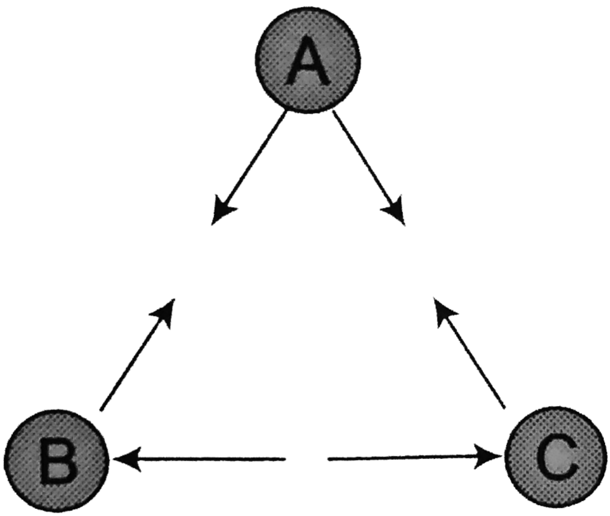
14. The diagram shows the arrangement of three small uniformly charged spheres, A, B and C. The arrow indicate the direction of the electrostatic forces acting between the spheres (for example, the left arrow on sphere A indicates the electrostatic force on sphere A due to sphere B). At least two of the spheres are positively charged. Which sphere, if any, could be negatively charged?



A. sphere A

B. sphere B

C. sphere C

D. no sphere

Answer: A

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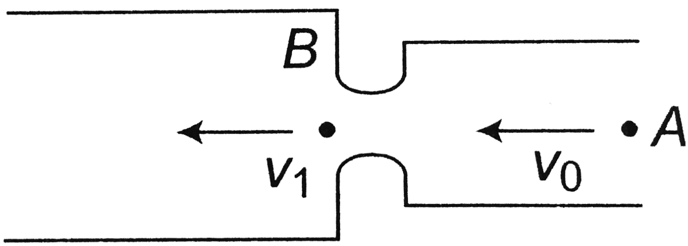
15. The velocity of an electron at point A_1 is V_0 where cross sectional areas is A. The velocity of electron just the end of contraction at point B, where cross sectional area is $2A$ is V_1. Find the correct option:



A. $V_1 < V_0$

B. $V_1 = V_0$

C. $V_1 > V_0$

D. $V_1 = \frac{V_0}{2}$

Answer: c

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16. A glass rod rubbed with silk is used to charge a gold leaf electroscope and the leaves are observed to diverge. The electroscope thus charged is exposed to X-rays for a short period. Then

A. The divergence of leaves will not be affected

B. The leaves will diverge further

C. The leaves will collapse

D. The leaves will melt

Answer: b

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17. One metallic sphere A is given positive charge whereas another identical metallic sphere B of exactly same mass as of A is given equal amount of negative charge. Then

A. Mass of A and mass of B still remain equal

B. Mass of A increases

C. Mass of B decreases

D. Mass of B increases

Answer: D

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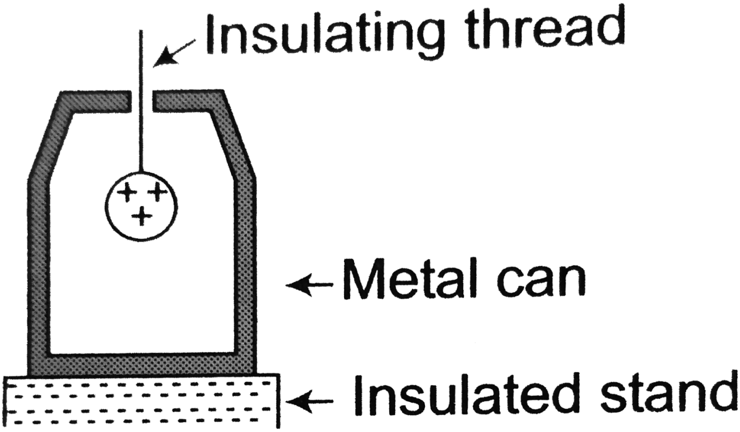
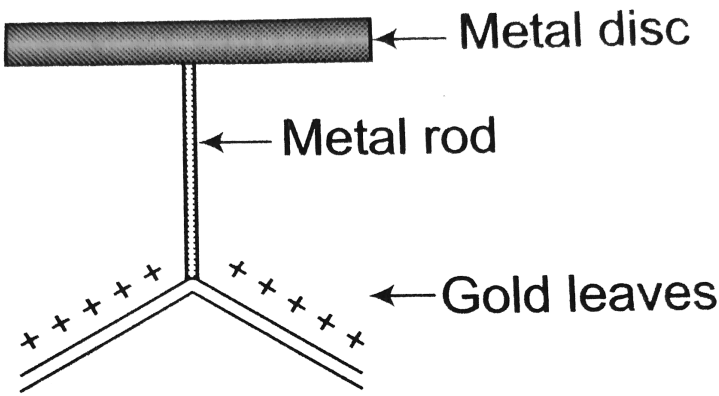
18. A charged metallic ball is lowered into an insulated metal can.



The ball is made to touch bottom of the can. Then it is placed on the disc of electroscope shown below. Final



A. leaves of electroscope diverges

B. leaves of electroscope converges

C. leaves of electroscope remains unaffected

D. leaves of electroscope oscillates

Answer: B

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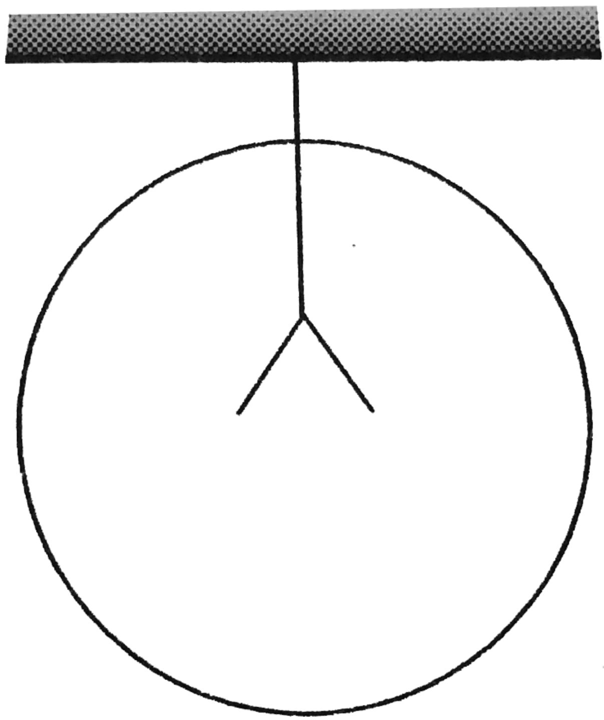
19. An electroscope is given a positive charge, causing its foil leaves to separate. When an object is brought near the top plate of electroscope, the foils separate even further. We conclude



A. that the object is positively charges.

B. that the object is electrically neutral.

C. that the object is negatively charged.

D. none of these

Answer: a

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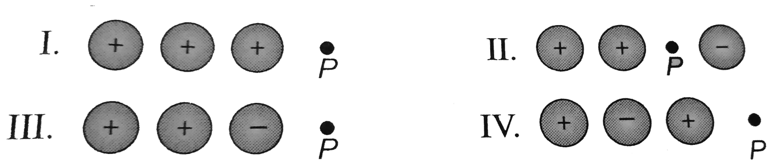
20. Given are four arrangements of three fixed electric charges. In each arrangement, a point labelled P is also identified- test charge, $+q$, is placed at point P. All of the charges are of same magnitude Q, but they can be either positive or negative as indicated. The charges and point P all lie on a straight line. The distances between adjacent items, either between two charges or between a charge and point P, all are the same. Compare forces on +q in each case.



A. $II > I > III > IV$

B. $I > II > III > IV$

C. $II > I > IV > III$

D. $III > IV > I > II$

Answer: C

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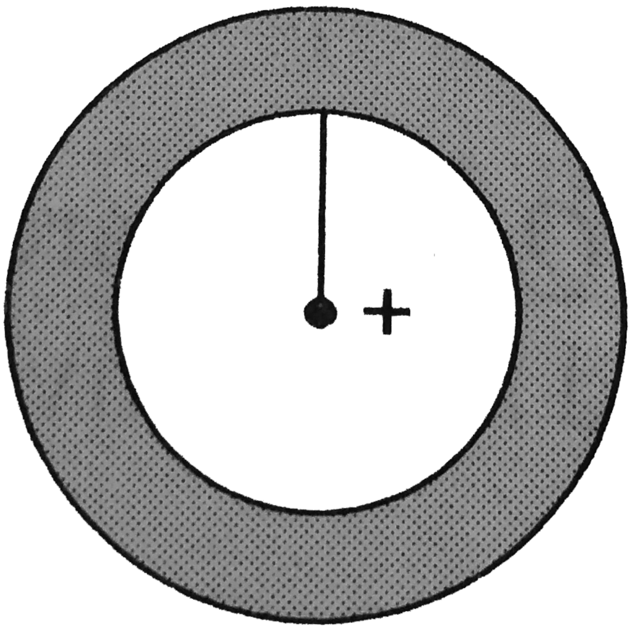
21. An electrically isolated hollow (initially uncharged), conducting sphere has a small positively charged ball suspended by an insulating rod from its inside surface (see diagram).



This causes the inner surface of the sphere to become negatively charged. When the ball is centred in the sphere, the electric field outside the conducting sphere is

A. zero

B. the same as if the sphere wasn't there

C. twice what it would be if the sphere wasn't there

D. equal in magnitude but opposite in direction to what it would be if the sphere wasn't there

Answer: B

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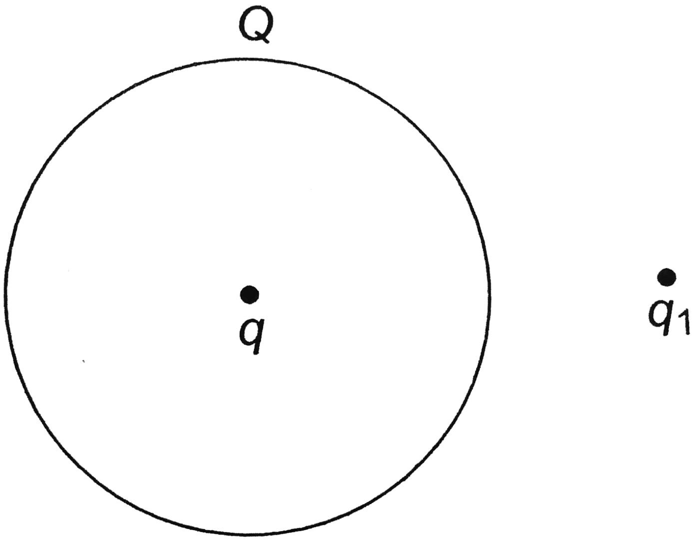
22. A thin metallic spherical shell contains a charge Q on it. A point charge q is placed at the center of the shell and another charge q_1 is placed outside it as shown in figure. All the three charges are positive



The force on the charge at the centre is

A. towards left

B. towards right

C. upward

D. zero

Answer: D

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23. A copper sphere of mass $2.0g$ contains about 2×10^{22} atoms. The charge on the nucleus of each atom is $29e(e = \text{electron charge})$. The mass of an electron is $9.11 \times 10^{-31} kg$. How much mass will the sphere lose or gain if it is given a charge of $+2\mu C$?

A. Loss a mass of $1.13 \times 10^{-14} g$

B. Gain a mass of $1.13 \times 10^{-14} g$

C. Neither gain nor lose any mass

D. Change in mass will depend upon the kinetic energy of the electrons

Answer: a

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24. Assume that each of copper atom has one free electron. Estimate the number of free electrons in $1mg$ of copper. Given that atomic weight of copper

$= 63.5$ and Avogadro number $= 6.02 \times 10^{23}$. What is the charge possessed by these free electrons?

A. $1.52C$

B. $1.76C$

C. $4.76C$

D. $1.25C$

Answer: a

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25. Estimate the number of free electrons in $1g$ of water and negative charge possessed by them. Given that Avogadro number $= 6.02 \times 10^{23}$ and molecular weight of water $= 18$

A. $6.25 \times 10^{4} C$

B. $5.35 \times 10^{4} C$

C. $1.76 \times 10^{4} C$

D. $1.25 \times 10^{4} C$

Answer: b

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26. Three point charges are placed at the corner of an equilateral triangle. Assuming only electrostatic forces are acting.

A. the system can never be in equilibrium

B. the system will be equilibrium if the charges rotate about the centre of the triangle

C. the system will be in equilibrium if the charges have different magnitudes and different signs

D. the system will be in equilibrium if the charges have the same magnitude but different signs.

Answer: A

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27. Two identical pendulums A an dB are suspended from the same point. Both are givne positive charge, with A having more charge than B. They diverge and reach equilibrium with the suspension of A and B making angles θ_1 and θ_2 with the vertical respectively.

A. $\theta_1 > \theta_2$

B. $\theta_1 < \theta_2$

C. $\theta_1 = \theta_2$

D. The tension in A is greater than that in B

Answer: C

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28. Two identical small conducting spheres having unequal positive charges q_1 and q_2 are separated by a distance r. If they are now made to touch each other and then separated again to the same distance, the electrostatic force between them in this case will be

A. less than before

B. same as before

C. more than before

D. zero

Answer: c

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29. Two point charges placed at a distance r in air experience a certain force. Then the distance at which they will experience the same force in a medium of dielectric constant K is

A. r/K

B. Kr

C. $\frac{r}{\sqrt{K}}$

D. $r+\sqrt{K}$

Answer: C

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30. Two copper balls, each weighing $10g$ are kept in air $10cm$ apart. If one electron from every 10^6 atoms is transferred from one ball to the other, the coulomb force between them is (atomic weight of copper is 63.5)

A. $2.0 \times 10^{10} N$

B. $2.0 \times 10^4 N$

C. $2.0 \times 10^8 N$

D. $2.0 \times 10^6 N$

Answer: C

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31. What is the Coulomb's force between two α-particles separated by a distance of $3.2 \times 10^{-15} m$.

A. $90N$

B. $45N$

C. $60N$

D. $75N$

Answer: A

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32. Force of attraction between two point electric charges placed at a distance d in a medium is F. What distance apart should these be kept in the same medium, so that force between them becomes $F/3$?

A. $2\sqrt{3}d$

B. $3d$

C. $9d$

D. $\sqrt{3}d$

Answer: D

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33. Two identical balls each have a mass of $10g$. What charges should these balls be given so that their interaction equalizes the force of universal gravitation acting between them? The radii of the balls may be ignored in comparison to distance between them.

A. $6.34 \times 10^{-11} C$

B. $8.57 \times 10^{-11} C$

C. $6.34 \times 10^{-13} C$

D. $8.57 \times 10^{-13} C$

Answer: d

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34. Two point charges $+3\mu C$ and $+8\mu C$ repel each other with a force of $40N$. If a charge of $-5\mu C$ is added to each of them, then the force between them will become

A. $-10N$

B. $+10N$

C. $+20N$

D. $-20N$

Answer: A

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35. The distance between charges $5.0 \times 10^{-11} C$ and $-2.7 \times 10^{-11} C$ is $0.2m$. The distance at which a third charge should be placed in order that it will not experience any force along the line joining the two charges is

A. $0.44m$

B. $0.65m$

C. $0.556m$

D. $0.350m$

Answer: C

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36. Calculate the ratio of electrostatic to gravitational force between two electrons placed at certain distance in air. Given that $m_e = 9.1 \times 10^{-31} kg, e = 1.6 \times 10^{-19} C$ and $G = 6.6 \times 10^{-11} Nm^{-2}$.

A. 8.4×10^{42}

B. 3.2×10^{41}

C. 4.2×10^{42}

D. 1.2×10^{42}

Answer: c

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37. Two point charges $+9e$ and $+e$ are kept $16cm$. Apart from each other. Where should a third charge q be placed between them so that the system is in equilibrium state:

A. $24cm$ form $+9e$

B. $12cm$ from $+9e$

C. $24cm$ from $+e$

D. $12cm$ from $+e$

Answer: B

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38. Two spherical conductors B and C having equal radii and cayying equal charges on them repel each other with a force F when kept apart at some distance. A third spherical conductor having same radius as that B but uncharged is brought in contact with B, then brought in contact with C and finally removed away from both. The new force of repulsion between B and C is

A. $F/4$

B. $3F/4$

C. $F/8$

D. $3F/8$

Answer: d

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39. 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. $3F/4$

C. $F/2$

D. $F/4$

Answer: A

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40. What equal charges would have to be placed on earth and moon to neutralize their gravitational force of attraction?

Given that mass of earth $=10^{25}kg$ and mass of moon $=10^{23}kg$

A. $8.57 \times 10^{16}C$

B. $8.57 \times 10^{13}C$

C. $5.45 \times 10^{13} C$

D. $5.45 \times 10^{16} C$

Answer: b

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41. Three charges $4q$, Q and q are in a straight line in the position of $0. l / 2$ and l respectively. The resultant force on q will be zero, if $Q =$

A. $-q$

B. $-2q$

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

D. $4q$

Answer: A

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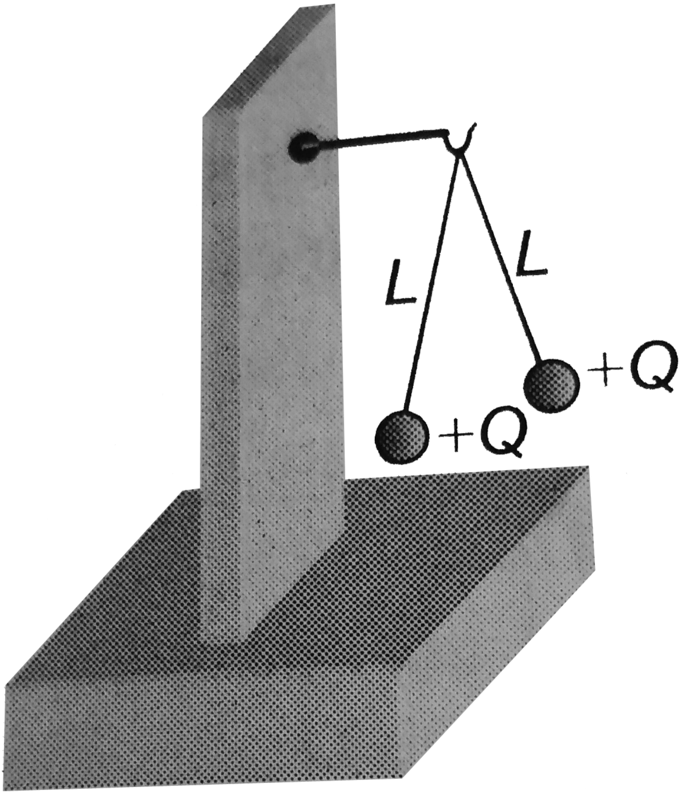
42. Two small balls having equal positive charge Q (coulomb) on each are suspended by two insulated string of equal length L meter, from a hook fixed to a stand. The whole gravity (state of weightlessness). Then the angle between the string and tension in the string is `



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

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

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

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

Answer: a

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43. Two similar spheres having $+q$ and $-q$ and $+4q$ charges are kept at a certain distance. The force acts between the two is F. If in the middle of two spheres, another similar sphere having $+q$ charge is kept,then it experience a force in magnitude and direction as

A. Zero having no direction

B. $8F$ towards $+q$ charge

C. $8F$ towards $-q$ charge

D. $4F$ towards $+q$ charge

Answer: c

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44. Point charges $+4q, \ -q$ and $+4q$ 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 are in equilibrium

C. All the charges are in unstable equilibrium

D. All the charges are in stable equlibrium

Answer: C

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45. Two identical balls having like charges and placed at a certain distance apart repel each other with a certain force. They are brought in contact and then moved apart to a distance equal to half their initial separation. The force of repulsion between them increases 4.5 times in comparision with the initial value. The ratio of the initial charges of the balls is

A. 2

B. 3

C. 4

D. 6

Answer: a

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46. Two charges $+4e$ and $+e$ are at a distance x apart. At what distance,a charge q must be placed from charge $+e$ so that is in equilibrium

A. $x/2$

B. $2x/3$

C. $x/3$

D. $x/6$

Answer: c

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47. Three charges $4q$, Q and q are in a straight line in the position of 0, $l/2$ and l respectively. The resultant force on q will be zero, if $Q =$

A. Q

B. $Q/2$

C. $-Q/2$

D. $-Q$

Answer: d

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48. Two equal negative charges $-q$ are fixed at points $(0, -a)$ and $(0, a)$ on y-axis. A poistive charge Q is released from rest at point $(2a, 0)$ on the x-axis. The charge Q will

A. Execute simple harmonic motion about the origin

B. Move to the origin and remains at rest

C. Move to infinity

D. Execute oscillatory but not simple harmonic motion.

Answer: d

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49. Electric charges of $1\mu C, -1\mu C$ and $2\mu C$ are placed in air at the corners A, B and C respectively of an equilateral triangle ABC having length of each side $10cm$. The resultant force on the charge at C is

A. $0.9N$

B. $1.8N$

C. $2.7N$

D. $3.6N$

Answer: B

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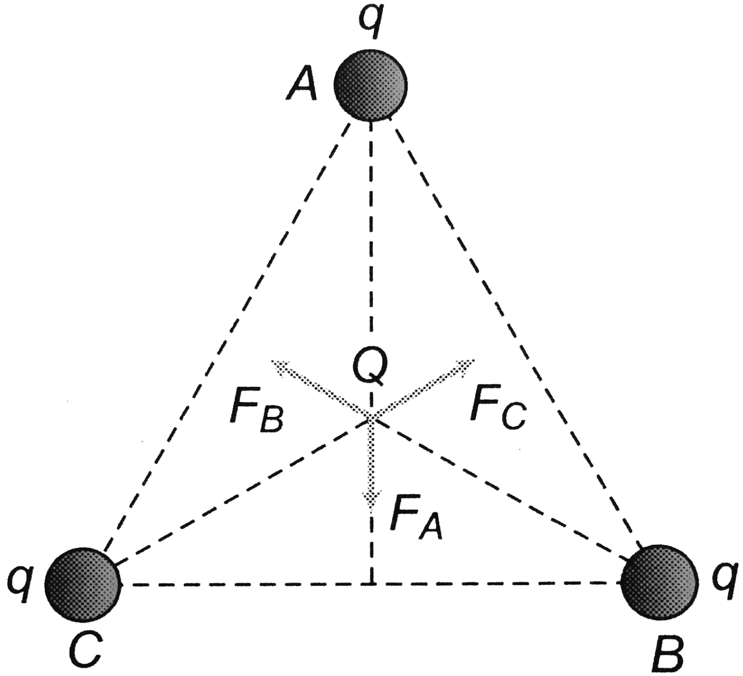
50. Three charges each of magnitude q are placed at the corners of an equilateral triangle, the electrostatic force on the charge place at the centre is (each side of triangle is L)



A. Zero

B. $\dfrac{1}{4\pi\varepsilon_0}\dfrac{q^2}{L^2}$

C. $\dfrac{1}{4\pi\varepsilon_0}\dfrac{3q^2}{L^2}$

D. $\dfrac{1}{12\pi\varepsilon_0}\dfrac{q^2}{L^2}$

Answer: A

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51. Equal charges q are placed at the four corners $A, B, C, D$of a square of length a. The magnitude of the force on the charge at B will be

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

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

C. $\left(\frac{1+2\sqrt{2}}{2}\right)\frac{q^2}{4\pi\varepsilon_0 a^2}$

D. $\left(2+\frac{1}{\sqrt{2}}\right)\frac{q^2}{4\pi\varepsilon_0 a^2}$

Answer: c

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52. Charges $Q - q, Q, \; -q$ are placed at the corners A, B, C, D of a square respectively. If the resultant force on the charge Q is zero due to other charges, what is the relation between Q and q?

A. $Q = \; -2\sqrt{2}q$

B. $Q = \; -2q$

C. $Q = \; -\sqrt{2}q$

D. $Q = \; -\dfrac{1}{2\sqrt{2}}q$

Answer: a

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53. An infinite number of charges, each of charge $1\mu C$ are placed on the x-axis with co-ordinates $x = 1, 2, 4, 8.... \infty$ If a charge of $1C$ is kept at the origin, then what is the net force action on $1C$ charge

A. $9000N$

B. $12000N$

C. $24000N$

D. $36000N$

Answer: B

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54. 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. $+\frac{Q}{4}$

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

Answer: b

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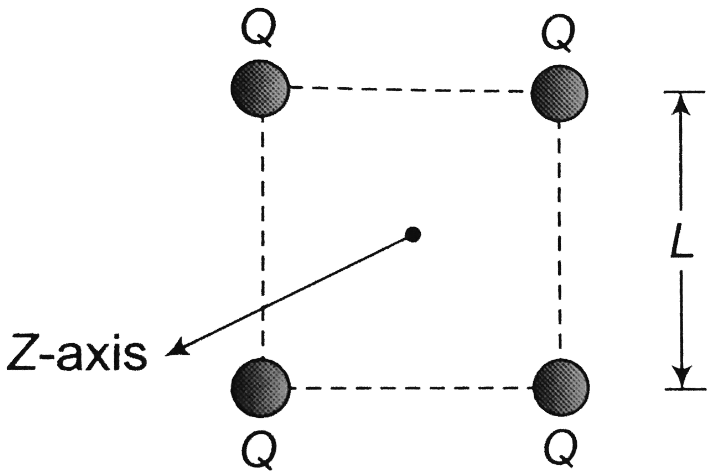
55. Four point $+ve$ charges of same magnitude(Q) are placed at four corners of a rigid square frame as shown in figure. The plane of the frame is perpendicular to z-axis. If a $-ve$ point charge is placed at a distance z away from the above frame $(z < \; < L)$ then



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 the frame

D. It passes through the frame only once.

Answer: a

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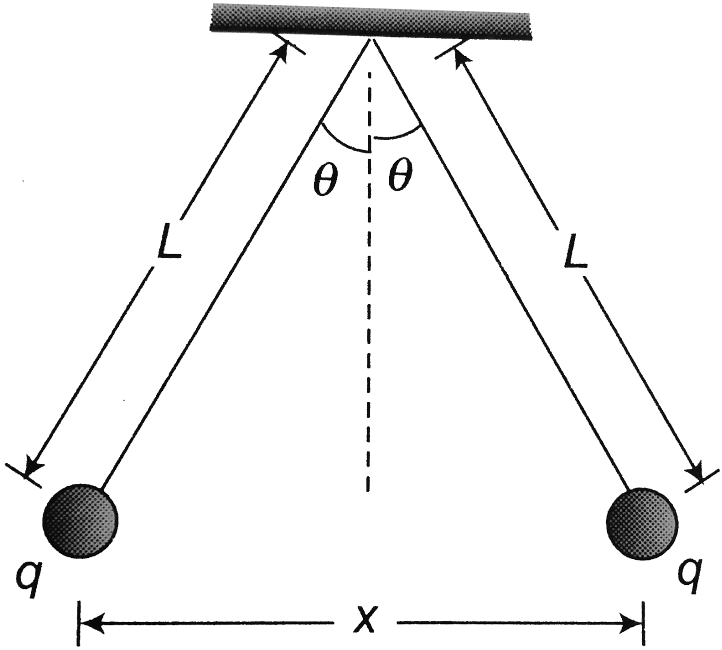
56. In the given figure two tiny conducting balls of identical mass m and identical charge q hang from non-conducting threads of equal length L. Assume that θ is so small that than $\theta \approx \sin\theta$, then for equilibrium x is equal to



A. $\left(\dfrac{q^2 L}{2\pi\varepsilon_0 mg}\right)^{\frac{1}{3}}$

B. $\left(\dfrac{qL^2}{2\pi\varepsilon_0 mg}\right)^{\frac{1}{3}}$

C. $\left(\dfrac{q^2 L^2}{4\pi\varepsilon_0 mg}\right)^{\frac{1}{3}}$

D. $\left(\dfrac{q^2 L}{4\pi\varepsilon_0 mg}\right)^{\frac{1}{3}}$

Answer: a

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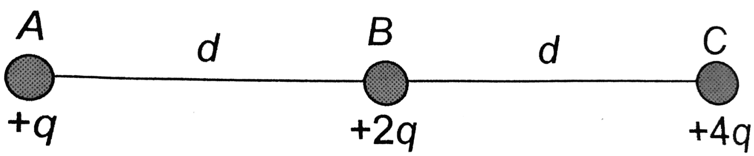
57. Three charges $+q, +2q$ and $4q$ are connected by strings as shown in the figure.What is ratio of tensions in the strings AB and BC



A. $1:2$

B. $1:3$

C. $2:1$

D. $3:1$

Answer: B

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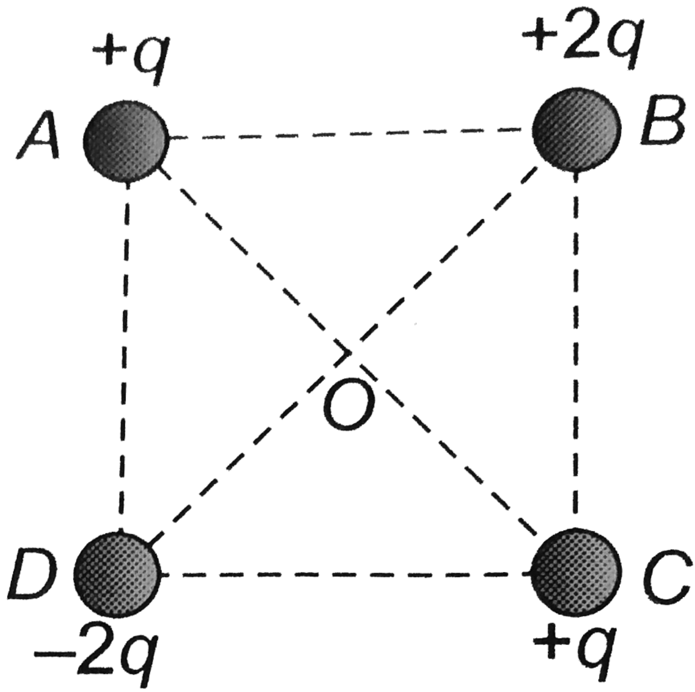
58. Four charges are arranged at the corners of a square $ABCD$, as shown in the adjoining figure, The

force on a positive charge kept at the centre O is



A. Zero

B. Along the diagonal AC

C. Along the diagonal BD

D. Perpendicular to side AD

Answer: C

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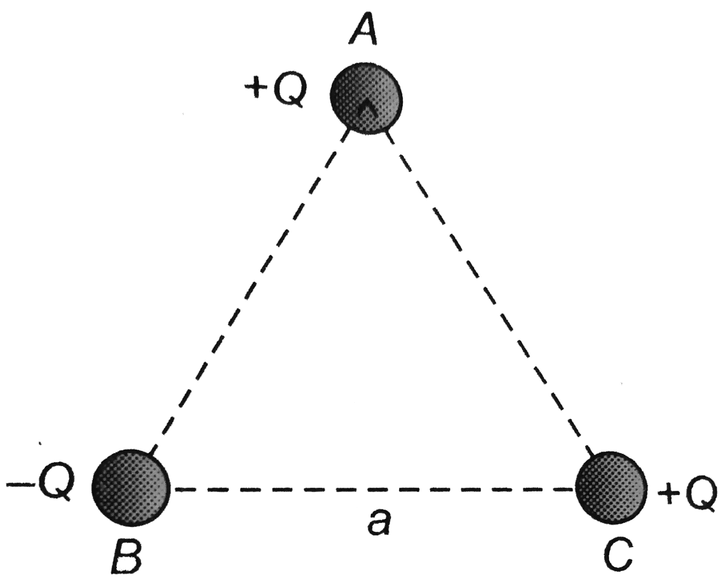
59. Three charges are placed at the vertices of an equilateral trianlge of side a as shown in the following figure. The force experienced by the charge placed at the vertex A in a direction normal to BC is



A. $Q^2 / (4\pi\varepsilon_0 a^2)$

B. $\sqrt{3}Q^2 / (4\pi\varepsilon_0 a^2)$

C. Zero

D. $Q^2 / (2\pi\varepsilon_0 a^2)$

Answer: c

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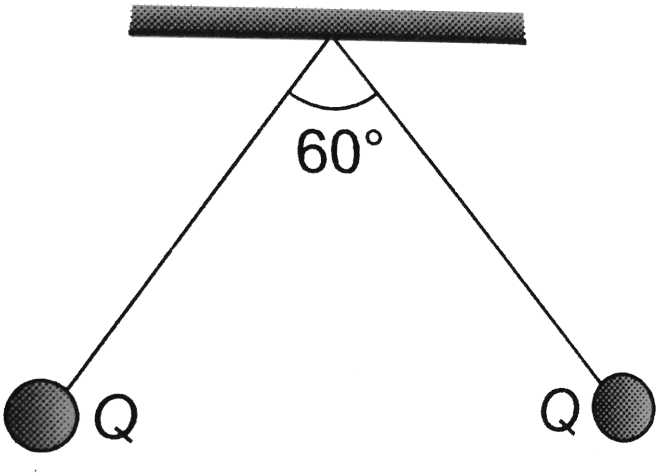
60. Two small spherical balls each carrying a charge $Q = 10\mu C$(10 micro=coulomb) are suspended by two insulating threads of equal lengths $1cm$ each, from a point fixed in the ceiling. It is found that in equilibrium threads are sepreated by an angle 60°

between them, as shown in figure. What is the tension

in the threads

(Given $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 Nm/C^2$)



A. $18N$

B. $1.8N$

C. $0.18N$

D. None of the above

Answer: b

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61. 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 si

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

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

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

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

Answer: b

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62. The distance between two equal balls having unlike charges is $2cm$. The radii of the balls are much less than the distance between them. The balls attract each other with a force of 36×10^{-5}N. After the ball have been connected by a wire and latter has been removed, the balls repel each other with a force of 20.25×10^{-5}N. Determine the original charges on the balls

A. $+8 \times 10^{-9}$ and $-2 \times 10^{-9}C$

B. -6×10^{-9} and $+1.5 \times 10^{-9}C$

C. $+4 \times 10^{-9} C$ and $-1 \times 10^{-9} C$

D. $-8 \times 10^{-9} C$ and $+2 \times 10^{-9} C$

Answer: a

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Electric Field Due To Point Charge

1. Two point charges$(+Q)$ and $(-2Q)$ are fixed on the X-axis at position a and $2a$ from origin respectively. At what position on the axis, the resultant electric field is zero

A. Only $x = \sqrt{2}a$

B. Only $x = -\sqrt{2}a$

C. Both $x = \pm\sqrt{2}a$

D. $x = \frac{3a}{2}$ Only

Answer: B

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2. Two charges $+5\mu C$ and $+10\mu C$ are placed $20cm$ apart. The net electric field at the mid-point between the two charges is

A. $4.5 \times 10^6 N/C$ directed towards $+5\mu C$

B. $4.5 \times 10^6 N/C$ directed towards $+10\mu C$

C. $13.5 \times 10^6 N/C$ directed towards $+5\mu C$

D. $13.5 \times 10^6 N/C$ directed towards $+10\mu C$

Answer: A

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3. The distance between the two charges $25\mu C$ and $36\mu C$ is $11cm$. At what point on the line joining the two, the intensity will be zero

A. At a distance of $5cm$ from $25\mu C$

B. At a distance of $5cm$ from $36\mu C$

C. At a distance of $10cm$ from $25\mu C$

D. At a distance of $11cm$ from $36\mu C$

Answer: A

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4. Two charges $+4e$ and $+e$ are at a distance x apart. At what distance,a charge q must be placed from charge $+e$ so that is in equilibrium

A. $x / 2$

B. $2x / 3$

C. $x / 3$

D. $x/4$

Answer: D

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5. Two point charges $+8q$ and $-2q$ are located at $x=0$ and $x=L$ respectively. The location of a point on the x axis at which the net electric field due to these two point charges is zero is

A. $8L$

B. $4L$

C. $2L$

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

Answer: C

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6. Two point charges Q and $-3Q$ are placed at some distance apart. If the electric field at the location of Q is E then at the locality of $-3Q$, it is

A. $-E$

B. $E/3$

C. $-3E$

D. $-E/3$

Answer: B

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7. An infinite number of electric charges each equal to 5 nano-coulomb (magnitude) are placed along X-axis at $x = 1cm, x = 2cm, x = 8cm$......and so on. In the setup if the consecutive charges have opposite sign, then the electrical field in Newton/Coulomb at $x = 0$ is $\left(\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 N - m^2 / C^2\right)$

A. 12×10^4

B. 24×10^4

C. 36×10^4

D. 48×10^4

Answer: C

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8. Two point charges $-q$ and $+q/2$ are situated at the origin and the point $(a, 0, 0)$ respectively. The point along the X-axis where the electric field Vanishes is

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

B. $x = \sqrt{2}a$

C. $x = \frac{\sqrt{2}a}{\sqrt{2} - 1}$

D. $x = \frac{\sqrt{2}a}{\sqrt{2}+1}$

Answer: C

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9. Two point charges $+4q$ and $+q$ are placed at a distance L apart. A third charge Q is so placed that all the three charges are in equilibrium. Then location. And magnitude of the third charge will be

A. At a distance $\frac{L}{3}$ from $+4q$ charge, $\frac{4q}{9}$

B. At a distance $\frac{L}{3}$ from $+4q$ charge $-\frac{4q}{9}$

C. At a distance $\frac{2L}{3}$ from $+4q$ charge $-\frac{4q}{9}$

D. At a distance $\frac{2L}{3}$ from $+q$ charge $\frac{4q}{9}$

Answer: C

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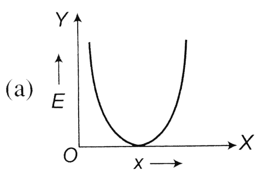
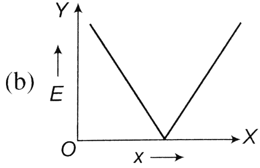
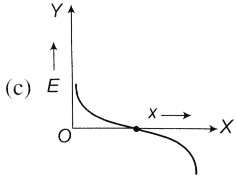
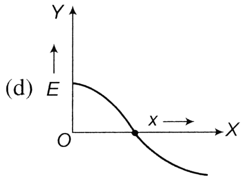
10. Two ideantical point charges are placed at a separation of d. P is a point on the line joining the charges, at a distance x from any one charge. The field at P is E, E is plotted against x for value of x from close to zero to slightly less then d. Which of the following represents the resulting curve

A. 

B. 

C. 

D. 

Answer: d

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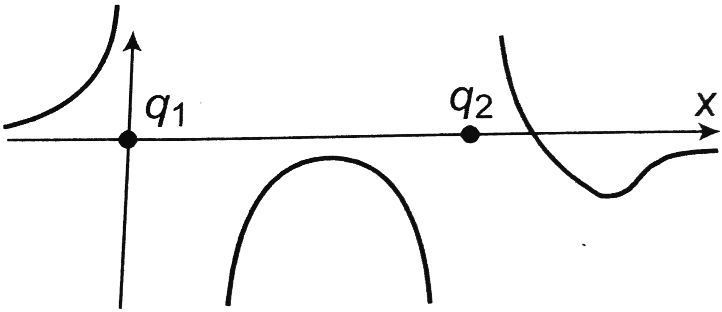
11. Two charges q_1 and q_2 are kept on x-axis and electric field at different points an x-axis is plotted against x. Choose correct statement about nature and magnitudes of q_1 and q_2



A. $q_1 + ve,\ q_2 - ve,\ |q_1| > |q_2|$

B. $q_1 + ve,\ q_2 - ve,\ |q_1| < |q_2|$

C. $q_1 - ve,\ q_2 + ve,\ |q_1| > |q_2|$

D. $q_1 - ve,\ q_2 + ve,\ |q_1| < |q_2|$

Answer: C

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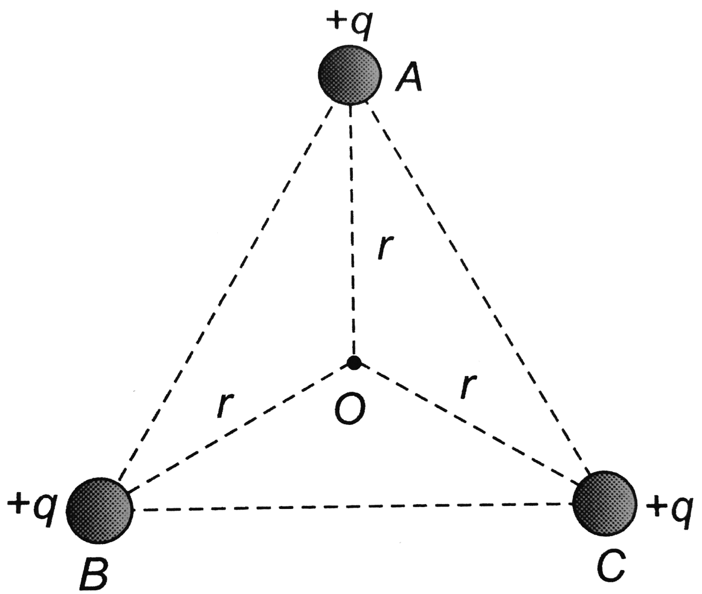
12. ABC is an equilateral triangle. Charges $+q$ are placed at each corner. The electric intensity at O will be



A. $\frac{1}{4\pi\varepsilon_0}\frac{q}{r^2}$

B. $\frac{1}{4\pi\varepsilon_0}\frac{q}{r}$

C. Zero

D. $\frac{1}{4\pi\varepsilon_0}\frac{3q}{r^2}$

Answer: C

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13. Equal charges q are placed at the vertices A and B of an equilatral triangle ABC of side a. The magnitude of electric field at the point C is

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

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

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

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

Answer: C

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14. Two charges each equal to $\eta q(\eta^{-1} < \sqrt{3})$ are placed at the corners of an equilateral triangle of side a. The electric field at the third corner is E_3 where $(E_0 = q/4\pi\varepsilon_0 a^2)$

A. $E_3 = E_0$

B. $E_3 < E_0$

C. $E_3 > E_0$

D. $E_3 \geq E_0$

Answer: c

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

A. $\dfrac{n}{n-1}k\dfrac{q}{r^2}$

B. $\dfrac{n-1}{n}k\dfrac{q}{r^2}$

C. 0

D. $(n-1)k\dfrac{q}{r^2}$

Answer: c

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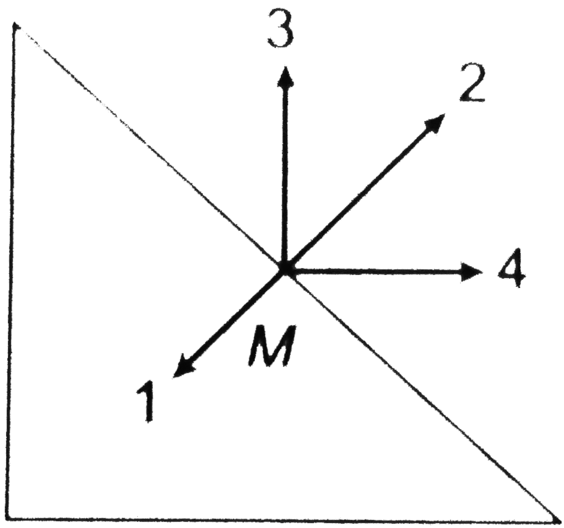
16. Three identical points charges, as shown are placed at the vertices of an isosceles right angled triangle. Which of the nembered vectors coincides in direction with the electric field at the mid-point M

the hypotenuse



A. 1

B. 2

C. 3

D. 4

Answer: b

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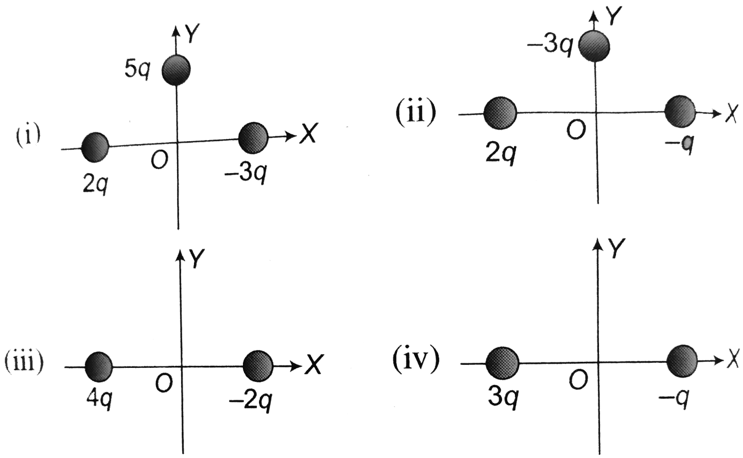
17. In the following four situations charged particles are equal distance from the origin. Arrange them the magnitude of the net electric field at origin greatest first



A. $(i) > (ii) > (iii) > (iv)$

B. $(ii) > (i) > (iii) > (iv)$

C. $(i) > (iii) > (ii) > (iv)$

D. $(iv) > (iii) > (ii) > (i)$

Answer: c

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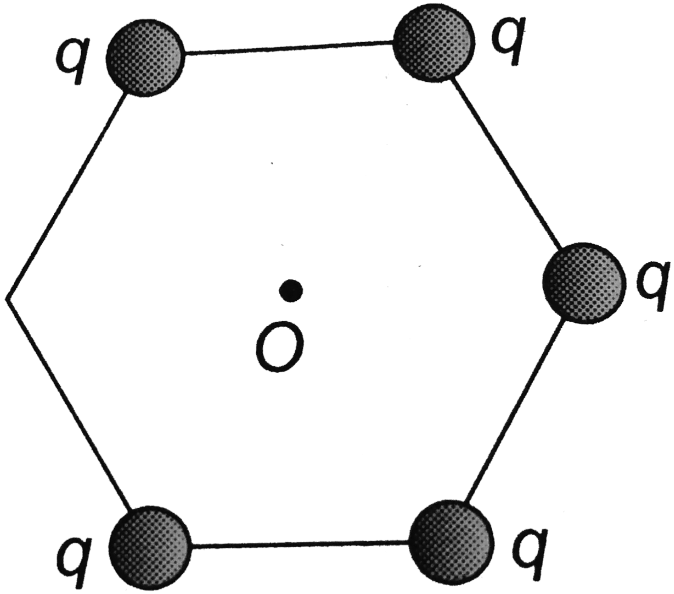
18. Five point charge each having magnitudes q are placed at the corner of hexagon as shown in figure. Net electric field at the centre $'O'$ is $\overrightarrow{E}$. To get net electric field at $'O'$ be $6\overrightarrow{E}$, charge placed on the remaining sixth corner should be



A. $6q$

B. $-6q$

C. $5q$

D. $-5q$

Answer: D

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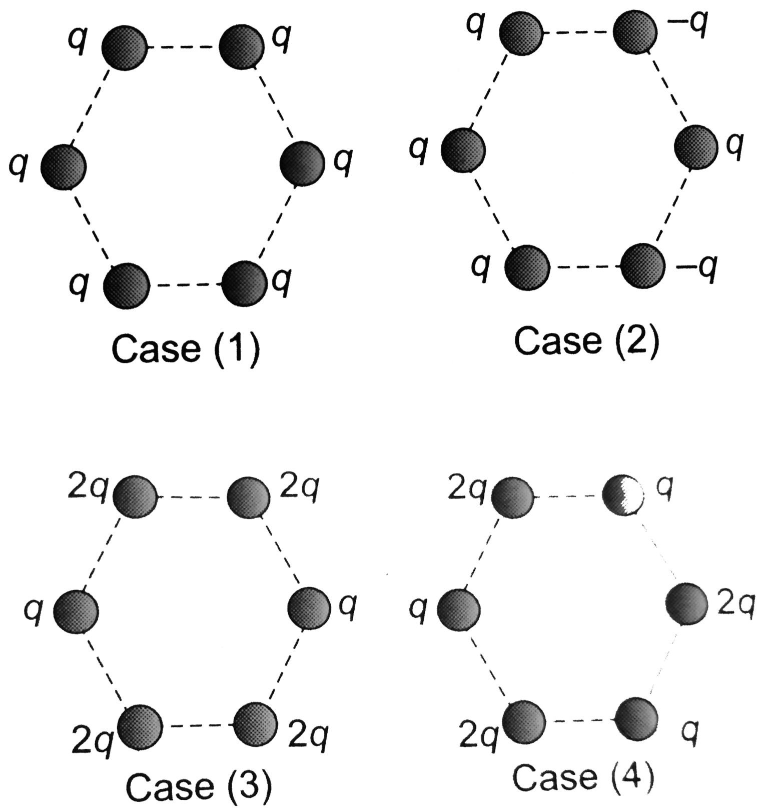
19. Figure below show regular hexagons with charges at the vertices. In which of the following cases the electric field at the center is not zero



A. 1

B. 2

C. 3

D. 4

Answer: B

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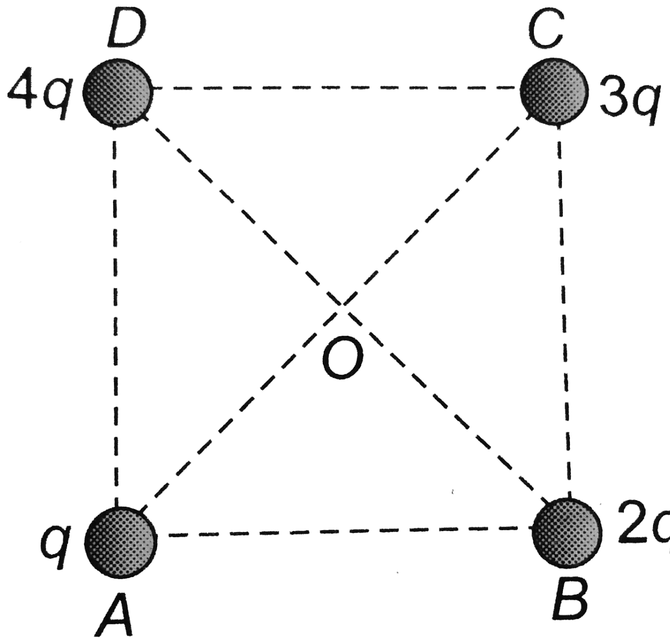
20. Charges $q, 2q, 3q$ and $4q$ are placed at the corners A, B, C and D of a square as shown in the following figure. The directon of electric field at the centre of the square is along



A. AB

B. CB

C. BD

D. AC

Answer: B

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21. Infinite charges of magnitude q each are lying at $x = 1, 2, 4, 8\dots\ meter$ on X-axis. The value of intensity of electric field at point $x = 0$ due to these charges will be

A. $12 \times 10^9 qN/C$

B. Zero

C. $6 \times 10^9 qN/C$

D. $4 \times 10^9 qN/C$

Answer: A

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22. Charges q is uniformly distributed over a thin half ring of radius R. The electric field at the centre of the ring is

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

B. $\dfrac{q}{4\pi^2\varepsilon_0 R^2}$

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

D. $\dfrac{q}{2\pi\varepsilon_0 R^2}$

Answer: A

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23. $1g$ of cork with a charge $1\mu C$ floats motionless $1cm$ above a large uniformly charged plane near the surface of the earth. The surface charge density of the plane, assuming it to be an infinite sheet,is

A. $8.7 \times 10^{-8} C / m^2$

B. $17.3 \times 10^{-18} C / m^2$

C. Zero

D. $-1\mu C / m^2$

Answer: b

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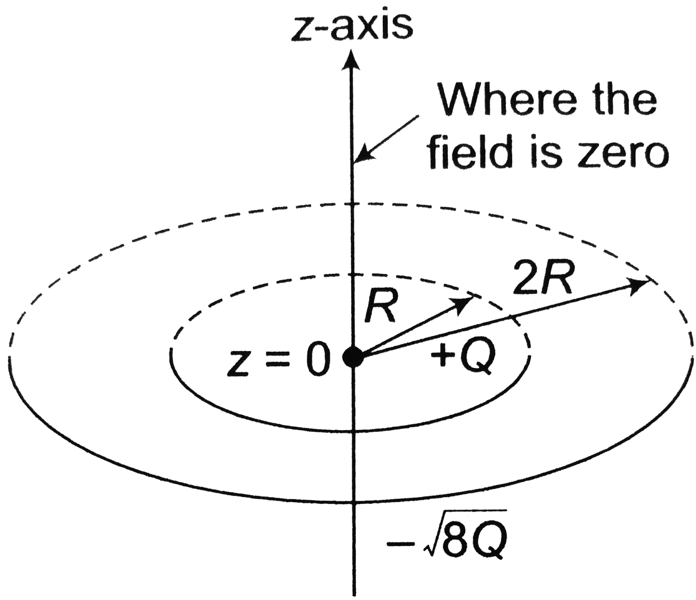
24. Two concentric rings, one of radius R and total charge $+Q$ and second of radius $2R$ and total charge $-\sqrt{8}Q$, lie in $x-y$ plane (i.e., $z=0$plane). The common centre of rings lies at origin and the common axis coincides with z-axis. The charge is uniformly distributed on both rings.

At what distance from origin is the net electric field on z-axis zero?



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

B. $\frac{R}{\sqrt{2}}$

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

D. $\sqrt{2}R$

Answer: D

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25. The number of electrons to be put on a spherical conductor of radius $0.1m$ to produce an electric field of $0.036N/C$ just above its surface is

A. 2.7×10^5

B. 2.6×10^5

C. 2.5×10^5

D. 2.4×10^5

Answer: C

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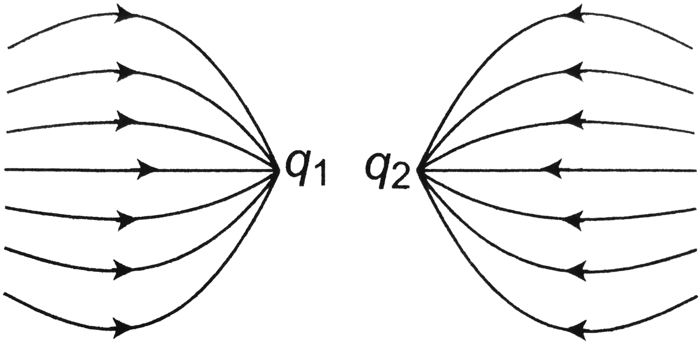
Electric Field And Motion

1. The given figure gives electric line of force due to two charges q_1 and q_2. What are the signs of the two charges ?



A. Both are negative

B. Both are positive

C. q_1 is positive but q_2 is negative

D. q_1 is negative but q_2 is positive

Answer: A

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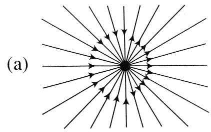
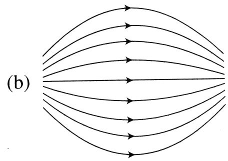
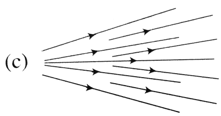
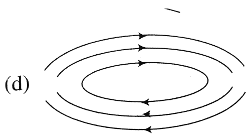
2. Consider the four field patterns shown. Assuming there are no charge in the regions shown, which of the patterns represent a possible electrostatic field?

A. 

B. 

C. 

D. 

Answer: B

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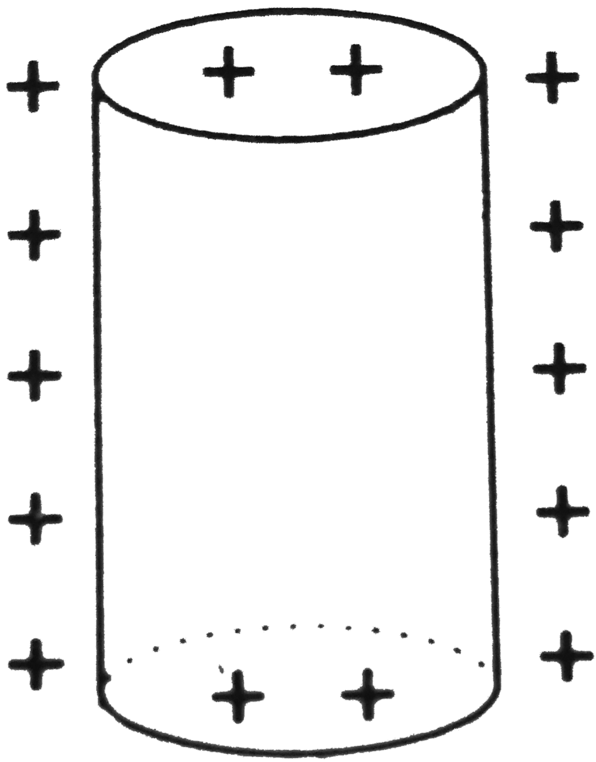
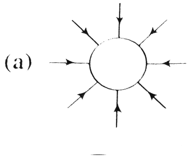
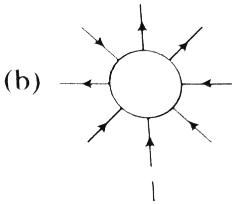
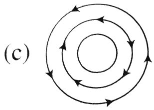
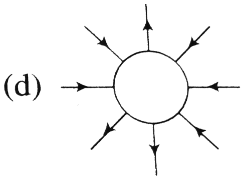
3. Which of the following figures correctly shows the top view sketch of the electric field lines for a uniformly charged hollow cylinder as shown in figure?



A. 

B. 

C. 

D. 

Answer: b

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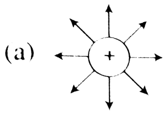
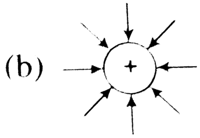
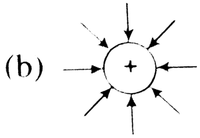
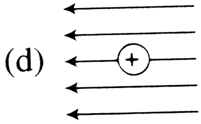
4. Which of the following figure represents the electric field lines due to a single positive charge?

A. 

B. 

C. 

D. 

Answer: a

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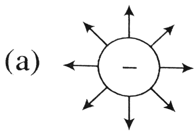
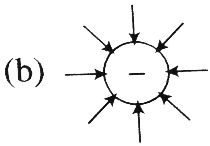
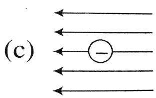
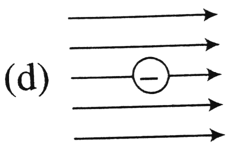
5. Which of the following figure represents the field lines due to a single negative charge ?

A. 

B. 

C. 

D. 

Answer: b

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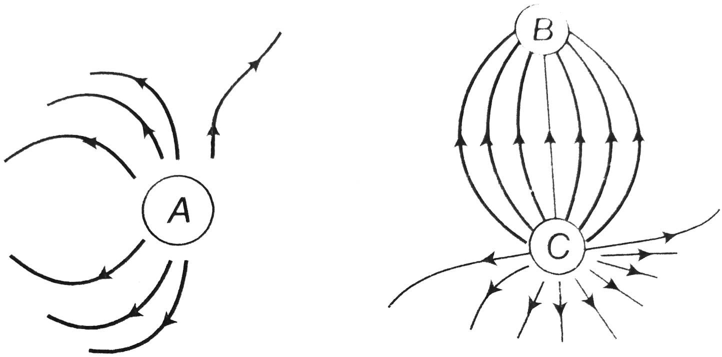
6. Figure shows the electric field lines around three point charges A, B and C. Which of the following charges are positive?



A. only A

B. Only C

C. Both A and C

D. Both B and C

Answer: C

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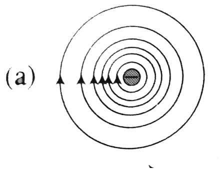
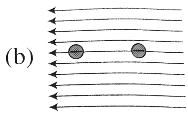
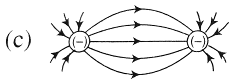
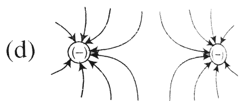
7. Which of the following represent the electric field lines dut to a combinations of two negative charges?

A. 

B. 

C. 

D. 

Answer: d

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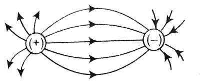
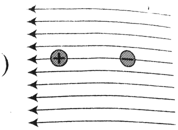
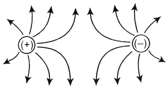
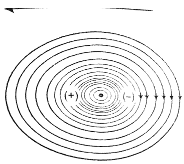
8. Which of the following figure represents the electronic field lines due to a combination of the one positive and one negative charge?

A. (a) 

B. (b) 

C. (c) 

D. (d) 

Answer: a

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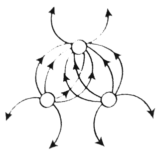
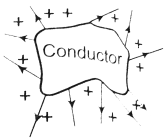
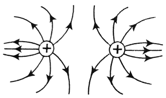
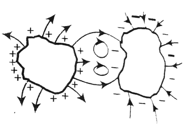
9. Which of the following curves shown below cannot possibly represent electrostatic field lines?

A. (a) 

B. (b) 

C. (c) 

D. (d) 

Answer: B

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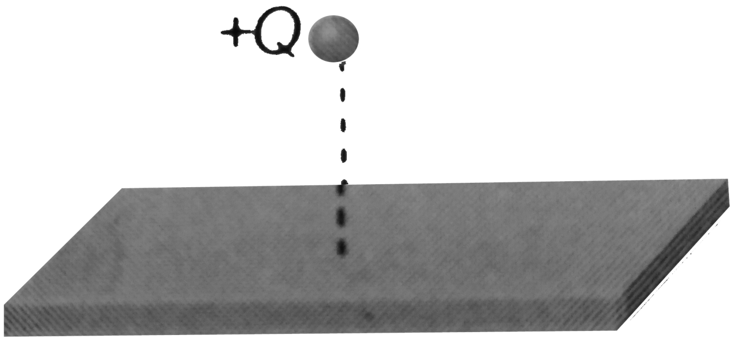
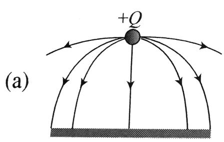
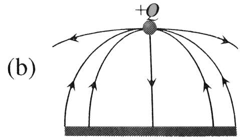
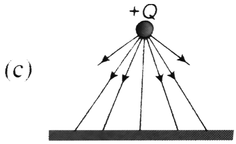
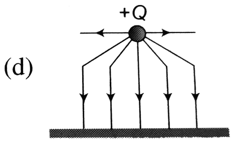
10. A charge Q is fixed at a distance d in front of an infinite metal plate. The lines of force are represented by



A. 

B. 

C. 

D. 

Answer: A

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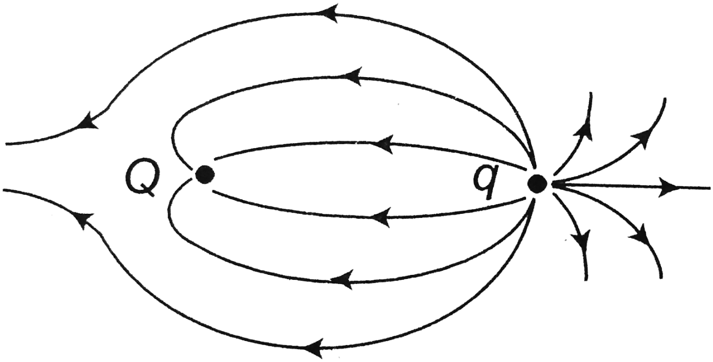
11. The lines of force of the electric field due to two charges q and Q are sketched in the figure. State if



A. Q is positive and $|Q| > |q|$

B. Q is negative and $|Q| > |q|$

C. q is positive and $|Q| < |q|$

D. q is negative and $|Q| < |q|$

Answer: C

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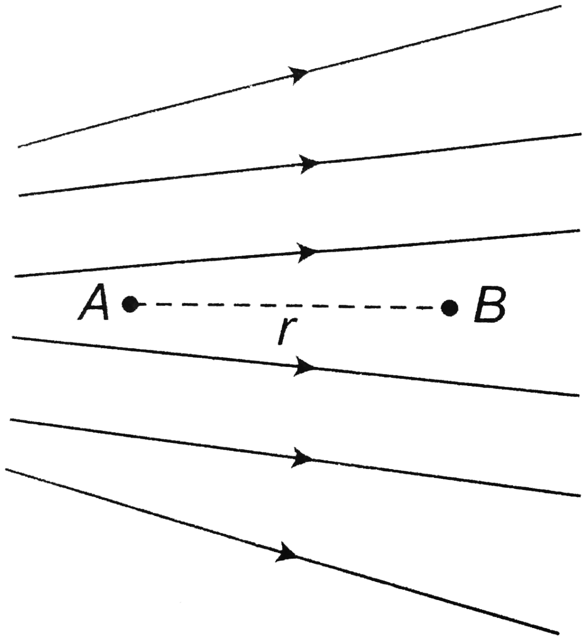
12. Figure shows the electric lines of force emerging from a charged body. If the electric field at A and B are E_A and E_B respectively and if the displacement between A and B is r then



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

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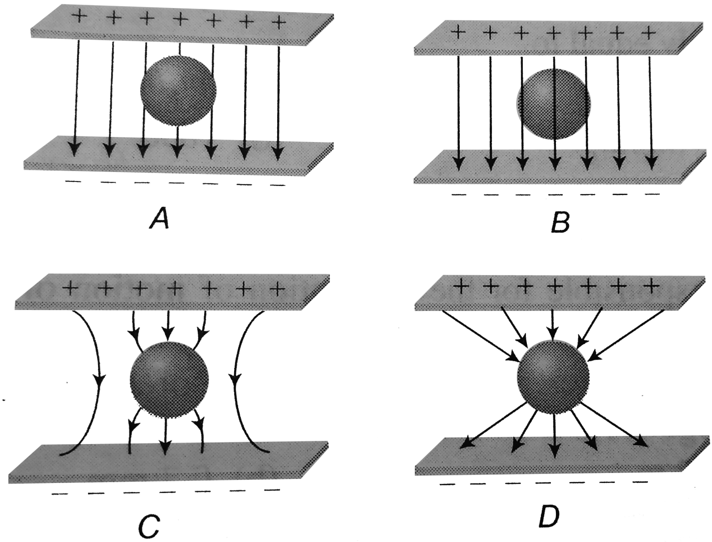
13. An uncharged sphere of metal is placed in between two charged plates as shown. The lines of force look like



A. A

B. B

C. C

D. D

Answer: C

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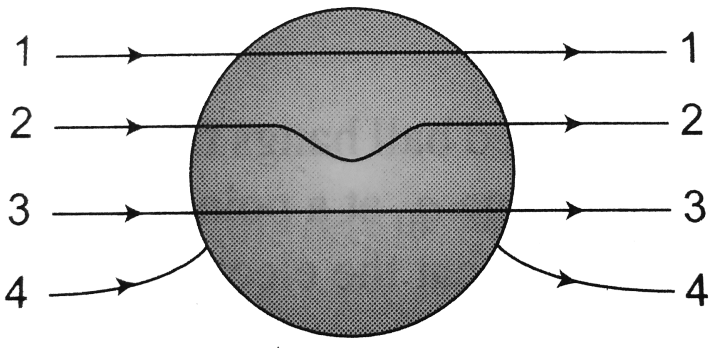
14. A metallic solid is placed in a uniform electric field. The lines of force follow the path (s) shown in figure as



A. 1

B. 2

C. 3

D. 4

Answer: D

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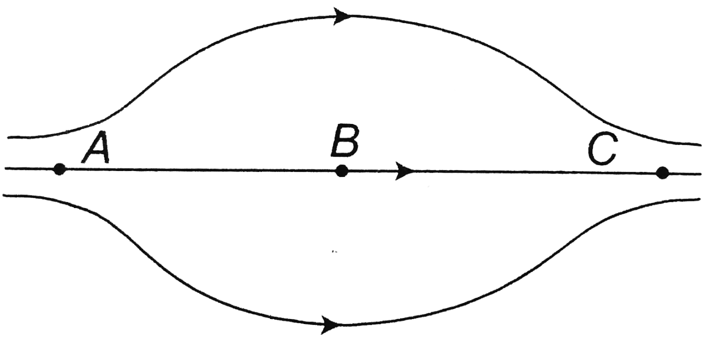
15. The figure shows some of the electric field lines corresponding to an electric field. The figure suggests



A. $E_A > E_B > E_C$

B. $E_A = E_B = E_C$

C. $E_A = E_C > E_B$

D. $E_A = E_C < E_B$

Answer: C

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16. 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. E

B. more than E

C. less than E

D. zero

Answer: D

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17. The bob of a pendulum of mass $8\mu g$ carries an electric charge of 39.2×10^{-10} coulomb in an electric field of 20×10^3 volt/meter and it is at rest. The angle made by the pendulum with the vertical will be

A. 27°

B. 45°

C. 87°

D. 127°

Answer: B

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18. A hemisphere is uniformaly charged positively. The electric field at a point on a diameter away from the centre is directed

A. perpendicular to the diameter

B. parallel to the diameter

C. at an angle tilted towards the diameter

D. at an angle tilted away from the diameter

Answer: A

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19. A positive point charge, which is free to move, is placed inside a hollow conducting sphere with negative charge, away from its centre. It will

A. move toward the centre

B. move towards the nearer wall of the conductor

C. remain stationary

D. oscillate between the centre and nearer wall.

Answer: C

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20. A charge particle is free to move in an electric field. It will travel

A. Always along a line force

B. Along a line of force, if its initial velocity is zero

C. Along a line of force, if has some initial velocity in the direction of an acute with the line of force

D. None of these

Answer: b

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21. A positively charged ball hang a silk thread. We put a positive test charge q_0 at a point and measure F/q_0, then it can be predicted that the electric field strength E.

A. $> F/q_0$

B. $= F/q_0$

C. $< F/q_0$

D. Can not be estimated

Answer: a

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22. 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

B. a circle

C. an ellipse

D. a parabola

Answer: d

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23. A proton and an electron are placed in a uniform electric field. Which of the following is correct?

A. The electric force acting on them will be equal

B. The magnitudes of the forces will be equal

C. Their acceleration will be equal

D. The magnitudes of their accelerations will be equal

Answer: b

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24. An electron enters in an electric field with its velocity in the direction of the electric lines of force. Then

A. The path of the electron will be a circle

B. The path of the electron will be a parabola

C. The velocity of the electron will decrease

D. The velocity of the electron will increase

Answer: C

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25. The intensity of electric field required to balance a proton of mass $1.7 \times 10^{-27} kg$ and charge $1.6 \times 10^{-19} C$ is nearly

A. $1 \times 10^{-7} V/m$

B. $1 \times 10^{-5} V/m$

C. $1 \times 10^{7} V/m$

D. $1 \times 10^{5} V/m$

Answer: A

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26. The intensity of the electric field required to keep a water drop of radius $10^{-5} cm$ just suspended in air when charged with one electron is approximately

A. $260 \text{Volt} / cm$

B. $260 \text{newton} / \text{coulomb}$

C. $130 \text{Volt} / cm$

D. $130 \text{newton} / \text{coulomb}$

Answer: b

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27. How many electrons should be removed from a coin of mass $1.6g$, so that it may float in an electric field of intensity of $10^9 NC^{-1}$ directed upward. (take $g = 10m/s^2$)

A. 10^6

B. 10^7

C. 10^9

D. 10^8

Answer: d

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28. Conduction electrons are almost uniformly distributed within a conducting plate. When placed in an electric field $\overrightarrow{E}$, the electric field within the plate

A. Is zero

B. Depends upon E

C. Depends upon $\overrightarrow{E}$

D. Depends upon the atomic number of the conducting element

Answer: A

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29. 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 is

A. $\frac{2E^2t^2}{mq}$

B. $\frac{E^2q^2t^2}{2m}$

C. $\frac{Eq^2m}{2t^2}$

D. $\frac{Eqm}{2t}$

Answer: b

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30. An electron falls through a small distance in a uniform electric field of magnitude $2 \times 10^4 NC^{-1}$. The direction of the field reversed keeping the magnitude unchanged and a proton falls through the same distance. The time of fall will be

A. Same in both cases

B. More in the case of electron

C. More in the case of proton

D. Independent of charge

Answer: c

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31. There is a uniform electric field of strength $10^3 V / m$ along y-axis. A body of mass $1g$ and charge $10^{-6} C$ is projected into the field from origin along the positive x-axis with a velocity $10m / s$. Its speed in m / s after $10s$ is (Neglect gravitation)

A. 10

B. $5\sqrt{2}$

C. $10\sqrt{2}$

D. 20

Answer: C

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32. A positively charge particle moving along x-axis with a certain velocity enters a uniform electric field directed along positively y-axis. Its

A. Vertical velocity changes but horizontal velocity remains constant

B. Horizontal velocity changes but vertical velocity remiand constant

C. Both vertical and horizontal velocities change

D. Neither vertical nor horizontal velocity changes.

Answer: A

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33. An electron of mass m_e initially at rest moves through a certain distance in a uniform electric field in time t_1. A proton of mass m_p also initially at rest takes time t_2 to move through an equal distance in this uniform electric field.Neglecting the effect of gravity, the ratio of t_2 / t_1 is nearly equal to

A. 1

B. $(m_p / m_e)^{1/2}$

C. $(m_e / m_p)^{1/2}$

D. 1836

Answer: b

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34. An electron moving with the speed 5×10^6 per sec is shot parallel to the electric field of intensity $1 \times 10^3 N/C$. Field is responsible for the retardation of motion of electron. Now evaluate the distance travelled by the electron before coming to rest for an instant (mass of $e = 9 \times 10^{-31} Kg$ charge $= 1.6 \times 10^{-19} C$)

A. $7cm$

B. $0.7mm$

C. $7cm$

D. $0.7cm$

Answer: c

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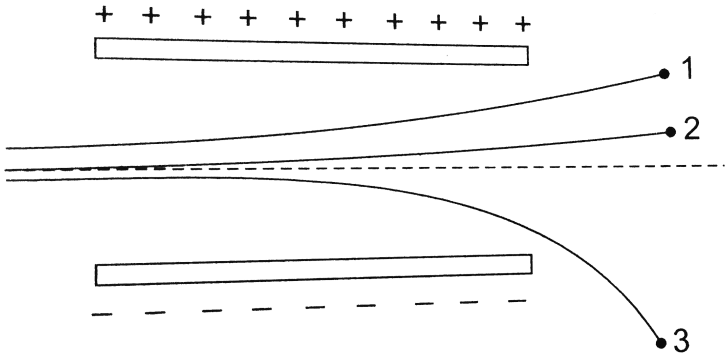
35. Figure shows tracks of three charged particles crossing a uniform electrostatic field with same velocities along horizontal. Give the sign of the three charges. Which particle has the highest charge to mass ratio?



A. 1

B. 2

C. 3

D. Can not be calculated

Answer: c

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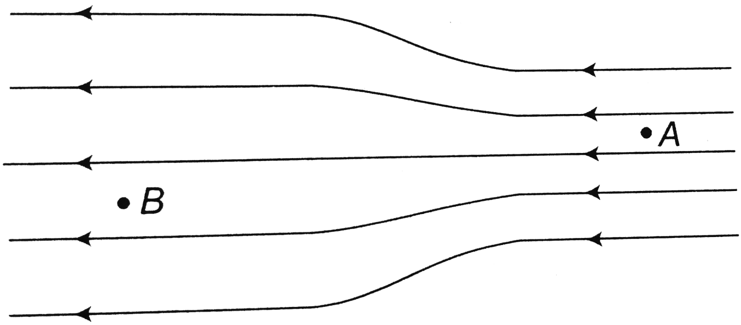
36. In the electric field shown in figure, the electric field lines on the left have twice the separation as that between those on the right. If the magnitudes of the fields at point A is $40NC^{-1}$, calculate the force experienced by a proton placed at point A. Also find the magnitude of electric field at point B



A. $15NC^{-1}$

B. $20NC^{-1}$

C. $25NC^{-1}$

D. $30NC^{-1}$

Answer: b

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37. An electron is released with a velocity of $5 \times 10^6 ms^{-1}$ in an electric field of $10^3 NC^{-1}$ which has been applied so as to oppose its motion. What distance would the electron travel and how much time could it take before it is brought to rest?

A. $2.8 \times 10^{-8} s$

B. $1.8 \times 10^{-8} s$

C. $6.4 \times 10^{-8} s$

D. $4.2 \times 10^{-8} s$

Answer: a

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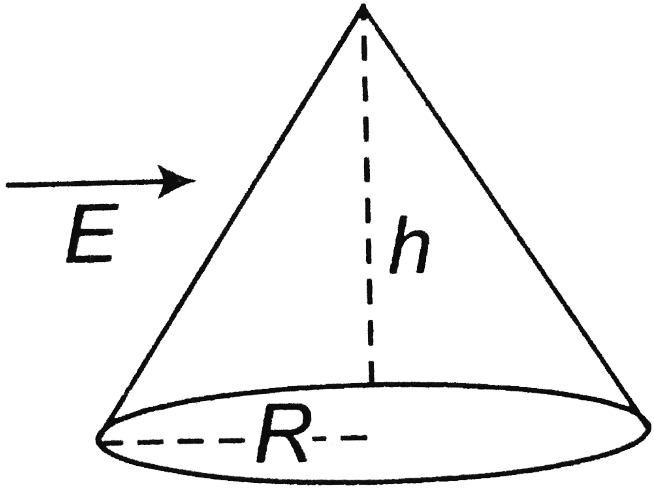
Electric Field And Gauss'S Law

1. A cone lies in a uniform electric field E as shown in figure. The electric flux entering the cone is



A. $E\pi R^2$

B. ERh

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

D. Eh^2

Answer: B

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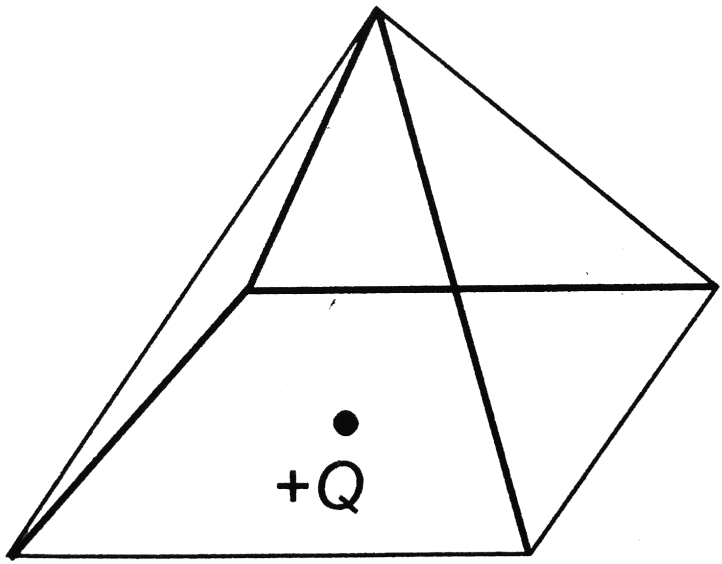
2. A point charge $+Q$ is positioned at the centre of the base of a square pyramid as shown. The flux through one of the four identical upper faces of the pyramid is



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

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

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

D. None of these

Answer: C

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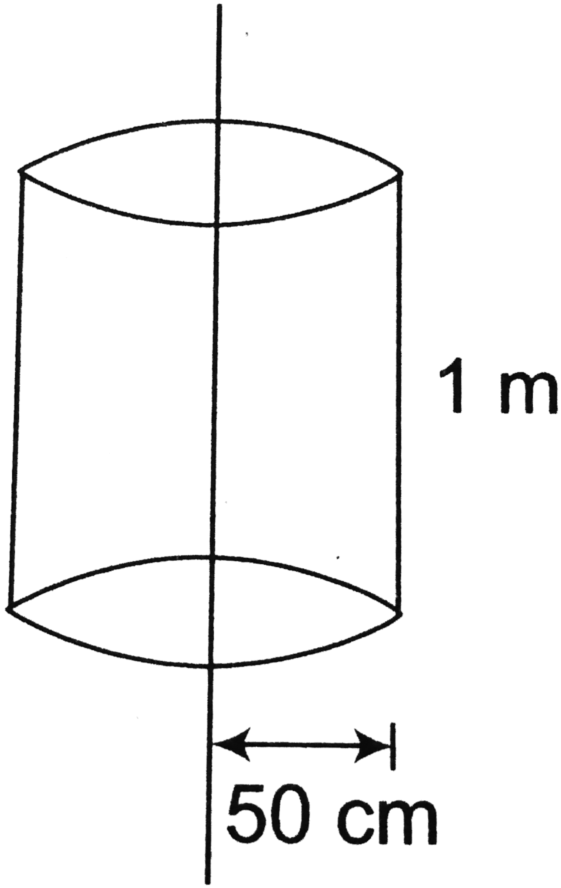
3. Electric charge is uniformly distributed along a along straight wire of radius $1mm$. The charge per centimeter length of the wire is Q coulomb. Another cyclindrical surface of radius $50cm$ and length $1m$ symmetrically enclose the wire ask shown in figure. The total electric flux passing through the cyclindrical surface is



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

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

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

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

Answer: B

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4. A cyclinder of radius r and length l is placed in an uniform electric field in such a way that the axis of the cyclinder is parallel to the field. The flux of the field through the cyclindrical surface is

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

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

C. $\frac{2\pi rl}{\varepsilon_0}$

D. zero

Answer: D

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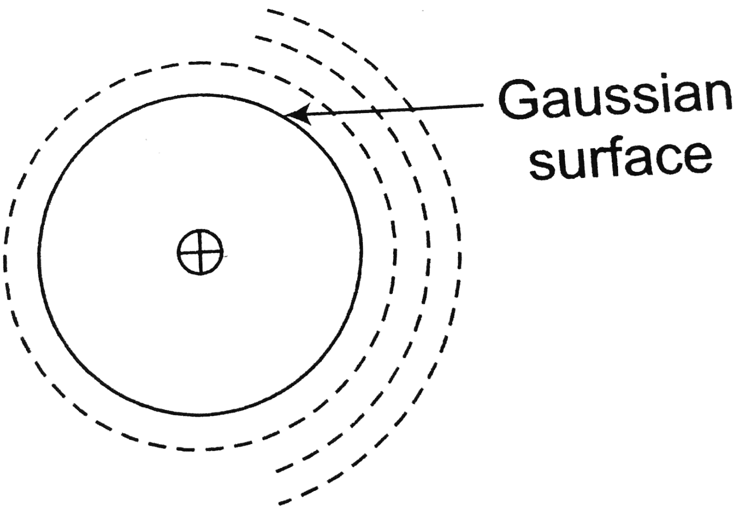
5. A charge q is enclosed by an imaginary Gaussian surface.



If radius of surface is increasing at a rate $\frac{dr}{dt} = K$, then

A. flux linked with surface is increasing at a rate $\frac{d\phi}{dt} = K$

B. flux linked with surface is decreasing at a rate $\frac{d\phi}{dt} = -K$

C. flux linked with surface is decreasing at a rate $\frac{d\phi}{dt} = \frac{1}{K}$

D. flux linked with surface is $\frac{q}{\varepsilon_0}$

Answer: d

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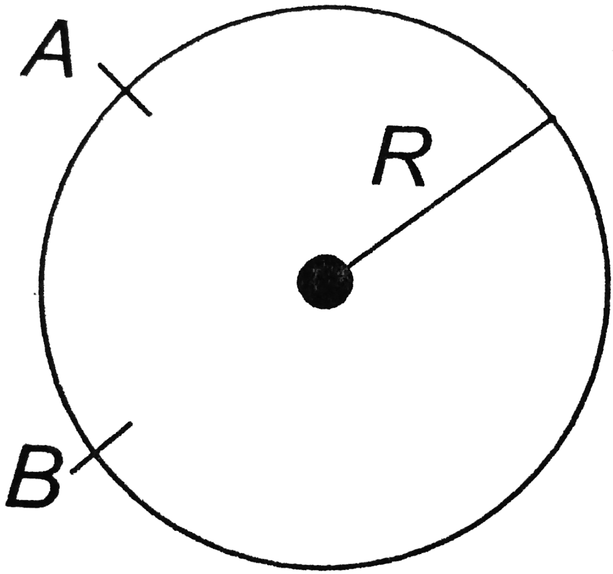
6. A spherical shell of radius R has two holes A and B through which a ring having charge $+q$ passes through without touching the shell. The flux through spherical shell is $\frac{q}{3\varepsilon_0}$. Find the radius of the ring.



A. $R\sqrt{2}$

B. $2R$

C. $0.5R$

D. R

Answer: D

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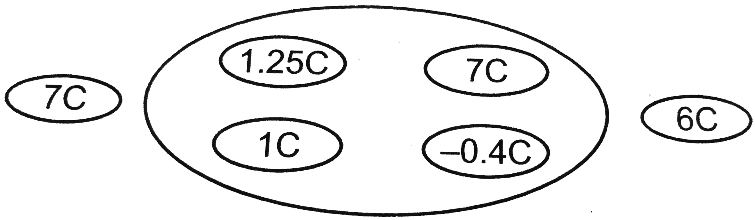
7. What is the electric flux linked with closed surface?



A. $10^{11} N - m^2 / C$

B. $10^{12} N - m^2 / C$

C. $10^{10} N - m^2 / C$

D. $8.86 \times 10^{13} N - m^2 / C$

Answer: B

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8. Electric field at a point varies as r^0 for

A. An electric dipole

B. A point charge

C. A plane infinite sheet of charge

D. A line charge of infinite length

Answer: C

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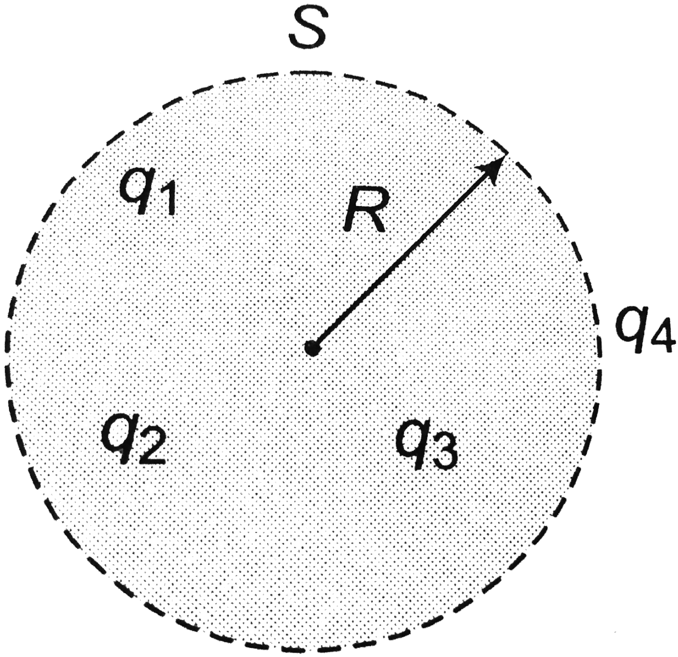
9. q_1, q_2, q_3 and q_4 are point charges located at point as shown in the figure and S is a spherical Gaussian surface of radius R. Which of the following is true according to the Gauss's law



A. $\oint_s \left(\vec{E}_1 + \vec{E}_2 + \vec{E}_3\right) . d\vec{A} = \dfrac{q_1 + q_2 + q_3}{2\varepsilon_0}$

B. $\oint_s \left(\vec{E}_1 + \vec{E}_2 + \vec{E}_3\right) . d\vec{A} = \dfrac{(q_1 + q_2 + q_3)}{\varepsilon_0}$

C.

$$\oint_s \left(\vec{E}_1 + \vec{E}_2 + \vec{E}_3\right) . d\vec{A} = \frac{(q_1 + q_2 + q_3 + q_4)}{2\varepsilon_0}$$

D. None of these

Answer: B

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10. 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. $\dfrac{(-4 \times 10^3)}{\varepsilon} C$

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

Answer: D

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11. If a spherical conductor comes out from the closed surface of the sphere then total flux emitted from the surface will be

A. $\frac{1}{\varepsilon_0}$(the angle enclosed by surface)

B. $\varepsilon_0 \times$ (the angle enclosed by surface)

C. $\frac{1}{4\pi\varepsilon_0} \times$ (the angle enclosed by surface)

D. 0

Answer: A

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12. If the electric flux entering and leaving an enclosed surface respectively is ϕ_1 and ϕ_2, the electric charge inside the surface will be

A. $(\phi_1 + \phi_2)\varepsilon_0$

B. $(\phi_2 - \phi_1)\varepsilon_0$

C. $(\phi_1 + \phi_2) / \varepsilon_0$

D. $(\phi_2 - \phi_1) / \varepsilon_0$

Answer: B

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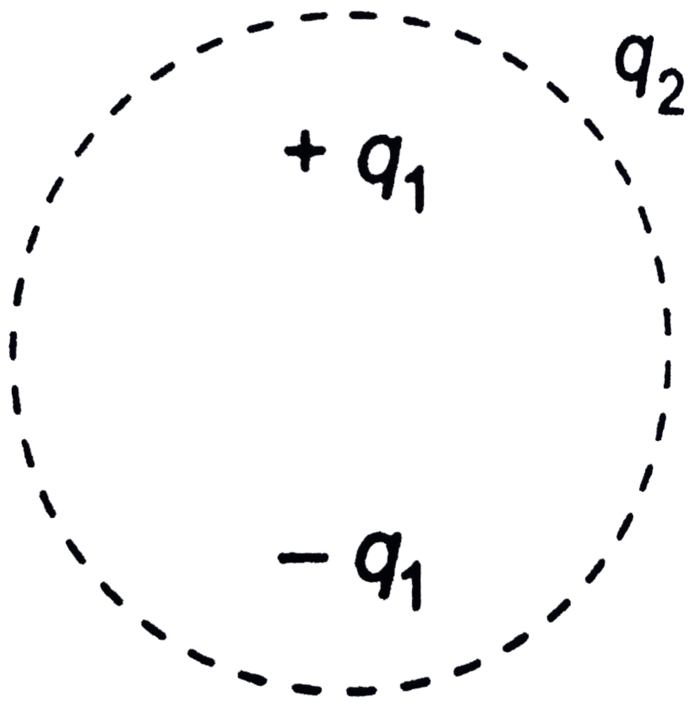
13. Consider the charge configuration and a spherical Gaussian surface as shown in the figure. When calculating the flux of the electric field over the spherical surface, the electric field will be due to.



A. q_2

B. Only the positive charges

C. All the charges

D. $+q_1$ and $-q_1$

Answer: C

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14. An electric dipole is put in north-south direction in sphere filled with water. Which statement is correct?

A. Electric flux is coming towards sphere

B. Electric flux is coming out of sphere

C. Electric flux entering into sphere and leaving the sphere are same

D. Water does not permit electric flux to enter into sphere

Answer: C

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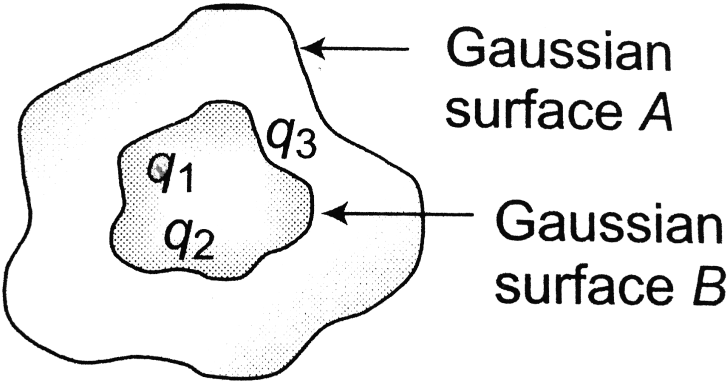
15. The electric flux for Gaussian surface A that enclose the charge particles in free space is (given

$q_1 = -14nC, q_2 = 78.85nC, q_3 = -56nC)$



A. $10^3 Nm^2C^{-1}$

B. $10^3 CN^{-1}C^{-2}$

C. $6.32 \times 10^3 Nm^2C^{-1}$

D. $6.32 \times 10^3 CN^{-1}m^{-2}$

Answer: A

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16. A solid metallic sphere has a charge $+3Q$. Concentric with this sphere is a conducting spherical shell having charge $-Q$. The radius of the sphere is a and that of the spherical shell is $b(b > a)$ What is the electric field at a distance $R(a < R < b)$ from the centre

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

B. $\dfrac{3Q}{2\pi\varepsilon_0 R}$

C. $\dfrac{3Q}{4\pi\varepsilon_0 R^2}$

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

Answer: C

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17. An electric field given by $\overrightarrow{E} = 4\hat{i} + 3(y^2 + 2)\hat{j}$ passes through Gaussian cube of side $1m$ placed at origin such that its three sides represents x, y and z axis. This net charge enclosed within the cube is

A. $4\varepsilon_0$

B. $3\varepsilon_0$

C. $4\varepsilon_0$

D. zero

Answer: B

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18. A point charge q is placed at a distance $a/2$ directly above the center of a square of side a. The electric flux through the square is

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

B. $\frac{q}{\pi\varepsilon_0}$

C. $\frac{q}{4\varepsilon_0}$

D. $\frac{q}{6\varepsilon_0}$

Answer: D

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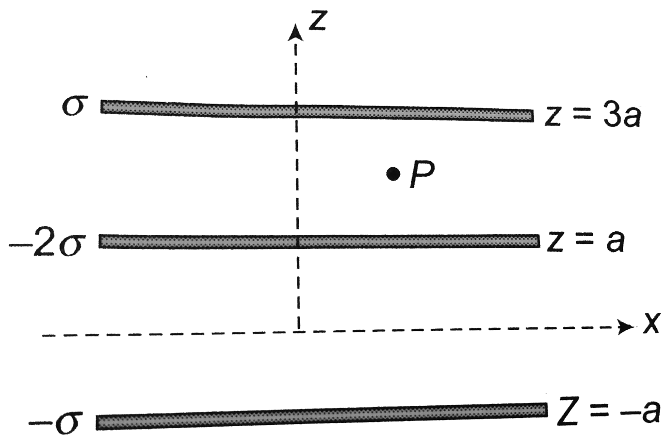
19. Three infinitely long charge sheets are placed as shown in figure. The electric field at point P is



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

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

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

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

Answer: B

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20. Two infinitely long parallel conducting plates having surface charge densities $+\sigma$ and $-\sigma$ respectively, are separated by a small distance. The medium between the plates is vacuum. If ε_0 is the dielectric permittivity of vacuum, then the electric field in the region between the plates is

A. $0 \text{ volts} / meter$

B. $\dfrac{\sigma}{2\varepsilon_0} \text{volts} / meter$

C. $\dfrac{\sigma}{\varepsilon_0} \text{volts} / meter$

D. $\dfrac{2\sigma}{\varepsilon_0} \text{volts} / meter$

Answer: C

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21. At a point $20cm$ from the centre of a uniformly charged dielectric sphere of radius $10cm$, the electric field is $100V/m$. The electric field at $3cm$ from the centre of the sphere will be

A. $150V/m$

B. $125V/m$

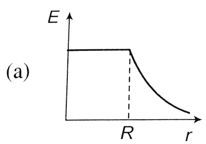
C. $120V/m$

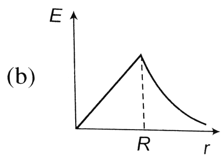
D. Zero

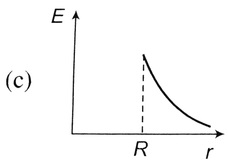
Answer: c

Watch Video Solution

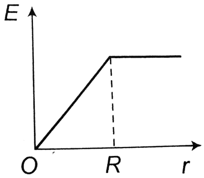
22. The electric field due to uniformly charged sphere of radius R as a function of the distance from its centre is represented graphically by

A. 

B. 

C. 

(d)

D. 

Answer: B

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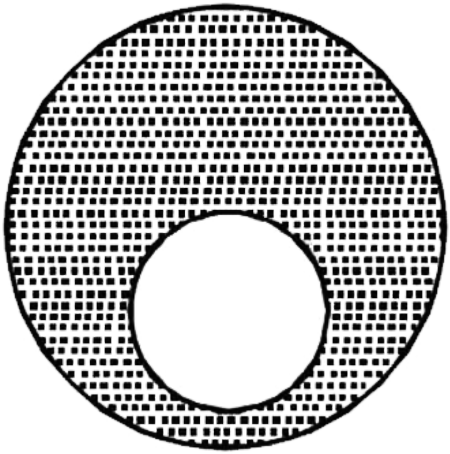
23. A spherical portion has been removed from a solid sphere having a charge distributed uniformly in its volume as shown in the figure. The electric field inside the emptied space is



A. zero everywhere

B. non-zero and uniform

C. non-uniform

D. zero only at its centre

Answer: B

Watch Video Solution

24. The number of electric field lines crossing an area ΔS is n_1 when $\Delta \overrightarrow{S} || \overrightarrow{E}$, while number of field lines crossing same area is n_2 when $\Delta \overrightarrow{E}$ makes an angle of 30° with $\overrightarrow{E}$, then :

A. $n_1 = n_2$

B. $n_1 > n_2$

C. $n_1 < n_2$

D. cannot say anything

Answer: B

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25. In a region of space the electric field in the x-direction and proportional to x i.e., $\overrightarrow{E} = E_0 x \hat{i}$. Consider an imaginary cubical volume of edge a with its sides parallel to the axes of coordinates. The charge inside this volume will be

A. zero

B. $\varepsilon_0 E_0 a^3$

C. $\frac{1}{\varepsilon_0} E_0 a^3$

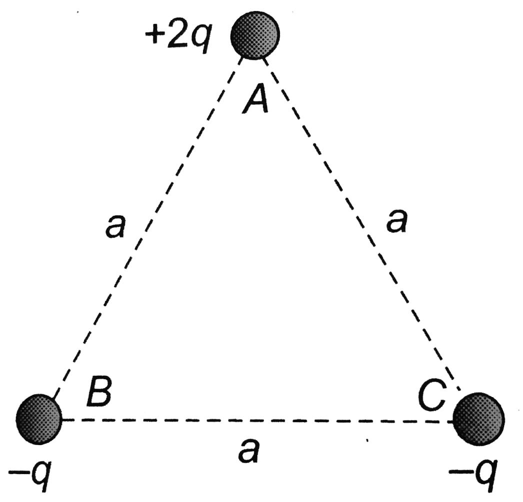
D. $\frac{1}{6} \varepsilon_0 E_0 a^3$

Answer: b

Watch Video Solution

Electric Dipole

1. Three charges of $(+ 2q), (- q)$ and $(- q)$ are placed at the corners A, B and C of an equilateral triangle of side a as shown in the adjoining figure. Then the dipole moment of this combination is



A. qa

B. Zero

C. $qa\sqrt{3}$

D. $\frac{2}{\sqrt{3}}qa$

Answer: C

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2. A given charge is situated at a certain distance from an electric dipole in the end-on position experiences a force F If the distance of the charge is doubled, the force acting on the charge will be

A. $2F$

B. $F/2$

C. $F/4$

D. $F/8$

Answer: D

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

A. A force and a torque

B. A force but not a torque

C. A torque but not a force

D. Neither a force nor a torque

Answer: A

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

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

B. $12 \times 10^{-3} Nm$

C. $24 \times 10^{-1} Nm$

D. $24 \times 10^{-3} Nm$

Answer: B

Watch Video Solution

5. Two charges $+3.2 \times 10^{-19}$ and $-3.2 \times 10^{-19} C$ placed at 2.4Å apart from an electric dipole. It is placed in a uniform electric field of intensity $4 \times 10^{5} \text{volt} / m$. The electric dipole moment is

A. $15.36 \times 10^{-29} \text{coulomb} \times m$

B. $15.36 \times 10^{-19} \text{coulomb} \times m$

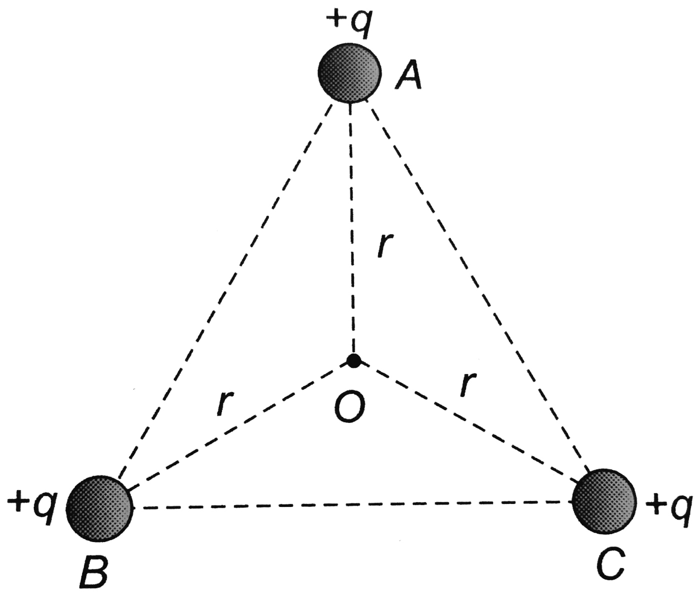
C. 7.68×10^{-29}coulomb $\times m$

D. 7.68×10^{-19}coulomb $\times m$

Answer: C

Watch Video Solution

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



A. q

B. $2ql$

C. $\sqrt{3}ql$

D. $4ql$

Answer: c

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7. The electric field at a point on equatorial of a dipole and direction of the dipole moment

A. Will be parallel

B. Will be in opposite direction

C. Will be perpendicular

D. Are not related

Answer: B

Watch Video Solution

8. 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: B

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9. An electric dipole is placed in an electric field generated by a point charge

A. The net electric force on the dipole must be zero

B. The net electric force on the dipole may be zero

C. The torque on the dipole due to the field must be zero

D. The torque on the dipole due to the field may be zero

Answer: D

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10. A point Q lies on the perpendicular bisector of an electrical dipole of dipole moment p. If the distance of Q from the dipole is r (much larger than the size of the dipole), then electric field at Q is proportional to

A. p^{-1} and r^{-2}

B. p and r^{-2}

C. p^2 and r^{-3}

D. p and r^{-3}

Answer: D

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11. If the magnitude of intensity of electric field at a distance x on axial line and at a distance y on equatorial line on a given dipole are equal, then $x : y$ is

A. $1:1$

B. $1:\sqrt{2}$

C. $1:2$

D. $2^{\frac{1}{3}}:1$

Answer: D

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12. An electric dipole in a uniform electric field experiences (When it is placed at an angle θ with the field)

A. Force and torque both

B. Force but not torque

C. Torque but not force

D. No force and no torque

Answer: C

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13. 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. $13.1 \times 11^{11} N/C$

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

Answer: A

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14. The ratio of electric fields on the axis and at equator of an electric dipole will be

A. $1:1$

B. $2:1$

C. $4:1$

D. None of these

Answer: B

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15. For a dipole $q = 2 \times 10^{-6} C$ and $d = 0.01 m$. Calculate the maximum torque for this dipole if

$E = 5 \times 10^5 N / C$

A. $1 \times 10^{-3} Nm^{-1}$

B. $10 \times 10^{-3} Nm^{-1}$

C. $10 \times 10^{-3} Nm$

D. $1 \times 10^2 Nm^2$

Answer: C

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16. What is the angle between the electric dipole moment and the electric field strength due to it on the equatorial line

A. 0°

B. 90°

C. 180°

D. None of these

Answer: C

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17. The electric field due to an electric dipole at a distance r from its centre in axial position is E. If the dipole is rotated through an angle of 90° about its perpendicular axis, the electric field at the same point will be

A. E

B. $E/4$

C. $E/2$

D. $2E$

Answer: C

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18. A neutral water molecule (H_2O) in its vapour state has an electric dipole moment of magnitudes

$6.4 \times 10^{-30} C - m$. How far apart are the molecules centres of positive and negative charge?

A. $4m$

B. $4mm$

C. $4\mu m$

D. $4pm$

Answer: D

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19. An electric dipole consists of two equal and opposite charges placed $2cm$ apart. When the dipole is placed in a uniform electric field of strength $10^5 NC^{-1}$, it experiences a maximum torque of $0.2 \times 10^{-3} Nm$. Find the magnitude of each charge

A. $20 \mu m$

B. $10 \mu C$

C. $15 \mu C$

D. $40 \mu C$

Answer: b

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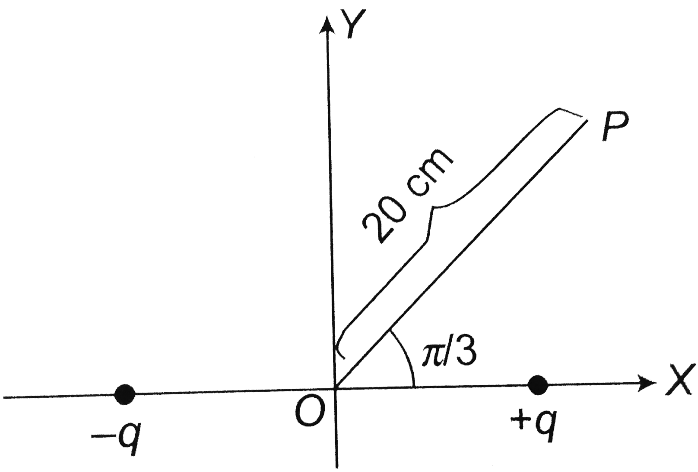
20. An electric dipole is placed along the X-axis O. Point P is at a distance of $20cm$ from the origin such that OP makes an angle $\pi/3$ with the X-axis. If the electric field at P makes an angle θ with the$X$-axis the value of θ will be



A. $\frac{\pi}{3}$

B. $\frac{\pi}{3}+\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

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

D. $\tan^{-1}\left(\frac{\sqrt{3}}{2}\right)$

Answer: B

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21. An electric dipole is placed at the origin O and is directed along the x-axis. At a point P, far away from the dipole, the electric field is parallel to y-axis. OP makes an angle θ with the x-axis then

A. $\tan\theta = \sqrt{3}$

B. $\tan\theta = \sqrt{2}$

C. $\theta = 45^\circ$

D. $\tan\theta = \frac{1}{\sqrt{2}}$

Answer: b

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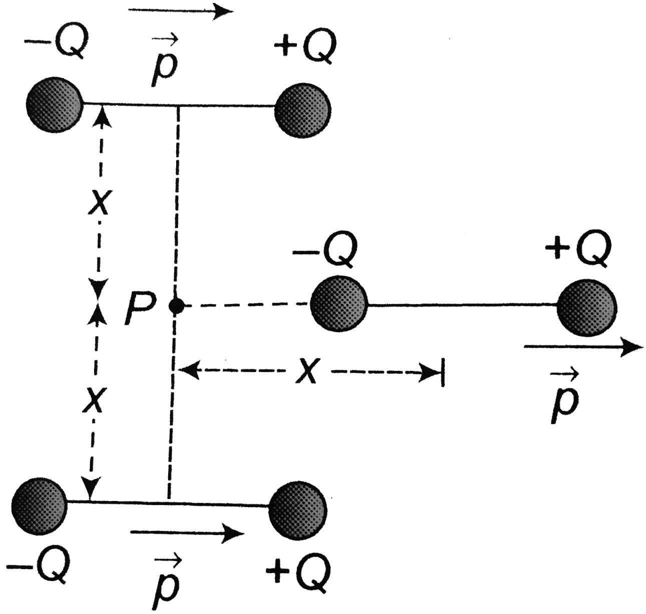
22. Three identical dipoles are arranged as shown below. What will be the net electric field at P?

$\left(k = \dfrac{1}{4\pi\varepsilon_0}\right)$



A. $\dfrac{k.\,p}{x^3}$

B. $\dfrac{2kp}{x^3}$

C. Zero

D. $\dfrac{\sqrt{2}kp}{x^3}$

Answer: C

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23. Two electric dipoles of moment p and $64p$ are placed in opposite direction on a line at a distance of $25cm$. The electric field will be zero at point between the dipoles whose distance from the dipole of moment p is

A. $5cm$

B. $\frac{25}{9}cm$

C. $10cm$

D. $\frac{4}{13}cm$

Answer: A

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24. Two point charges$(+Q)$ and $(-2Q)$ are fixed on the X-axis at position a and $2a$ from origin respectively. At what position on the axis, the resultant electric field is zero

A. Only $x=\sqrt{2}a$

B. Only $x=-\sqrt{2}a$

C. Both $x=\pm\sqrt{2}a$

D. $x=\frac{3a}{2}cm$

Answer: b

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

A. $\frac{9p}{32\pi\varepsilon_0}\hat{k}$

B. $\frac{-7p}{32\pi\varepsilon_0}\hat{k}$

C. $\frac{7p}{32\pi\varepsilon_0}\hat{k}$

D. none of these

Answer: b

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26. Total electric force on an electric dipole placed in an electric field of a point charge is :

A. always zero

B. never zero

C. zero when mid point of dipole coincides with the point charge

D. zero when dipole axis is along any electric line of force.

Answer: B

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27. The locus of the points (in the xy-plane) where the electric field due to a dipole (dipole axis is along x-axis and its equatorial is along y-axis) is perpendicular to its axis, is

A. straight line perpendicular to the axis

B. circle

C. Parabola

D. straight line having inclination $\theta = \tan^{-1}\sqrt{2}$

with the axis.

Answer: D

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28. An electric dipole is situated in an electric field of uniform intensity E whose dipole moment is p and moment of inertia is I. If the dipole is displaced slightly from the equilibrium position, then the angular frequency of its oscilliations is

A. $\left(\frac{pE}{I}\right)^{\frac{1}{2}}$

B. $\left(\frac{pE}{I}\right)^{\frac{3}{2}}$

C. $\left(\frac{I}{pE}\right)^{\frac{1}{2}}$

D. $\left(\frac{p}{IE}\right)^{\frac{1}{2}}$

Answer: a

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29. An electric dipole is kept on the axis of a uniformly charged ring at distance d from the centre of the ring. The direction of the dipole moment is along the axis. The dipole moment is p, charge of the ring is Q & radius of the ring is R. The force on the dipole is

A. $\dfrac{pQ}{3\pi\varepsilon_0\sqrt{3}R^2}$

B. $\dfrac{4pQ}{3\pi\varepsilon_0\sqrt{3}R^2}$

C. $\dfrac{pQ}{3\pi\varepsilon_0 R^2}$

D. zero

Answer: D

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Problems Based On Mixed Concepts

1. A copper atom consists of copper nucleus surrounded by 29 electrons. The atomic weight of copper is $63.5 mole^{-1}$. Let us now take two pieces of copper each weighing $10g$. Let us trandfer one elcetron from one piece to another for every 100 atoms in that piece. What will be the Coulomb force between the two pieces after the trandfer of electrons, if they are $1cm$ apart? Avogadro number $= 6 \times 10^{23} mole^{-1}$, charge on an electron $= -1.6 \times 10^{-19} C$.

A. $1.12 \times 10^{18} N$

B. $4.24 \times 10^{18} N$

C. $2.06 \times 10^{18} N$

D. $5.16 \times 10^{18} N$

Answer: c

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2. A particle of mass m and carrying charge $-q_1$ is moving around a charge $+q_2$ along a circular path of radius r. Period of revolution of the charge $-q_1$ about $+q_2$ is

A. $4\sqrt{\dfrac{\pi^3\varepsilon_0 m r^3}{q_1 q_2}}$

B. $\sqrt{\dfrac{\pi^3\varepsilon_0 m r^3}{q_1 q_2}}$

C. $2\sqrt{\dfrac{\pi^3\varepsilon_0 m r^3}{q_1 q_2}}$

D. $3\sqrt{\dfrac{\pi^3\varepsilon_0 m r^3}{q_1 q_2}}$

Answer: A

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3. Two point electric charges of value q and $2q$ are kept at a distance d apart from each other in air. A third charge Q is to be kept along the same line in such a way that the net force action on q and $2q$ is zero. Calculate the position of charge Q in terms of q and d.

A. $\dfrac{d}{\sqrt{2}-1}$

B. $\dfrac{d}{\sqrt{2}+1}$

C. $\dfrac{d}{\sqrt{3}+1}$

D. $\dfrac{d}{\sqrt{3}-1}$

Answer: b

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4. It is requird to hold four equal point charges $+q$ in equilibrium at the corners of a square. Find the point charge that will do this, if placed at the centre of the square.

A. $\left(1+\dfrac{\sqrt{2}}{2}\right)q$

B. $\left(\dfrac{1+2\sqrt{2}}{4}\right)q$

C. $\left(\dfrac{1+2\sqrt{2}}{2}\right)q$

D. $\left(\frac{1+\sqrt{2}}{4}\right)q$

Answer: b

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5. Two infinitely long parallel wires having linear charge densities λ_1 and λ_2 respectively are placed at a distance of R metres. The force per unit length on either wire will be $\left(k = \frac{1}{4\pi\varepsilon_0}\right)$

A. $k\frac{2\lambda_1\lambda_2}{R^2}$

B. $k\frac{2\lambda_1\lambda_2}{R}$

C. $k\frac{\lambda_1\lambda_2}{R^2}$

D. $k\frac{\lambda_1\lambda_2}{R}$

Answer: B

Watch Video Solution

6. The insulation property of air breaks down at $E=3\times10^6\text{volt}/meter$. The maximum charge that can be given to a sphere of diameter $5m$ is approximately (in coulombs)

A. 2×10^{-2}

B. 2×10^{-3}

C. 2×10^{-4}

D. 2×10^{-5}

Answer: b

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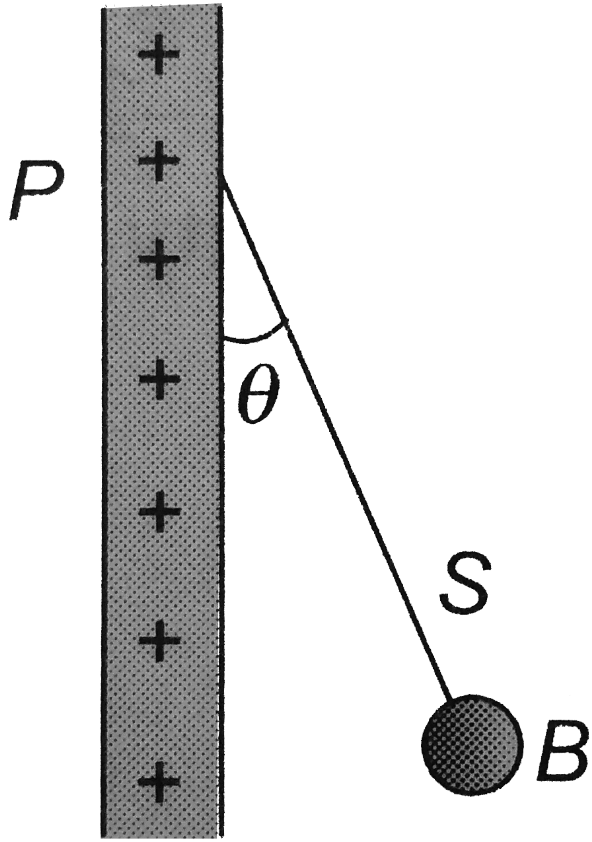
7. A charged ball B hangs from a silk thread S, which makes an angle θ with a large charged conducting sheet P, as shown in the figure. The surface charge density σ of the sheet is proportional to



A. $\sin\theta$

B. $\tan\theta$

C. $\cos\theta$

D. $\cot \theta$

Answer: b

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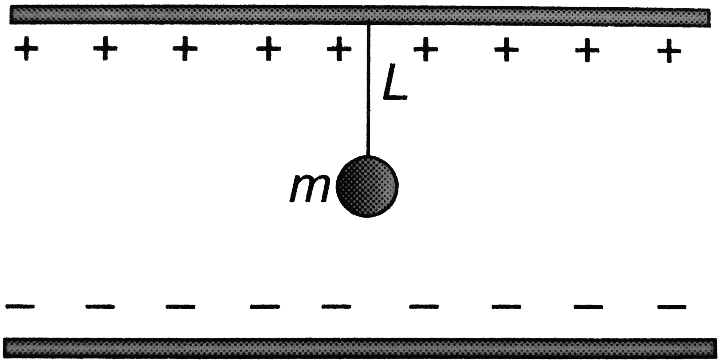
8. A small sphere carrying a charge q is hanging in between two parallel plates by a string of length L. Time period of pendulum is T_0. When parallel plates are charged, the time period changes to T. The ratio

T / T_0 is equal to



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

B. $\left(\dfrac{g}{g+\frac{qE}{m}}\right)^{3/2}$

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

D. None of these

Answer: c

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9. Two charges particle $(M, +Q)$ and $(m, -q)$ are placed in a gravity free space where a uniform electric field E exist. After the particles are released, they stay at a constant distance from each other. What is the distance? Neglect Gravitational interaction. k is electrostatic constant.

A. $\sqrt{\dfrac{kqQ}{E(q+Q)}}$

B. $\sqrt{\dfrac{(M+m)kQq}{E(qm+QM)}}$

C. $\sqrt{\dfrac{(M+m)kQq}{E(qM+Qm)}}$

D. not possible

Answer: c

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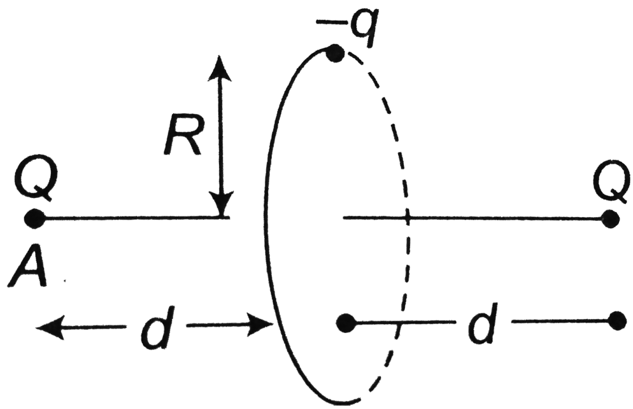
10. Two positive point charges each of magnitude $10C$ are fixed at positions A &B at a seperation $2d = 6m$. A negatively charged particle of mass $m = 90gm$ and charge of magnitude $10 \times 10^{-6}C$ is revolving in a circular path of radius $4m$ in the plane perpendicular to the line AB and bisecting the line AB. Neglect the effect of gravity. Find the angular velocity of the particle



A. $200rad / s$

B. $400rad / s$

C. $250rad / s$

D. $100rad / s$

Answer: b

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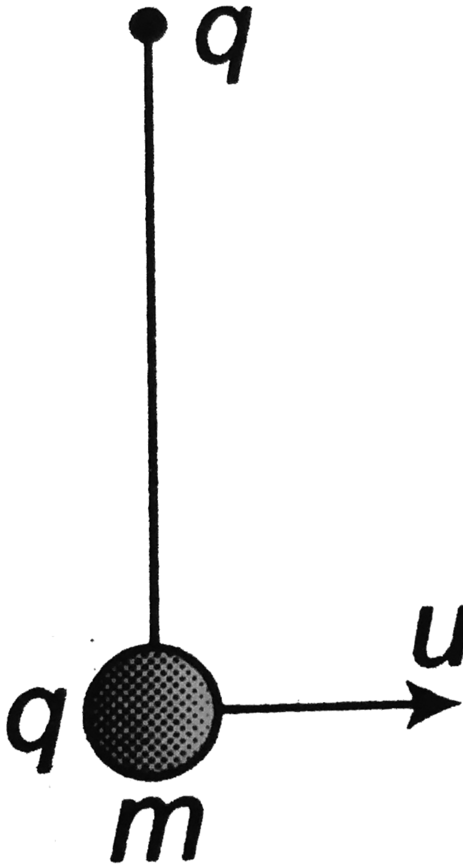
11. The bob of a pendulum has mass $m = 1kg$ and charge $q = 40\mu C$. Length of the pendulum is $l = 0.9m$. The point of suspension also has the same charge $40\mu C$. What the minimum speed u should be imparted to the bob so that it can complete verticel circel ?



A. $6ms^{-1}$

B. $2ms^{-1}$

C. $8ms^{-1}$

D. $4ms^{-1}$

Answer: a

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12. A positive charge q is placed in front of a conducting solid cube at a distance d from its centre. Find the electric field at the centre of the cube due to the charges appearing on its surface.

A. $\frac{q}{4\pi\varepsilon_0 d^2}$ towards the charge q

B. $\frac{q}{4\pi\varepsilon_0 d^2}$ away from the charge q

C. zero

D. can't be found

Answer: A

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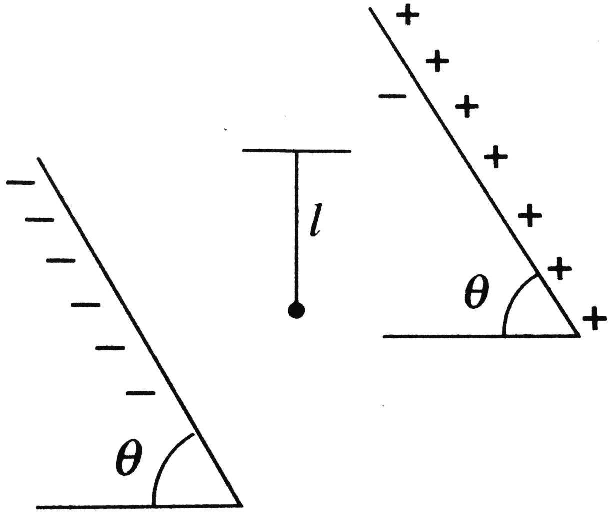
13. Consider a parallel plate capacitor having an electric field E inside it as shown in the adjacent figure. A particle of mass m and charge q is hanging inside the capacitor through a light inextensible string of length. The time period of this pendulum of small oscillations is



A. $T=2\pi\sqrt{\dfrac{l}{g+(qE/m)}}$

B. $T=2\pi\sqrt{\dfrac{l}{\sqrt{g^2+\dfrac{q^2E^2}{m^2}-\dfrac{2qgE}{m}}}}$

C. $T=2\pi\sqrt{\dfrac{l}{\sqrt{g^2+\dfrac{q^2E^2}{m^2}+\dfrac{2qgE}{m}}}}$

D. none of these

Answer: d

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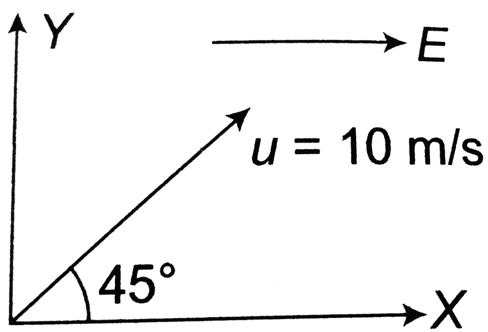
14. A charged particle of mass $m = 2kg$ and charge $1\mu C$ is thrown from a horizontal ground at an angle of 45° with horizontal with a spedd of $10m/s$. In space a horizontal electric field $E = 2 \times 10^7 N/C$ exists. Find the range of the projectile



A. $5m$

B. $30m$

C. $10m$

D. $20m$

Answer: D

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15. Four point positive charges are held at the vertices of a square in a horizontal plane. Their masses are $1kg, 2kg, 3kg, \& 4kg$. Another point positive charge of mass $10kg$ is kept on the axis of the sqaure. The weight of their fifth charge is balanced by the electrostatic force due to those four charges. If the four charge on the vertices are released such that they can freely move in any direction(vertical, horizontal etc.) then the acceleration of the centres of mass of the four charges immediately after the release is (Use $g = 10m/s^2$)

A. $10m/s^2$ downward

B. $20m/s^2$ downward

C. zero

D. $10m/s^2$ upward

Answer: b

Watch Video Solution

16. A soap bubble (surface tension $= T$) is charged to maximum surface density of charge $= \sigma$. When it is just going to burst. Its radius R is given by:

A. $R = \dfrac{\sigma^2}{8\varepsilon_0 T}$

B. $R = 8\varepsilon_0 \dfrac{T}{\sigma^2}$

C. $R = \dfrac{\sigma}{\sqrt{8\varepsilon_0 T}}$

D. $R = \dfrac{\sqrt{8\varepsilon_0 T}}{\sigma}$

Answer: b

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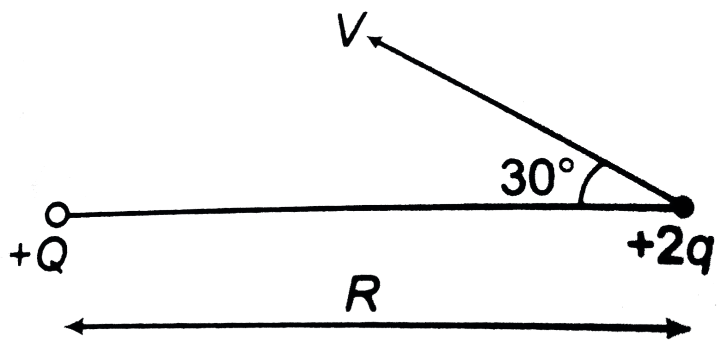
17. In the diagram shown the charge $+Q$ is fixed. Another charge $+2q$ and mass M is projected from a distance R from the fixed charge. Minimum separtion between the two charge if the velocity becomes $\frac{1}{\sqrt{3}}$ time of the projected velocity, at this moment is (Assume gravity to be absent)



A. $\frac{\sqrt{3}}{2}R$

B. $\sqrt{3}R$

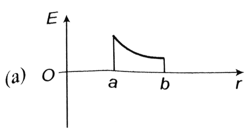
C. $\frac{1}{2}R$

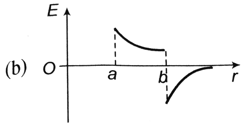
D. $4R$

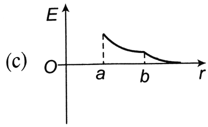
Answer: a

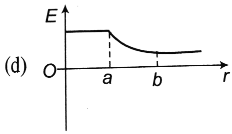
Watch Video Solution

18. Two concentric conducting shells of radius a and b $(b > a)$ carry charges Q and $-2Q$ respectively. The correct variation of electric intensity E as a function of r is given by

A. 

B. 

C. 

D. 

Answer: B

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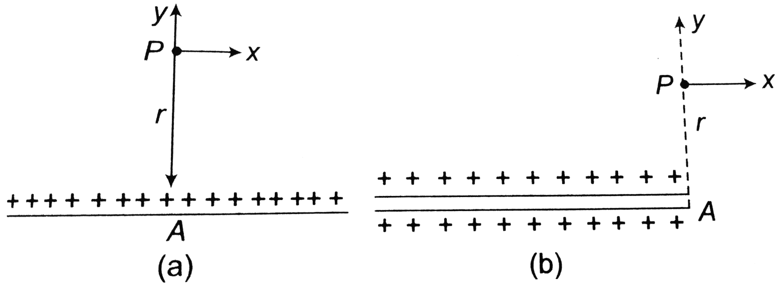
19. Electric field , due to an infinite line of change, as shown in figure at a point P at a distance r from the line is E. If wire is folded at point A, so that both parts lie alongside as shown in figure(b), then express electric field at P in vector form.



A. $\frac{E}{2}\hat{i} + \frac{E}{2}\hat{j}$

B. $E\hat{i} + E\hat{j}$

C. $\sqrt{2}E\hat{i} + \sqrt{2}E\hat{j}$

D. $\frac{E}{\sqrt{2}}\hat{i} + \frac{E}{\sqrt{2}}\hat{j}$

Answer: b

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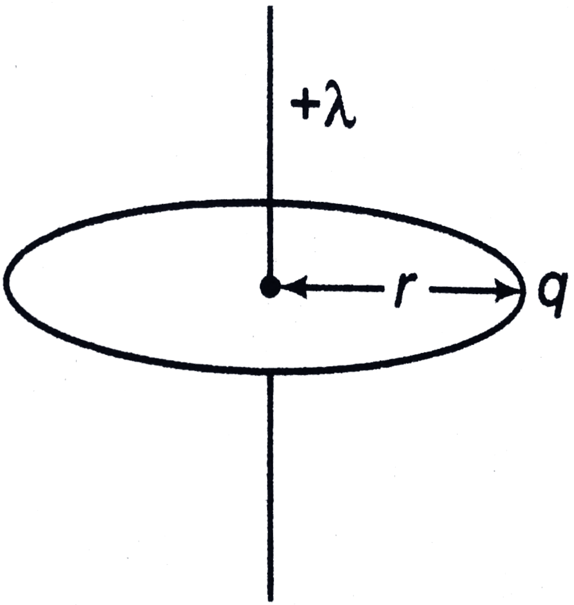
20. A particle of charge $-q$ and mass m moves in a circle of radius r around an infinitely long line charge of linear charge density $+\lambda$. Then, time period will be



where ,

$k = \frac{1}{4}\pi\varepsilon_0\Big)$

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

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

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

D. $TT = \dfrac{1}{2\pi r}\sqrt{\dfrac{m}{2k\lambda q}}$

Answer: a

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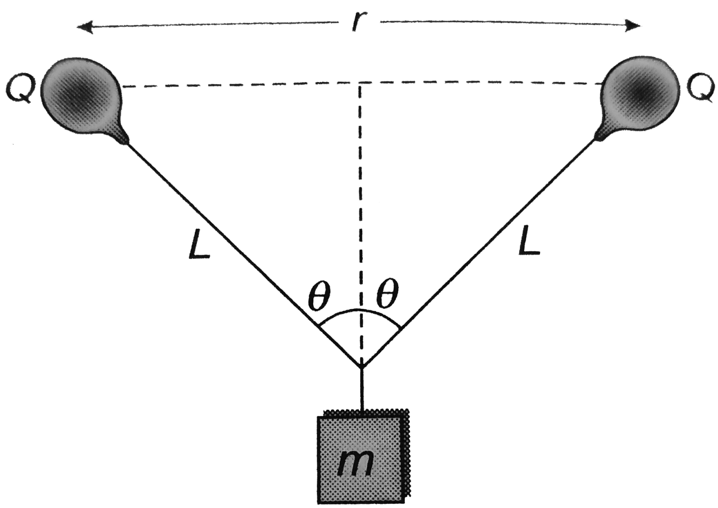
21. Two similar balloons filled with helium gas are tied to Lm long string. A body of mass m is tied to another ends of the strings. The balloons float on air at distance r. If the amount of charge on the ballons is same then the magnitude of charge on each balloon will be



A. $\left[\frac{mgr^2}{2k}\tan\theta\right]^{1/2}$

B. $\left[\frac{2k}{mgr^2}\tan\theta\right]^{1/2}$

C. $\left[\frac{mgr}{2k}\cot\theta\right]^{1/2}$

D. $\left[\frac{2k}{mgr}\tan\theta\right]^{1/2}$

Answer: a

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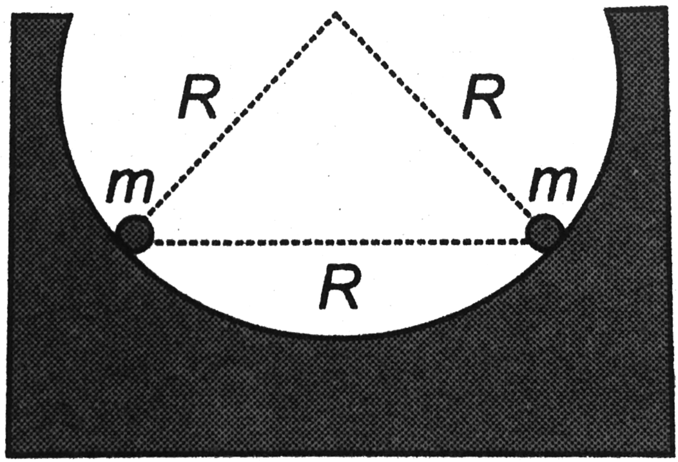
22. Two identical beads each have a mass m and charge q. When placed in a hemispherical bowl of radius R with frictionless, non-conducting walls, the beads move, and at equilibrium they area distance R apart (figure). Determine the charge on each bead.



A. $q = R\left(\frac{mg}{K\sqrt{3}}\right)^{1/2}$

B. $q=\left(R\frac{mg}{K\sqrt{3}}\right)^{1/2}$

C. $q=R\left(\frac{\sqrt{3}mg}{K}\right)^{1/2}$

D. $q=\left(R\frac{\sqrt{3}mg}{K}\right)^{1/2}$

Answer: a

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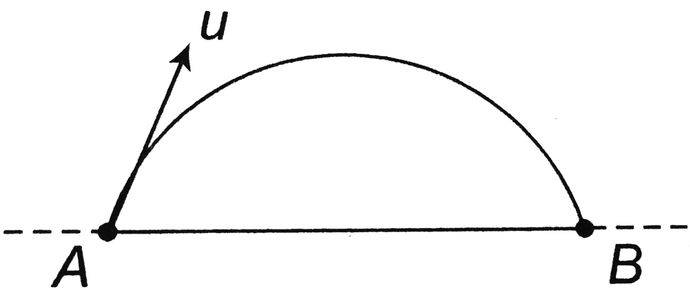
23. In the figure shown there is a large sheet of charge of uniform surface charge density $'\sigma'$.A charge particle of charge $'-q'$ and mass $'m'$ is projected from a point A on the sheet with a speed $'u'$ with the angle of projection such that it lands at maximum distance from A on the sheet. Neglecting gravity, find the time flight



A. $\frac{2\sqrt{2}mv\varepsilon_0}{\sigma q}$

B. $\frac{\sqrt{2}mv\varepsilon_0}{5\sigma q}$

C. $\frac{mv\varepsilon_0}{\sqrt{2}\sigma q}$

D. $\frac{mv\varepsilon_0}{2\sqrt{2}\sigma q}$

Answer: a

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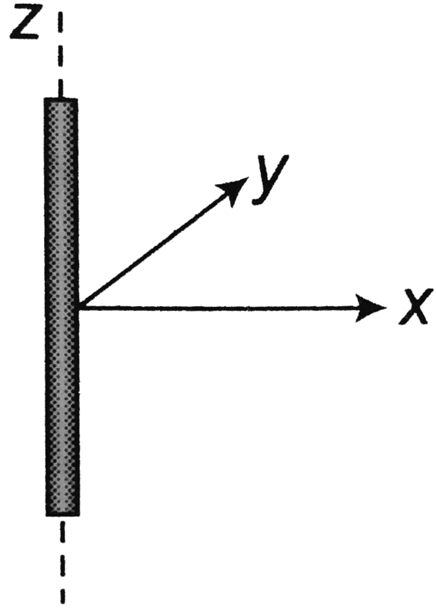
24. An infinitely long wire is kept along z-axis from $z = -\infty$ to $z = +\infty$, having uniform linear cahrges density $\frac{10}{9} nC / m$. The electric field at point $(6cm, 8cm, 10cm)$ will be



A. $\left(120\hat{\imath} + 160\hat{\jmath} + 200\hat{k}\right) V / m$

B. $200\hat{k} V / m$

C. $\left(160\hat{i}+120\hat{j}\right)V/m$

D. $\left(120\hat{i}+160\hat{j}\right)V/m$

Answer: D

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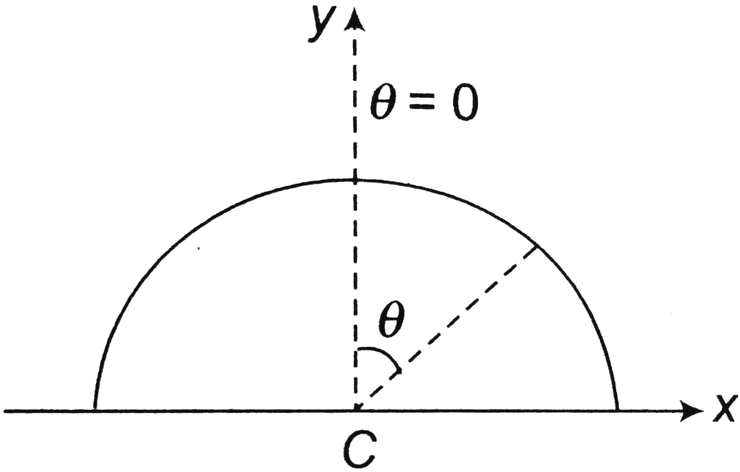
25. A semicircular wire is uniformly charged with linear charge density dependent on the angle θ from y-direction as $\lambda=\lambda_0|\sin\theta|$, where λ_0 is a constant. The electric field intensity at the centre of the arc is



A. $\frac{\lambda_0}{2\pi\varepsilon_0 R}(-\hat{j})$

B. $\frac{\lambda_0}{4\pi\varepsilon_0 R}(-\hat{j})$

C. $\frac{\lambda_0}{6\pi\varepsilon_0 R}(-\hat{j})$

D. $\frac{\lambda_0}{2\sqrt{2}\pi\varepsilon_0 R}(-\hat{j})$

Answer: b

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26. A copper ball of density $8.6 gcm^{-3}$, $1 cm$ is diameter is immersed in oil of density $0.8 dcm^{-3}$. If the ball remiand suspended in oil in a uniform electric field of intensity $36000 NC^{-1}$ acting in upward direction, what is the charge on the ball ?

A. $1.1 \mu C$

B. $4.2 \mu C$

C. $2.4 \mu C$

D. $3.7 \mu C$

Answer: a

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27. A charge q is placed at the some distance along the axis of a uniformly charged disc of surface charge density σ. The flux due to the charge q through the disc is ϕ. The electric force on charge q exerted by the disc is

A. $\sigma\phi$

B. $\frac{\sigma\phi}{4\pi}$

C. $\frac{\sigma\phi}{2\pi}$

D. $\frac{\sigma\phi}{3\pi}$

Answer: a

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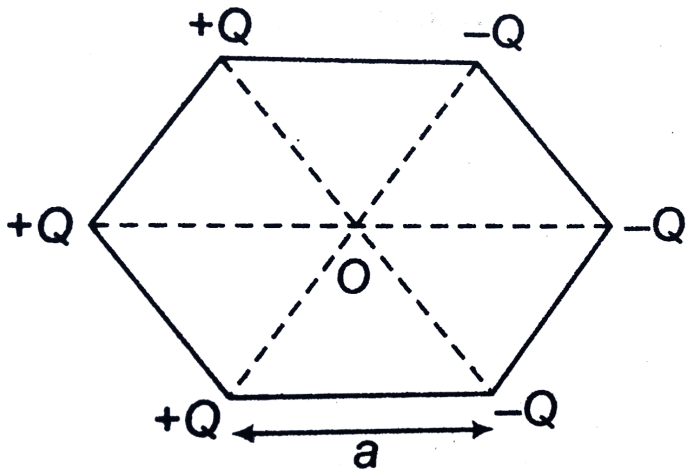
28. Six charges are placed at the vertices of a rectangular hexagon as shown in the figure. The electric field on the line passing through point O and perpendicular to the plane of the figure as a function of distance x from point O is (xgtgta)



A. 0

B. $\dfrac{Qa}{\pi\varepsilon_0 x^3}$

C. $\dfrac{2Qa}{\pi\varepsilon_0 x^3}$

D. $\dfrac{\sqrt{3}Qa}{\pi\varepsilon_0 x^3}$

Answer: b

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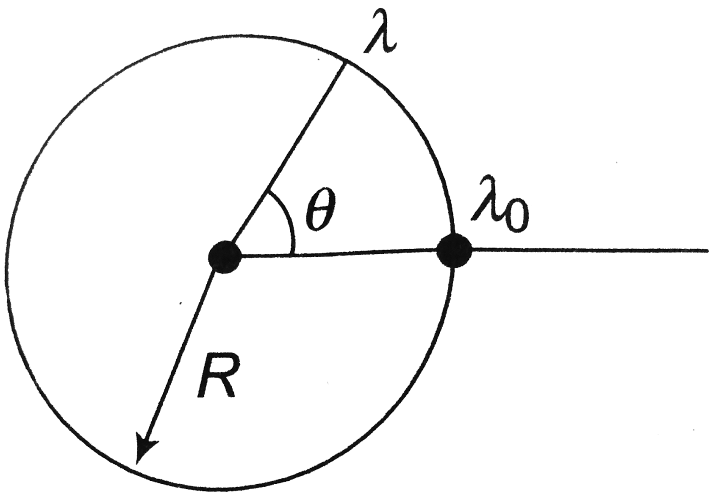
29. A thin non-conducting ring of radius R has a linear charge density $\lambda = \lambda_0 \cos\theta$, where θ is measured as shown. The total electric dipole moment of the charge distribution is



A. $R^2\lambda_0$

B. $2\pi R^2\lambda_0$

C. $\frac{\pi R^2\lambda_0}{2}$

D. $\pi R^2\lambda_0$

Answer: d

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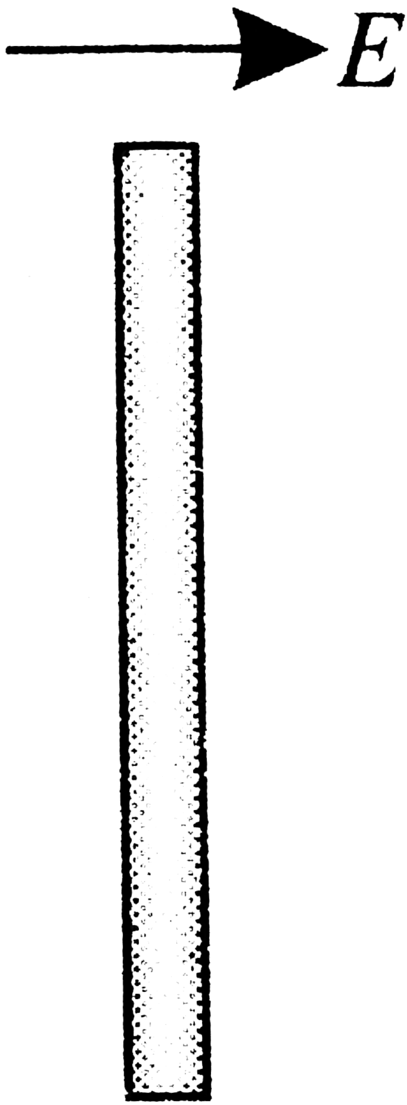
30. An uncharged conducting large plate is placed as shown. Now an electric field E towards right is applied. Find the induced charge density on the right surface of the plate.



A. $-\varepsilon_0 E$

B. $\varepsilon_0 E$

C. $-2\varepsilon_0 E$

D. $2\varepsilon_0 E$

Answer: B

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31. An uncharged aluminium block has a cavity within it. The block is placed in a region where a uniform electric field is directed upward. Which of the following is a correct statement describing conditions in the interior of the block's cavity?

A. The electric field in the cavity is directed upwards

B. The electric field in the cavity is directed downwards

C. There is no electric field in the cavity

D. The electric field in the cavity is of varying magnitude and is zero at the exact centre.

Answer: c

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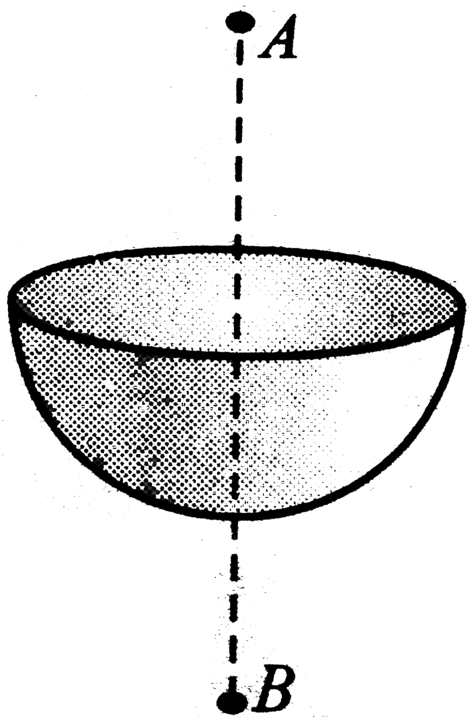
32. Figure shows a uniformly charged hemisphere of radius R. It has a volume charge density ρ. If the electric field at a point 2R, above the its center is E, then what is the electric field at the point 2R below its center?



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

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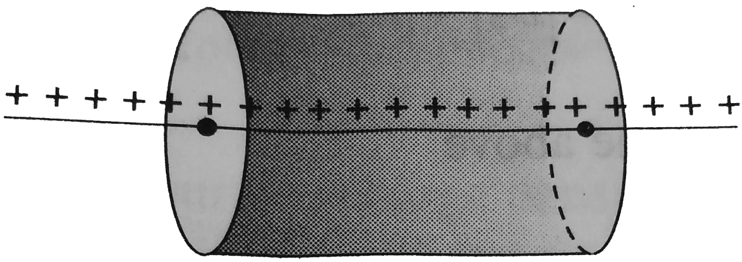
33. Consider an infinite line charge having uniform linear charge density and passing through the axis of a cyclinder. What will be the effect on the flux passing through curved surface if the portions of the line charge outside the cyclinder is removed



A. decrease

B. increase

C. remain same

D. can't say

Answer: A

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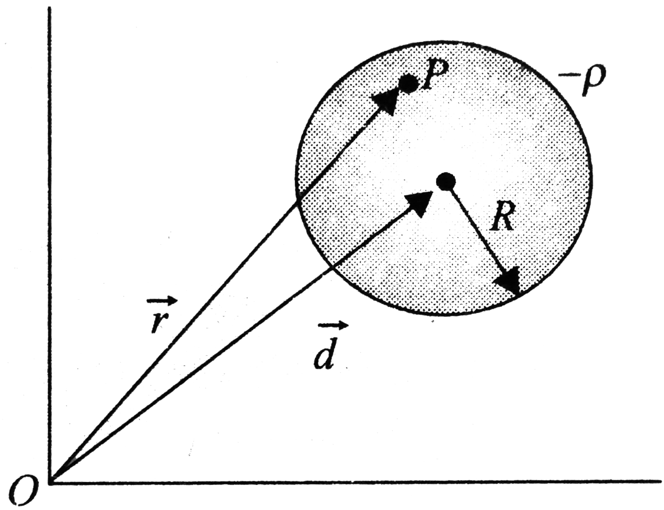
34. A nonconducting sphere of radius R is filled with uniform volume charge density $-\rho$. The center of this sphere is displaced from the origin by $\vec{d}$. The electric field $\vec{E}$ at any point P having position vector inside the sphere is



A. $\dfrac{\rho}{3\epsilon_0}\vec{d}$

B. $\dfrac{\rho}{3\epsilon_0}\left(\vec{r}-\vec{d}\right)$

C. $\frac{\rho}{3 \in_0}\left(\overrightarrow{d} - \overrightarrow{r}\right)$

D. $\frac{\rho}{3 \in_0}\overrightarrow{(r)}$

Answer: c

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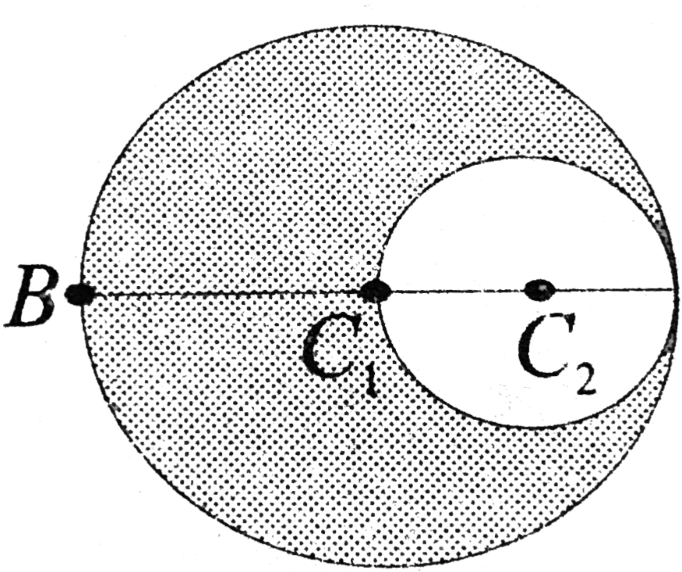
35. A positively charge sphere of radius r_0 carries a volume charge density ρ. A spherical cavity of radius $r_0/2$ is then scooped out and left empty. C_1 is the center of the sphere and C_2 that of the cavity. What is the direction and magnitude of the electric field at point B?



A. $\dfrac{17\rho r_0}{54 \in_0}$ left

B. $\dfrac{\rho r_0}{6 \in_0}$ left

C. $\dfrac{17\rho r_0}{54 \in_0}$ right

D. $\dfrac{\rho r_0}{6 \in_0}$ right

Answer: A

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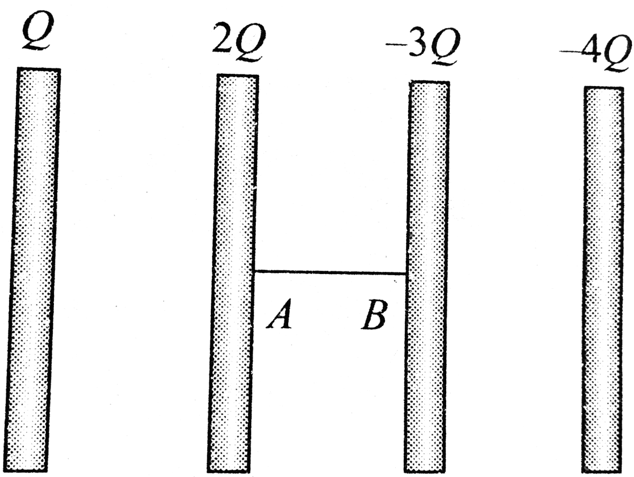
36. Four very large metal plates are given charges as shown in figure. The middle two are then connected through a wire. Find the charge that will flow through the wire.



A. $5Q$ from A to B

B. $5Q/2$ from A to B

C. $5Q$ from B to A

D. no charge will flow

Answer: a

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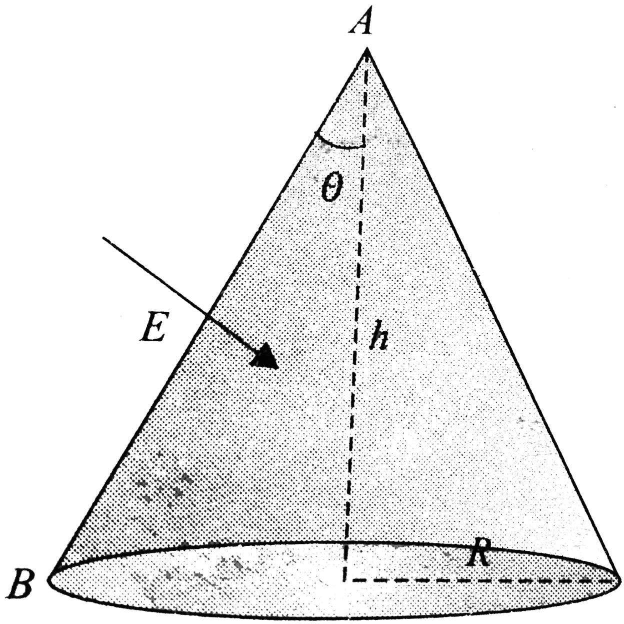
37. A conic surface is placed in a uniform electric field E as shown in figure. Such that the field is perpendicular to the surface on the side AB. The base of the cone is of radius R, and the height of the cone is h. The angle of the cone is θ.



Find the magnitude of the flux that enters the cone's curved surface from the left side. Do not count the outgoing flux ($\theta < 45^\circ$).

A. $ER[h\cos\theta + \pi(R/2)\sin\theta]$

B. $ER[h\sin\theta + \pi(R/2)\cos\theta]$

C. $ER[h\cos\theta + \pi R\sin\theta]$

D. none of these

Answer: A

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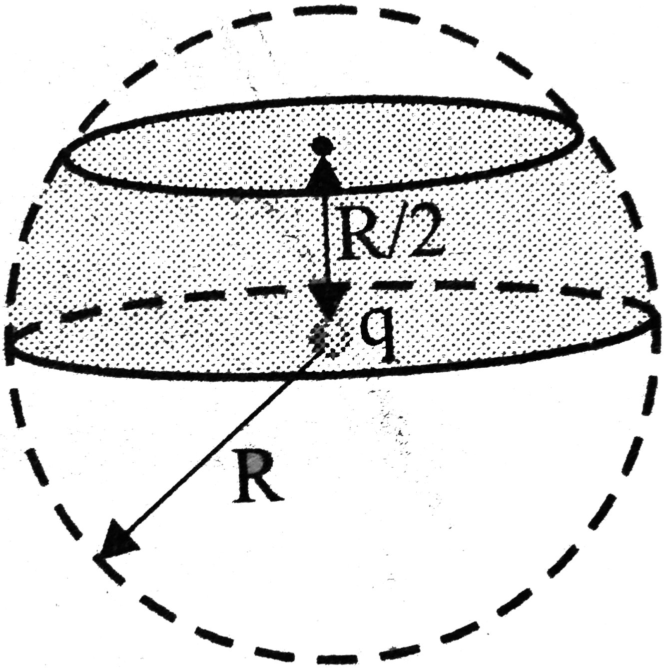
38. Flux passing through the shaded surface of a sphere when a point charge q is placed at the center is (radius of the sphere is R)



A. q/ε_0

B. $q/2\varepsilon_0$

C. $q/4\varepsilon_0$

D. zero

Answer: c

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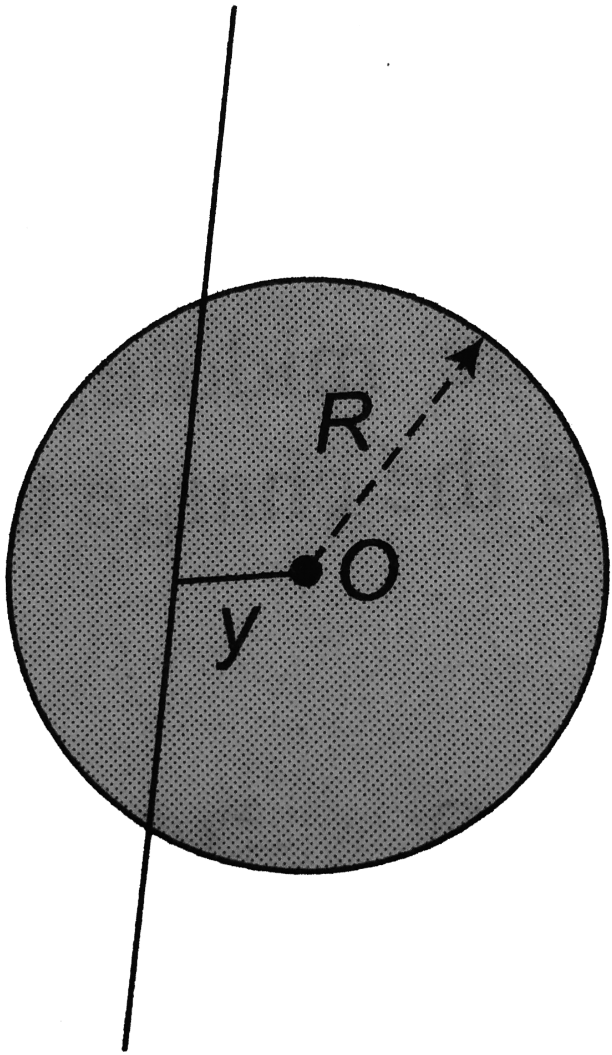
39. A uniformly charged and infinitely long line having a linear charge density $'\lambda'$ is placed at a normal distance y from a point O. Consider a sphere of radius R with O as centre and $R > y$. Electric flux through the surface of the sphere is



A. zero

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

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

D. $\dfrac{\lambda\sqrt{R^2 + y^2}}{\varepsilon_0}$

Answer: c

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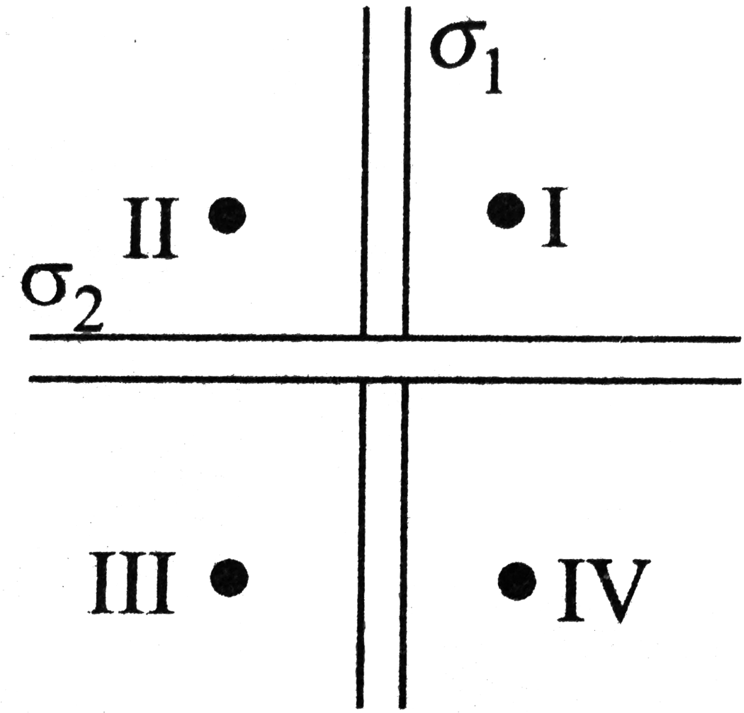
40. Two infinite sheets having charge densities σ_1 and σ_2 are placed in two perpendicular planes whose two-dimensional view is shown in figure. The charges are distributed uniformly on the sheets in electrostatic equilibrium condition. Four points are marked I, II, III and IV. The electric field intensities at these points are $\overrightarrow{E}_1, \overrightarrow{E}_2, \overrightarrow{E}_3$, and $\overrightarrow{E}_4$, respectively. The correct expression for the electric field intensities is



A. $\left|\vec{E}_1\right| = \left|\vec{E}_2\right| = \dfrac{\sqrt{\sigma_1^2 + \sigma_2^2}}{2\varepsilon_0} \neq \left|\vec{E}_4\right|$

B. $\left|\vec{E}_2\right| = \left|\vec{E}_4\right| = \dfrac{\sqrt{\sigma_1^2 + \sigma_2^2}}{2\varepsilon_0}$

C. $\left|\vec{E}_1\right| = \left|\vec{E}_2\right| = \left|\vec{E}_3\right| = \left|\vec{E}_4\right| \dfrac{\sqrt{\sigma_1^2 + \sigma_2^2}}{2\varepsilon_0}$

D. None of the above

Answer: c

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Section B - Assertion Reasoning

1. Assertion: Electric lines of force cross each other

Reason: Electric field at a point superimpose to give one resulant electric field

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: B

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2. Assertion. A metallic shield in the form of a hollow shell, can be built to block an electric field.

Reason. In a hollow spherical shell, the electric field inside is not zero at every point.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: a

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3. Assertion: If bob of a simple pendulum is kept in a horizontal electric field, its period of oscillation will remain same.

Reason: If bob is charged and kept in horizontal electric field, then the time period will be decreased.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: b

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4. Assertion: Through large number of free electron are present in the metal, yet there is no current in the absent of electric field.

Reason: In the absence of electric field, electrons move remdomly in all directions

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: b

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5. Assertion: If the meduim between two charges is replaced by another medium of grater dielectric constant then the electric force between them decreases.

Reason: Electric dipole moment varies inversely as the dielectric constant.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: c

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6. Assertion: The electric field due to dipole on its axis line at a distance r is E. Then electric field due to the same dipole on the equatorial line and at the same distance will be $\frac{E}{2}$

Reason: Electric field due to dipole varies inversely as the square of distance.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: c

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7. Assertion: When a body acquires positive charge, its mass decreases

Reason: A body acquires positive charge when it loses electrons.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: a

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8. Assertion: A small metal ball is suspended in a uniform magnetic field with the help of an isulated thread. When a high energy X rays beam falls on the ball. Then the ball will be defected in the direction of electric field.

Reason: The ball will oscillate in the field.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: c

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9. Assertion: Vehicle carrying highly inflammable materials have hanging chains, slightly touching the ground.

Reason: The body of a vehicle gets charged when moving through air at high speed.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: a

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10. Assertion: A line of force has sudden breaks.

Reason: An electrostatic line of force is a continuous curve.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: a

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11. Assertion. When charges are shared between any two bodies, no charge is really lost but some loss of energy does occur.

Reason. Some energy disappears in the from of heat, sparking etc.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: b

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12. Assertion: The surface charge densities of two spherical conductors of different radii are equal. Then the electric field intensities near their surface are also equal.

Reason: Surface charge density is equal to charge per unit area.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: B

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13. Assertion: Three equal charges are situated on a circle of radius r such that they form on equilateral triangle, then the electric field intensity at the centre is zero.

Reason: The force on unit positive charge at the centre, due to the three equal charges are represented by three sides of a triangle taken in the same order. Therefore, electric field intensity at centre is zero.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: a

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14. Assertion: On going away from a point charge or a small electric dipole, electric field decreases at the same rate in both the cases

Reason: Electric field is inversly proportional to square of distance from the charge or an electric dipole.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: D

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15. Assertion: The whole charge of a conductor cannot be transferred to another isolated conductor.

Reason: The total transfer of charge from one to another is not possible.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the

Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: D

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16. Assertion: At a point in space, the electric field points towards north. In the region, surrounding this point the rate of change of potential will be zero along the east and west.

Reason: Electric field due to a charge is the space around the charge.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: b

View Text Solution

17. Assertion: A point charge is brought in an electric field. The field at a nearby point will increase, whatever be the nature of the charge.

Reason: The electric field is independent of the nature of charge.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: d

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18. Assertion: The lightening conductor at the top of high building has sharp pointed ends.

Reason: The surface density of charge at sharp points is very high resulting in setting up of electric wind.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the

Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: a

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19. Assertion: The tyres of aircraft's are slightly conducting.

Reason: If a conductor is connected to a ground, the extra charge induced on conductor will flow to ground.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: B

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20. STATEMENT -1 : Induced charge does not contribute to electric field or potential at a give point .

STATEMENT -2 : A point charge q_0 is kept outside a solid metallic sphere , the electric field inside the sphere is zero.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: d

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21. Assertion. A metallic shield in the form of a hollow shell, can be built to block an electric field.

Reason. In a hollow spherical shell, the electric field inside is not zero at every point.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: a

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22. Assertion: Two charges q_1 and q_2 are placed at separation r. Then magnitude of the force on each charge is F.

Reason: Now a third charge q_3 is placed near q_1 and q_2. Then force on q_1 and q_2 remains F.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: b

Watch Video Solution

23. A charge is given velocity perpendicular to uniform electric field then

Assertion: Initial power delivered by electric field is zero.

Reason: Path of charge particle is circular.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: c

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24. Assertion: A charge conductor may have charged particle inside it

Reason: There can't exist electric field lines inside the couductor.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the

Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: B

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25. Assertion: If there exists coulombic attracation between two bodies both of them may not be charged.

Reason: In coulombic attraction two bodies are oppositely charged.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. if both Assertion and Reason are false

Answer: c

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AIPMTNEET Questions

1. A simple pendulum of period T has a metal bob which is negatively charged. If it is allowed to oscillate above a positively charged metal plate, its period will

A. remains equal to T

B. less than T

C. greater than T

D. infinite

Answer: B

Watch Video Solution

2. 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. $9.28 \times 19^7 N/C$

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

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

Answer: a

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3. Cathode rays travelling from east to west enter into region of electric field directed towards north to south in the plane of paper. The deflection of cathode rays is towards

A. East

B. South

C. West

D. North

Answer: d

Watch Video Solution

4. A charge q is located at the centre of a cube. The electric flux through any face is

A. $\dfrac{4\pi q}{6(4\pi\varepsilon_0)}$

B. $\dfrac{\pi q}{6(4\pi\varepsilon_0)}$

C. $\dfrac{q}{6(4\pi\varepsilon_0)}$

D. $\dfrac{2\pi q}{6(4\pi\varepsilon_0)}$

Answer: a

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5. An electron is moving round the nucleus of a hydrogen atom in a circular orbit of radius r. The coulomb force $\vec{F}$ between the two is (where $k = \frac{1}{4\pi\varepsilon_0}$)

A. $-k\frac{e^2}{r^3}\hat{r}$

B. $k\frac{e^2}{r^3}\vec{r}$

C. $-k\frac{e^2}{r^3}\vec{r}$

D. $k\frac{e^2}{r^3}\hat{r}$

Answer: c

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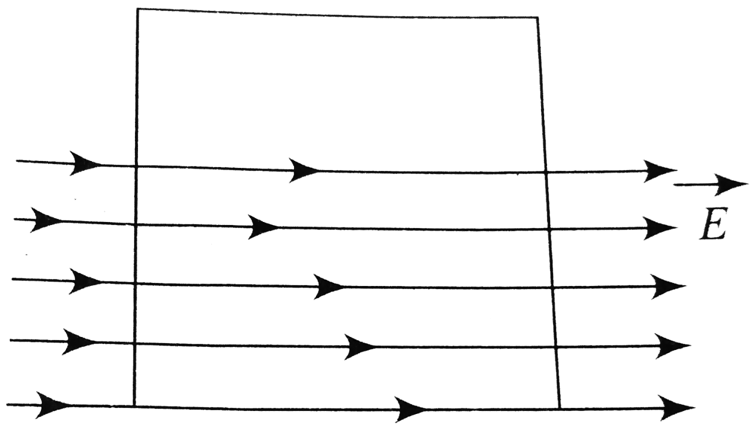
6. A square surface of side Lm is in the plane of the paper. A uniform electric field $\overrightarrow{E}\,(V/m)$, also in the plane of the paper, is limited only to the lower half of the square surface (see figure). The electric flux in SI units associated with the surface is:



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

B. $EL^2/2$

C. zero

D. EL^2

Answer: C

Watch Video Solution

7. An electric dipole of moment $\overrightarrow{P}$ is lying along a uniform electric field $\overrightarrow{E}$. The work done in rotating the dipole by 90° is:

A. $\sqrt{2}pE$

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

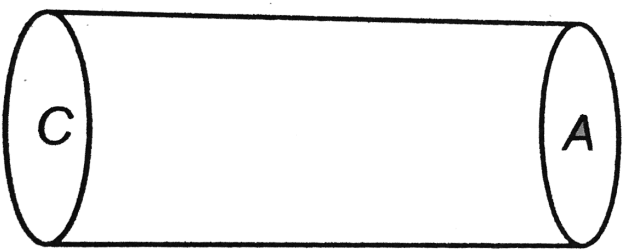
C. $2pE$

D. pE

Answer: d

Watch Video Solution

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

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

C. $\dfrac{\phi}{3}$

D. $\dfrac{q}{\varepsilon_0} - \phi$

Answer: A

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9. 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 $+y$ direction

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

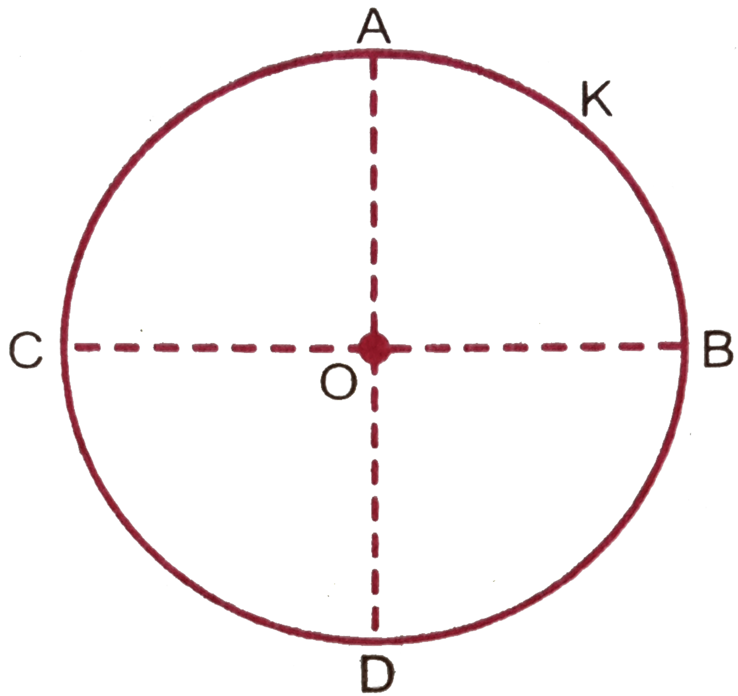
C. qa along the line joining points $(x = 0, y = 0, z = 0)$ and $(x = a, y = a, z = 0)$

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

Answer: b

Watch Video Solution

10. A thin conducting ring of radius R is given a charge $+Q$, Fig. The electric field at the center O of the ring due to the charge on the part AKB of the ring is E. The electric field at the center due to the charge on part $ACDB$ of the ring is



A. $3E$ along KO

B. E along OK

C. E along KO

D. $3E$ along OK

Answer: b

Watch Video Solution

11. The mean free path of electrons in a metal is $4 \times 10^{-8}m$ The electric field which can give on an average $2eV$ energy to an electron in the metal will be in the units V/m

A. 8×10^{-7}

B. 5×10^{-11}

C. 8×10^{-11}

D. 5×10^{7}

Answer: d

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12. 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. $\frac{4\pi\varepsilon_0 F d^2}{e^2}$

B. $\sqrt{\frac{4\pi\varepsilon_0 F e^2}{d^2}}$

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

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

Answer: c

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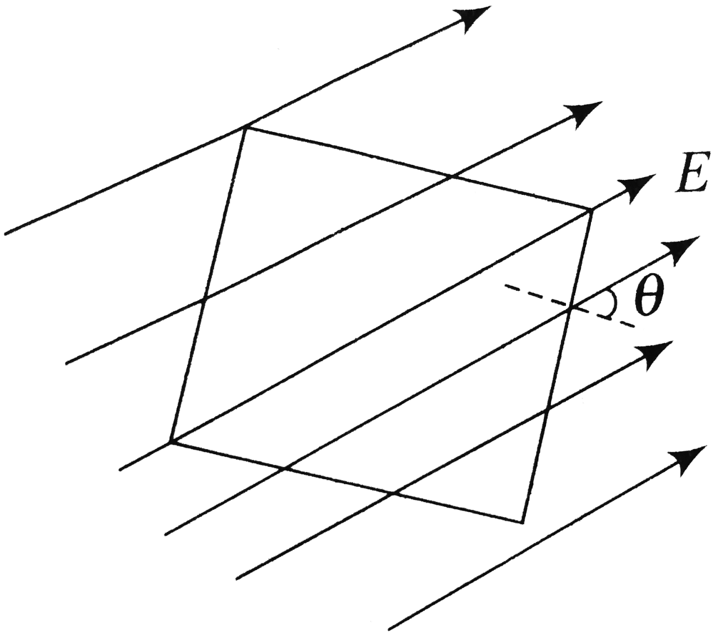
13. A square surface of side L metre in the plane of the paper is placed in a uniform electric field $E(\text{volt}/m)$ acting along the same place at an anlge θ with the horizontal side of the square as shown in figure. The electric flux linked to the surface in uint of

$V - m$ is



A. EL^2

B. $EL^2 \cos\theta$

C. $EL^2 \sin\theta$

D. 0

Answer: D

Watch Video Solution

14. The electric field at a distance $3R/2$ from the centre of a charge conducting spherical shell of radius R is E. The electric field at a distance $R/2$ from the centre of the sphere is

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

B. zero

C. E

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

Answer: b

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15. 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. be reduced to half

B. remain the same

C. be doubled

D. increase four times

Answer: b

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16. The electric potential V at any point x, y, z (all in meters) in space is given by $V = 4x^2$ volts. The electric field at the point (1m, 0, 2m) is.................V/m.

A. 8 along positive X-axis

B. 16 along negative X axis

C. 16 along X-aixs

D. 8 along, negative X-axis

Answer: D

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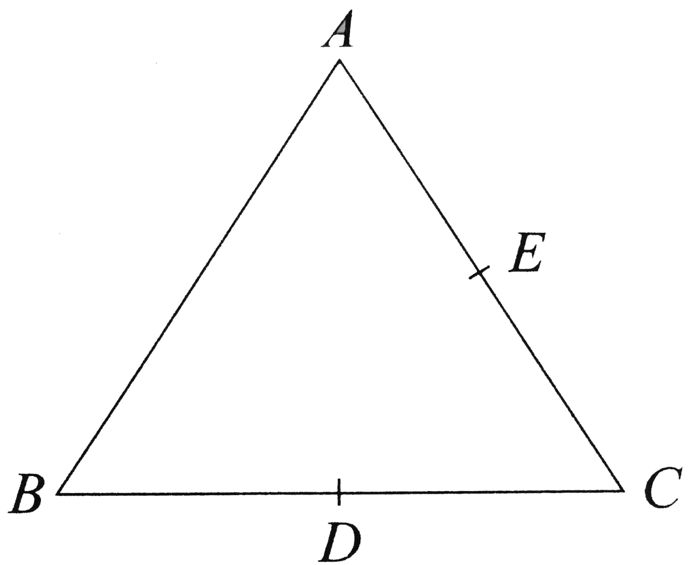
17. Three charges each $+q$, are placed at the corners of an isosceles triangle ABC of sides BC and AC, $2a$, D and E are the mid-points of BC and CA. The work done in taking a charge Q from D to E is



A. $\frac{eqQ}{8\pi\varepsilon_0 a}$

B. $\frac{qQ}{4\pi\varepsilon_0 a}$

C. zero

D. $\dfrac{3qQ}{4\pi\varepsilon_0 a}$

Answer: C

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18. An electric dipole moment p is placed in an electric field of intensity $'E'$. The dipole acquires a position such that the axis of the dipole makes an angle θ with the direction of the field. Assuming that the potential energy of the dipole to be zero when $\theta = 90^\circ$, the torque and the potential energy of the dipole will respectively be

A. $pE\cos\theta, \ -pE\sin\theta$

B. $pE\sin\theta, \ -pE\cos\theta$

C. $pE\sin\theta, \ -2pE\cos\theta$

D. $pE\sin\theta, 2pE\cos\theta$

Answer: b

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19. What is the flux through a cube of side $'a'$ if a point charge of q is at one of its corner :

A. $\frac{q}{2\in_0}6a^2$

B. $\frac{2q}{\in_0}$

C. $\frac{q}{8 \in_0}$

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

Answer: c

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20. Two metallic sphere of radii $1cm$ and $3cm$ are given charges of $4 \times 10^{-2}C$ and respectively. If these are connected by a counducting wire, the final charge on the bigger sphere is

A. $2 \times 10^{-2}C$

B. $3 \times 10^{-2} C$

C. $4 \times 10^{-2} C$

D. $1 \times 10^{-2} C$

Answer: B

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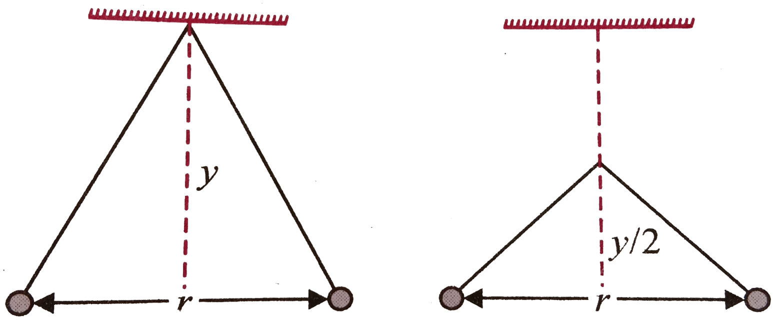
21. Two path balls carrying equal charges are suspended from a common point by strings of equal length, the strings are rightly clamped at half the height. The equilibrium separation between the balls, now becomes :



A. $\left(\frac{1}{\sqrt{2}}\right)^2$

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

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

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

Answer: b

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22. 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. $4\pi\varepsilon_0 Aa^2$

B. $A\varepsilon_0 a^2$

C. $4\pi\varepsilon_0 Aa^3$

D. $\varepsilon_0 Aa^2$

Answer: c

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23. 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 length is $2cm$,-

A. $5mC$

B. $7\mu C$

C. $8mC$

D. $2mC$

Answer: D

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24. Suppose the charge of a proton and an electron differ slightely. One of them is $-e$, the other is $(e + \Delta e)$. If the net of electrostatic force and gravitational force between two hydrogen atoms placed at a distance d (much greater than atomic size) apart is zero. Then Δe is of the order of [Given mass of hydrogen $m_h = 1.67 \times 10^{-27} kg$]

A. $10^{-23} C$

B. $10^{-37} C$

C. $10^{-47} C$

D. $10^{-20} C$

Answer: b

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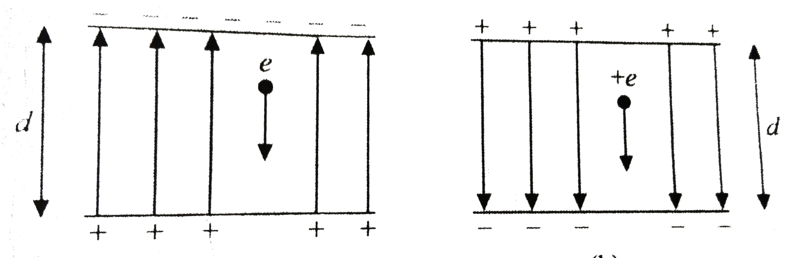
AIIMS Questions

1. An electron (mass m_e)falls through a distance d in a uniform electric field of magnitude E.



(a) (b)

,

The direction of the field is reversed keeping its magnitudes unchanged, and a proton(mass m_p) falls through the same distance. If the times taken by the electrons and the protons to fall the distance d is

t_{electron} and t_{proton} respectively, then the ratio $t_{\text{electron}} / t_{\text{proton}}$.

A. equal

B. smaller

C. 10 times greater

D. 5 times greater

Answer: b

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2. The point charges Q and $-2Q$ are placed at some distance apart. If the electirc field at the location of Q

is E, the electric field at the location of $-2Q$ will be

A. $-\frac{3E}{2}$

B. $-\frac{E}{2}$

C. $-E$

D. $-2E$

Answer: B

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3. An electron having charge $'e'$ and mass $'m'$ is moving a uniform electric field E. Its acceleration will be

A. $\dfrac{e^2}{m}$

B. $\dfrac{E^2 e}{m}$

C. $\dfrac{eE}{m}$

D. $\dfrac{mE}{e}$

Answer: c

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4. A conducting sphere of radius $10cm$ is charged $10\mu C$. Another uncharged sphere of radius $20cm$ is allowed to touch it for some time. After that if the spheres are separated, then surface density of charges, on the spheres will be in the ratio of

A. $1:4$

B. $1:3$

C. $2:1$

D. $1:1$

Answer: C

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5. An electric dipole in a uniform electric field experiences (When it is placed at an angle θ with the field)

A. only a force but not torque

B. only a torque but no net force

C. both, a torque and a net force

D. no torque and no net force

Answer: c

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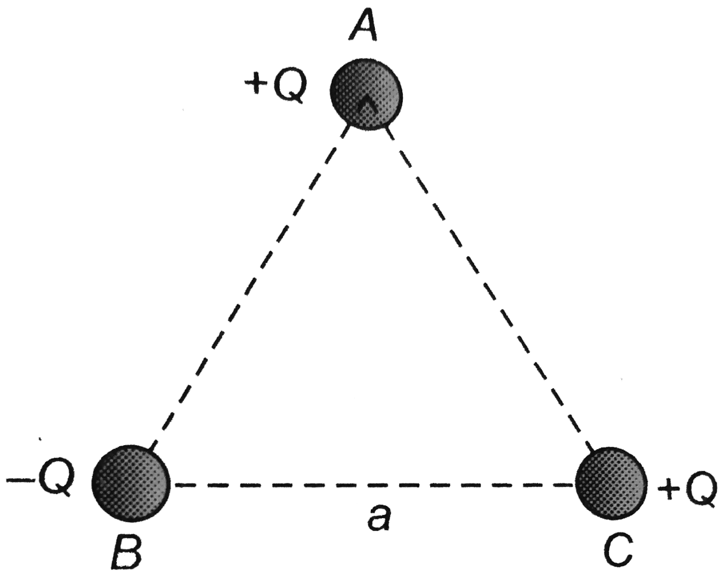
6. Three charges are placed at the vertices of an equilateral triangle of side a as shown in the following figure. The force experienced by the charge placed at the vertex A in a direction normal to BC is



A. $\dfrac{Q^2}{(4\pi\varepsilon_0 a^2)}$

B. $\dfrac{-Q^2}{(4\pi\varepsilon_0 a^2)}$

C. Zero

D. $\dfrac{Q^2}{(2\pi\varepsilon_0 a^2)}$

Answer: c

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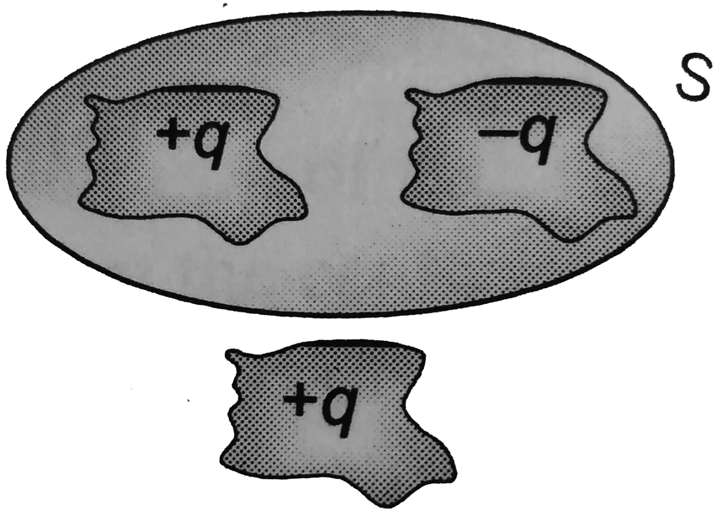
7. Shown below is a distribution of charges. The flux of electric field due to these charges through the surface S is



A. $\frac{3q}{\varepsilon_0}$

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

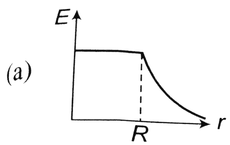
C. $\frac{q}{\varepsilon_0}$

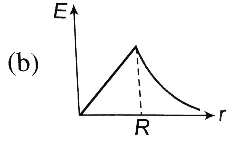
D. Zero

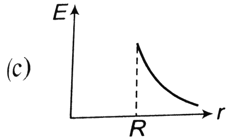
Answer: d

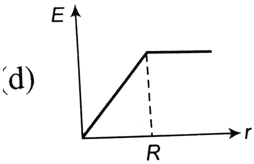
Watch Video Solution

8. The electric field due to uniformly charged sphere of radius R as a function of the distance from its centre is represented graphically by

A. 

B. 

C. 

D. 

Answer: B

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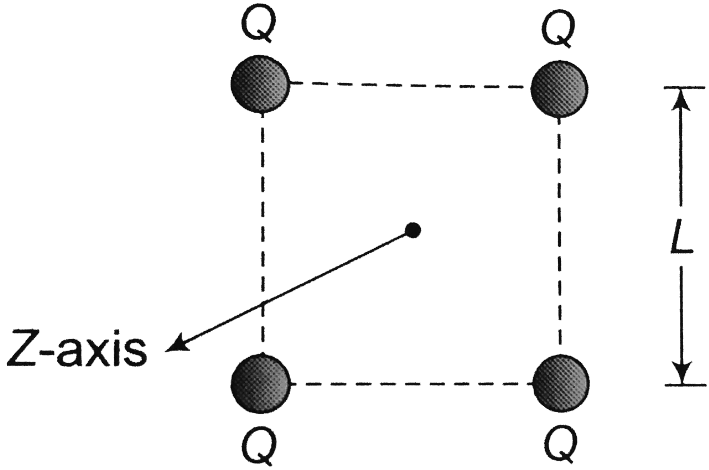
9. Four point $+ve$ charges of same magnitude(Q) are placed at four corners of a rigid square frame as shown in figure. The plane of the frame is perpendicular to z-axis. If a $-ve$ point charge is placed at a distance z away from the above frame $(z < < L)$ then



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 the frame

D. It passes through the frame only once.

Answer: a

Watch Video Solution

10. Two infinitely long parallel conducting plates having surface charge densities $+\sigma$ and $-\sigma$ respectively, are seperated by a small distance. The medium between the plates is vacuum. If ε_0 is the dielectric permittivity of vacumm, then the electric field in the region between the plates is

A. $0 \text{volts} / meter$

B. $\frac{\sigma}{2\varepsilon_0} \text{volts} / meter$

C. $\frac{\sigma}{\varepsilon_0} \text{volts} / meter$

D. $\frac{2\sigma}{\varepsilon_0}$ volts / $meter$

Answer: C

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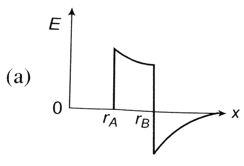
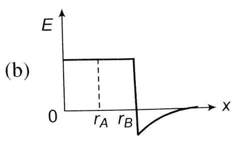
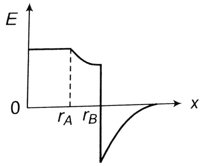
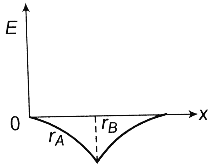
11. Two concentric coducting thin spherical shells A and B having radii r_A and $r_B (r_B > r_A)$ are charged to Q_A and $-Q_B (|Q_B| > |Q_A|)$. The electrical field along a line passing through the centre is

A. 

B. 

C. 

D. 

Answer: a

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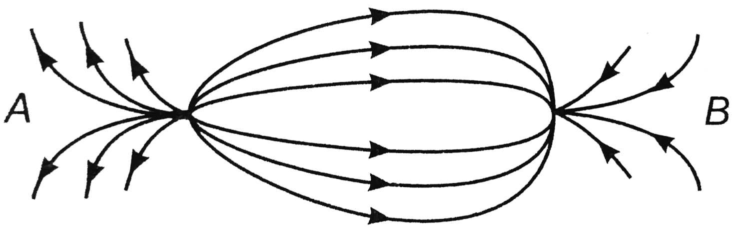
12. The spatial distribution of the electric field due to charges (A, B) is shown in figure. Which of the following statements is correct?



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

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

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

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

Answer: d

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

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

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

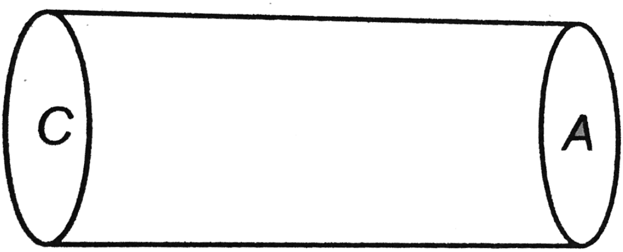
C. $\sqrt{2}qa$ along the line joining points $(x=0, y=0, z=0)$ and $(x=a, y=a, z=0)$

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

Answer: c

Watch Video Solution

14. 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. $\dfrac{q}{\varepsilon_0} - \phi$

B. $\dfrac{q}{2\varepsilon_0}$

C. $\dfrac{\phi}{3}$

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

Answer: d

Watch Video Solution

15. Two point charges $+8q$ and $-2q$ are located at $x = 0$ and $x = L$ respectively. The location of a point on the x axis at which the net electric field due to these two point charges is zero is

A. $8L$

B. $4L$

C. $2L$

D. $L/4$

Answer: c

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16. A sphere of radius R has a uniform distribution of electric charge in its volume. At a distance x from its centre, for $x < R$, the electric field is directly proportional to

A. $\frac{1}{x^2}$

B. $\frac{1}{x}$

C. x

D. x^2

Answer: C

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17. A positively charge particle moving along x-axis with a certain velocity enters a uniform electric field directed along positively y-axis. Its

A. vertical velocity changes but horozontal velocity remains constant

B. horizontal velocity changes but vertical velocity remains constant

C. both vertical and horizontal velocities change

D. neither verticle nor horizontal velocity changes

Answer: a

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18. An electron falls through a small distance in a uniform electric field of magnitude $2 \times 10^4 NC^{-1}$.

The direction of the field reversed keeping the magnitude unchanged and a proton falls through the same distance. The time of fall will be

A. same in both cases

B. more in the case of electron

C. more in the case of proton

D. independent of charge

Answer: c

Watch Video Solution

19. Two point charge $-q$ and $+q/2$ are situated at the origin and the point $(a, 0, 0)$ respectively. The point along the X-axis where the electic field Vanishes is

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

B. $x = \sqrt{2}a$

C. $x = \frac{\sqrt{2}a}{\sqrt{2}-1}$

D. $x = \frac{\sqrt{2}a}{\sqrt{2}+1}$

Answer: c

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20. Two charges each equal to $\eta q(\eta^{-1} < \sqrt{3})$ are placed at the corners of an equilateral triangle of side a. The electric field at the third corner is E_3 where $(E_0 = q/4\pi\varepsilon_0 a^2)$

A. $E_3 = E_0$

B. $E_3 < E_0$

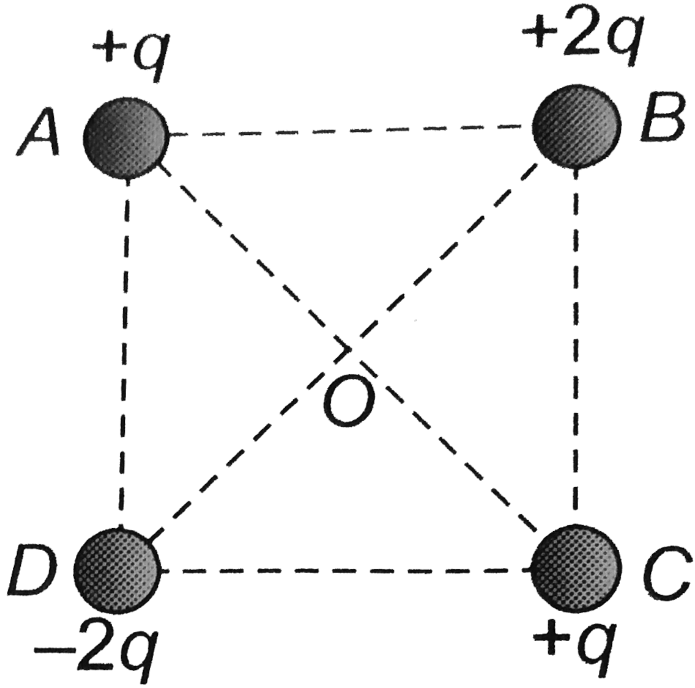
C. $E_3 > E_0$

D. $E_3 \geq E_0$

Answer: c

Watch Video Solution

21. Four charges are arranged at the corners of a square $ABCD$, as shown in the adjoining figure, The force on a positive charge kept at the centre O is



A. zero

B. along the diagonal AC

C. along the diagonal BD

D. perpendicular to side AB

Answer: c

Watch Video Solution

22. In a certain region of space, electric field is along the z-direction throughout. The magnitude of electric field is , however, not constant but increases uniformly along the positive z-direction. At the rate of $10^5 NC^{-1}m^{-1}$. What are the force and torque experienced by system having a total dipole moment equal to 10^{-7}Cm in the negative z-direction?

A. $10^{-4}N$ along $+z$-direction

B. $10^{-4}N$ along $-z$-direction

C. $10^{-2}N$ along $-z$-direction

D. $10^{-2}N$ along $+z$-direction

Answer: c

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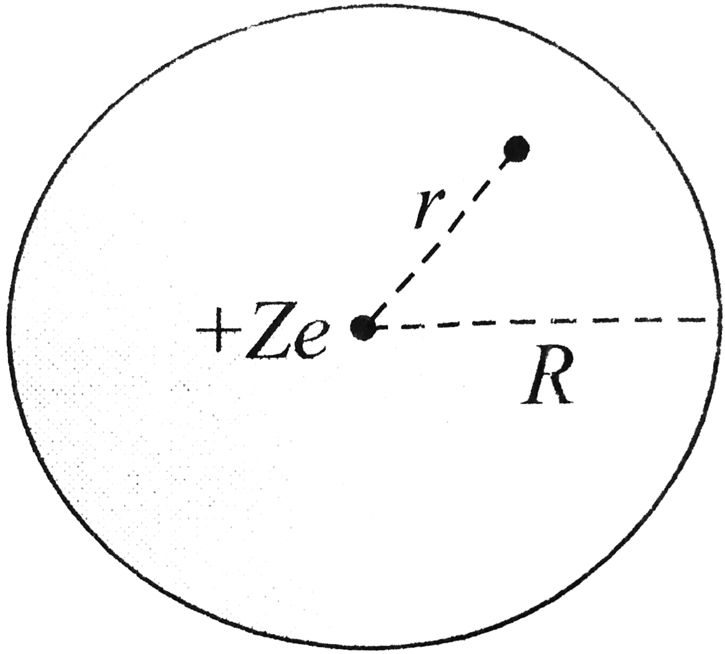
23. According to early model of an atom, the atom is considered it to have a positively charged point nucleus of charge Ze surrounded by a uniform density of negative charge up to a radius R. The atom as a whole is neutral. The electric field at a distance r from the nucleus is $(r < R)$



A. $\frac{Ze}{4\pi\varepsilon_0}\left[\frac{r}{R^3}-\frac{1}{r^2}\right]$

B. $\frac{Ze}{4\pi\varepsilon_0}\left[\frac{r}{R^3}+\frac{1}{r^2}\right]$

C. $\frac{Ze}{4\pi\varepsilon_0}\left[\frac{1}{r^2}-\frac{r}{R^3}\right]$

D. $\frac{Ze}{4\pi\varepsilon_0}\left[\frac{1}{r^3}-\frac{r}{R^2}\right]$

Answer: A

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24. A large solid sphere with uniformly distributed positive charge has a smooth narrow tunnel along its direction. A small particle with negative charge, initially at rest far from the sphere, approaches it along the line of the tunnel, reaches its surface with a speed v, and passes through the tunnel. Its speed at the centre of the sphere will be

A. 0

B. $\sqrt{1.5v}$

C. $\sqrt{2}$

D. v

Answer: b

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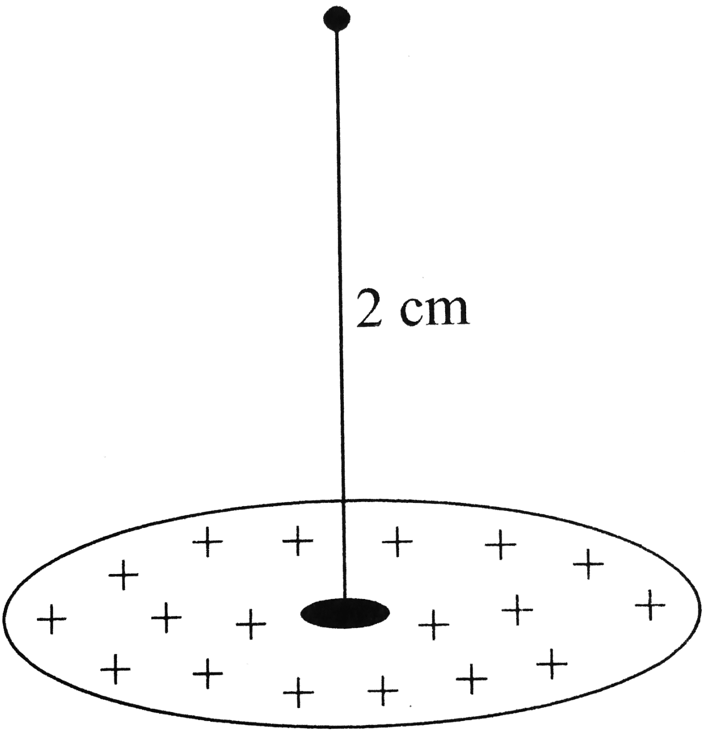
25. A uniformly charged non conducting disc with surface charge density $10nC/m^2$ having radius $R = 3cm$. Then find the value of electric field intensity at a point on the perpendicular bisector at a distance of $r = 2cm$



A. $348.6N/C$

B. $305.6N/C$

C. $251.2N/C$

D. $116.8N/C$

Answer: c

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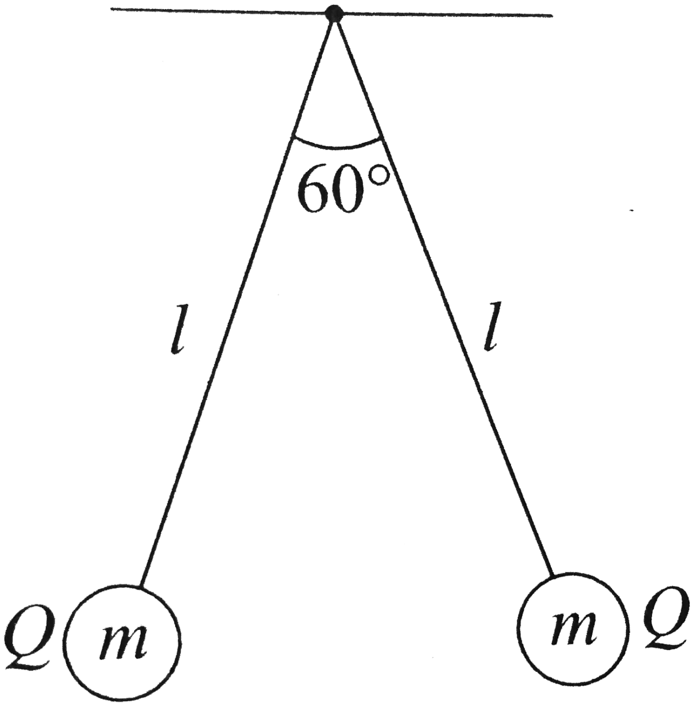
26. Two small balls, each having equal positive charge Q are suspended by two insulation strings of equal length l from a hook fixed to a stand. It mass of each ball $= m$ and total angle between the two strings is

60° m, then find the charge on each ball.



A. $\sqrt{\dfrac{mg}{4\pi\varepsilon_0 l^2}}$

B. $\sqrt{2\pi\varepsilon_0 l^2 mg}$

C. $\sqrt{\dfrac{\pi\varepsilon_0 l^2 mg}{4}}$

D. $\sqrt{\dfrac{4\pi\varepsilon_0 l^2 mg}{\sqrt{3}}}$

Answer: d

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Assertion Reason

1. Assertion. A metallic shield in the form of a hollow shell, can be built to block an electric field.

Reason. In a hollow spherical shell, the electric field inside is not zero at every point.

A. If both assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both assertion and reason are true but Reason is not the correct explanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If both assertion and reason are false

Answer: a

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2. Assetrion: Electric lines of force never cross each other.

Reason: Electric field at a point superimpose to give one resultant electric field

A. If both assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both assertion and reason are true but Reason is not the correct explanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If both assertion and reason are false

Answer: a

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3. Assetrion: The coulomb force is the dominating force in the universe.

Reason: The coulomb force is weaker than the gravitational force.

A. If both assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both assertion and reason are true but Reason is not the correct explanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If both assertion and reason are false

Answer: d

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4. Assetrion: Electric lines of force cross each other.

Reason: Electric field at a point superimpose to give one resultant electric field.

A. If both assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both assertion and reason are true but Reason is not the correct explanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If both assertion and reason are false

Answer: d

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5. Assetrion: If a proton and electron are placed in the same uniform electric field. They experience different acceleration

Reason: Electric force on a test charge is independent of its mass

A. If both assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both assertion and reason are true but Reason is not the correct explanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If both assertion and reason are false

Answer: B

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6. Assetrion: Acceleration of charged particle in non-uniform electric field does not depend on velocity of charged particle.

Reason: Charge is an invariant quantity. That is amount of charge on particle does not depend on frame of reference.

A. If both assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both assertion and reason are true but Reason is not the correct explanation of the Assertion.

C. If Assertion is true, but the Reason is false.

D. If both assertion and reason are false

Answer: b

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7. Assetrion: Net electric field insider conductor is zero

Reason: Total positive charge equals to total negative charge in a conductor

A. If both assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both assertion and reason are true but Reason is not the correct explanation of the

Assertion.

C. If Assertion is true, but the Reason is false.

D. If both assertion and reason are false

Answer: c

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Section D - Chapter End Test

1. The charge on $500cc$ of water due to protons will be

A. $6.0 \times 10^{27} C$

B. $2.67 \times 10^{7} C$

C. $6 \times 10^{23} C$

D. $1.67 \times 10^{23} C$

Answer: b

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2. A soap bubble is given a negative charge, then its radius

A. Decrease

B. Increase

C. Remain same

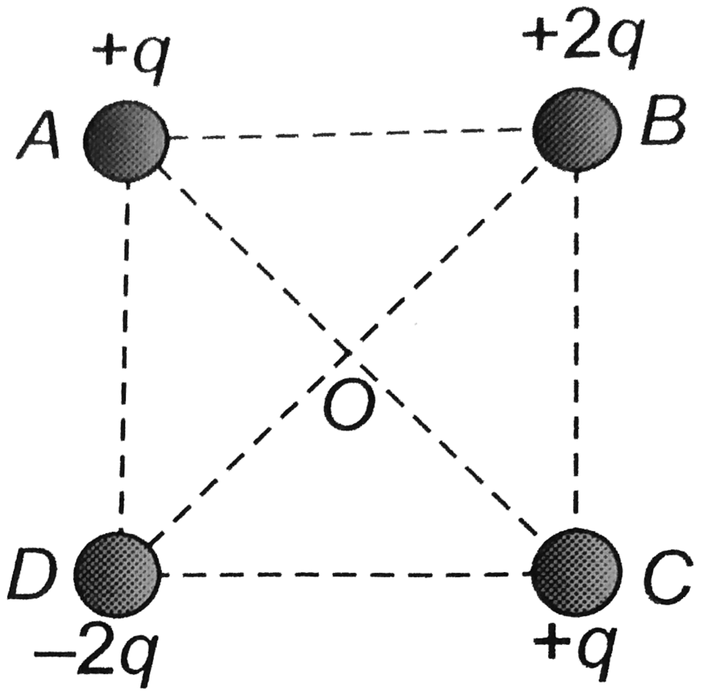
D. Nothing can be predicted as uniformation is insufficient

Answer: B

Watch Video Solution

3. Four charges are arranged at the corners of a square $ABCD$, as shown in the adjoining figure, The

force on a positive charge kept at the centre O is



A. Zero

B. Along the diagonal AC

C. Along the diagonal BD

D. Perpendicular to side AB

Answer: c

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4. $+2C$ and $+6C$ two charges are repelling each other with a force of $12N$. If each charges is given $-2C$ of charge is given $-2C$ of charge, then the value of the force will be

A. $4N$ (Attractive)

B. $4N$ (Repulsive)

C. $8N$ (Repulsive)

D. Zero

Answer: d

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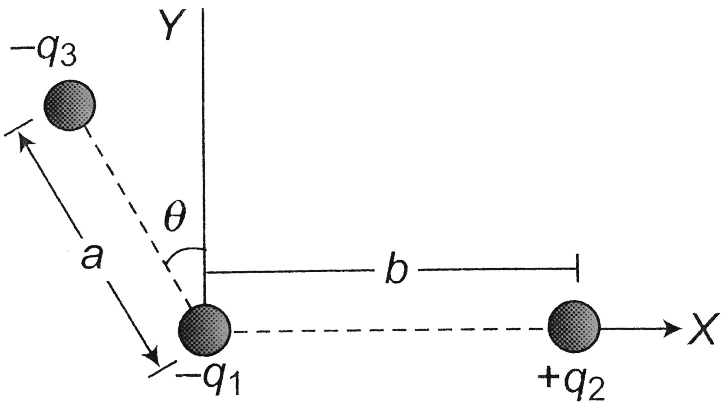
5. Three charges $-q_1$, $+q_2$ and $-q_3$ are placed as shown in the figure. The x-component of the force on $-q_1$ is proportional to



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

Answer: c

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6. Two metal pieces having a potential difference of $800V$ are $0.02m$ apart horizontally. A particle of mass $1.96 \times 10^{-15} kg$ is suspended in equilibrium between the plates. If the e is the elementary charge, then charge on the particle is

A. e

B. $3e$

C. $6e$

D. $8e$

Answer: b

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7. 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. $\dfrac{1}{4\pi\varepsilon_0}A\gamma_0^3$

B. $4\pi\varepsilon_0 A\gamma_0^3$

C. $\dfrac{4\pi\varepsilon_0 A}{\gamma_0}$

D. $\dfrac{1}{4\pi\varepsilon_0}\dfrac{A}{\gamma_0^3}$

Answer: b

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8. Two equal charges are separated by a distance d. A third charge placed on a perpendicular bisector at x distance will experience maximum coulomb force when

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

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

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

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

Answer: c

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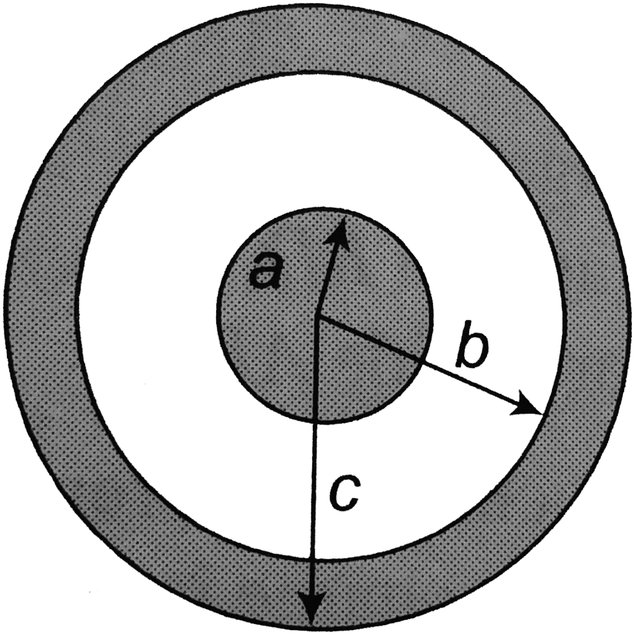
9. A solid conducting sphere of radius a has a net positive charge $2Q$. A conducting spherical shell of inner radius b and outer radius c is concentric with the solid sphere and has a net charge $-Q$. The surface charge density on the inner and outer surfaces of the spherical shell will be



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. None of the above

Answer: A

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10. Two small spheres of masses $M_1$and M_2 are suspended by weightless insulating threads of lengths L_1 and L_2. The spheres carry charges Q_1 and Q_2 respectively. The spheres are suspended such that they are in level with one another and the threads are inclined to the vertical at angles θ_1 and $\theta_2$respectively. Which one of the following conditions is essential for $\theta_1 = \theta_2$?

A. If $m_1 = m_2$

B. $|q_1| = |q_2|$

C. $l_1 = l_2$

D. $\frac{q_1}{m_1} = \frac{q_2}{m_2}$

Answer: a

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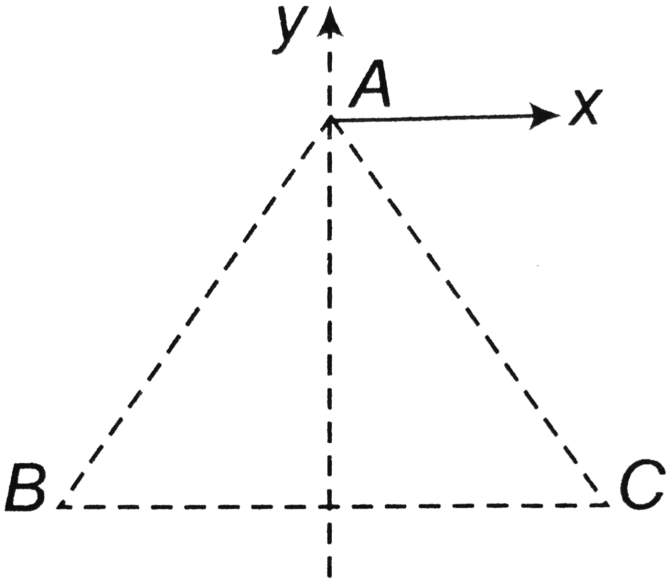
11. Three similar charges $+q$ are placed on 3 corners of an equilateral triangle ABC of side a. How many minimum charges should be placed on a circle of radius a with centre at A so that resultant force on the charge placed at the centre is $\frac{q^2}{4\pi\varepsilon_0 a^2}$ along x-

axis?



A. 4

B. 6

C. 3

D. Any number

Answer: C

12. A solid metallic sphere has a charge $+3Q$. Concentric with this sphere is a conducting spherical shell having charge $-Q$. The radius of the sphere is a and that of the spherical shell is $b(b > a)$ What is the electric field at a distance $R(a < R < b)$ from the centre

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

B. $\dfrac{3Q}{2\pi\varepsilon_0 R}$

C. $\dfrac{3Q}{4\pi\varepsilon_0 R^2}$

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

Answer: C

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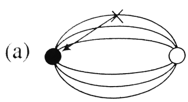
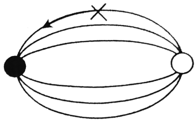
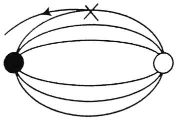
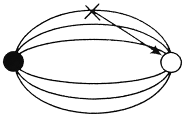
13. The following diagram shows the electric field lines between two opposite charges. The positive charge is indicated by the black circle, the negative charge by the white circle. An electron string from rest at the indicated position (X), and accelerated to high speed by the electric field will follow most likely which trajectory?

A. 

B. (b)


C. (c)


D. (d)


Answer: c

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14. The magnitude of electric field intensity at point $B(2, 0, 0)$ due to dipole of dipole moment, $\overrightarrow{p} = \hat{i} + \sqrt{3}\hat{j}$ kept at origin is (assume that the point B is at large distance from the dipole and $k = \frac{1}{4\pi\varepsilon_0}$)

A. $\frac{\sqrt{13}k}{8}$

B. $\frac{\sqrt{13}k}{4}$

C. $\frac{\sqrt{7}k}{8}$

D. $\frac{\sqrt{7}k}{4}$

Answer: C

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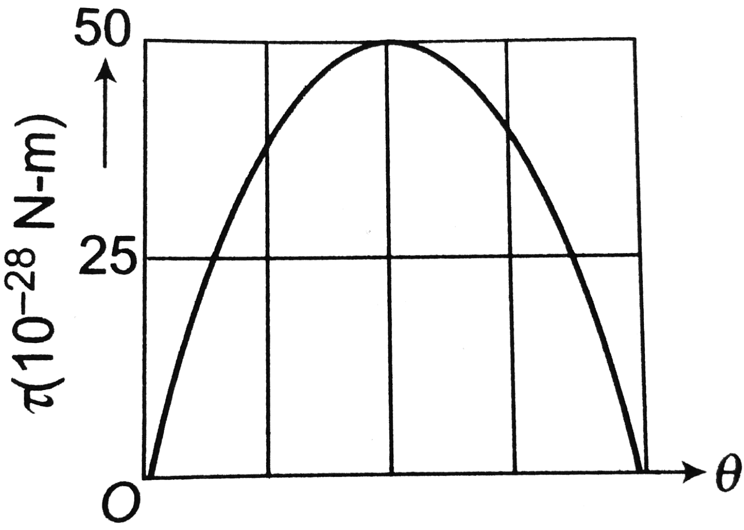
15. An electric dipole is placed in a uniform electric field $\vec{E}$ of magnitude $40 N/C$. Graph shows the magnitude of the square on the dipole versus the angle θ between the field $\overrightarrow{E}$ and the dipole moment $\overrightarrow{p}$. The magnitude of dipole moment $\overrightarrow{p}$ is equal to:



A. $1.25 \times 10^{-28} C - m$

B. $2.0 \times 10^{-25} C - m$

C. $2.5 \times 10^{-28} C - m$

D. $5.0 \times 10^{-28} C - m$

Answer: a

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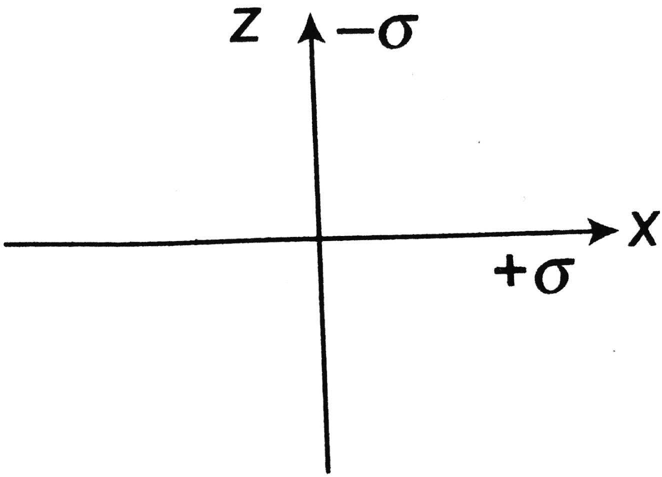
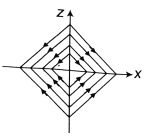
16. Two infinitely large charged planes having uniform suface charge density $+\sigma$ and $-\sigma$ are placed along $x-y$ plane and yz plane respectively as shown in the figure. Then the nature of electric lines of forces in

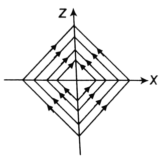
$x - z$ plane is given by:



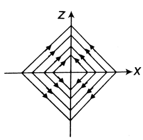
A. (a)



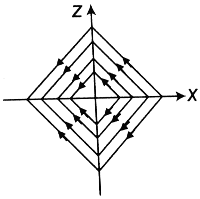
B. (b)



C. (c)



(d)



D.

Answer: c

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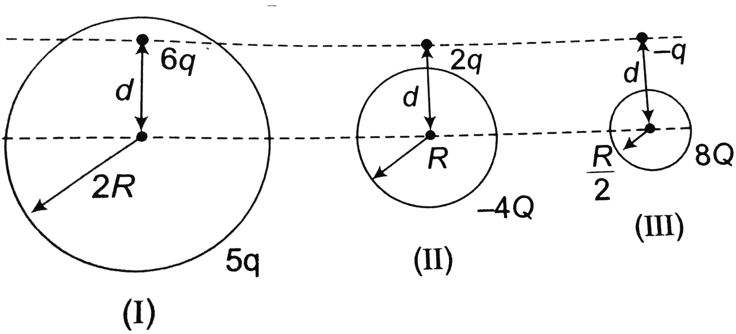
17. Figure, shown above, shows three situations involving a charged particle and a uniformly charged spherical shell. The charges and radii of the shells are indicated in the figure. If F_1, F_2 and F_3 are the magnitudes of the force on the particle due to the shell in situations (I),(II) and (III) then



A. $F_3 > F_2 > F_1$

B. $F_2 > F_2 = F_3$

C. $F_3 = F_2 > F_1$

D. $F_1 > F_2 > F_3$

Answer: c

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18. There are three concentric thin spheres of radius $a, b, c (a > b > c)$. The total surface charge densities on their surfaces are $\sigma, -\sigma, \sigma$ respectively. The magnitude of the electric field at r (distance from centre) such that $a > r > b$ is:

A. 0

B. $\frac{\sigma}{\in_0 r^2}\left(b^2 - c^2\right)$

C. $\frac{\sigma}{\in_0 r^2}\left(a^2 + b^2\right)$

D. none of these

Answer: b

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19. A α particle is released from rest $10cm$ from a large sheet carrying a surface charge density of $-2.21 \times 10^{-9} C / m^2$. It will strike the sheet after the time. ($\in_0 = 8.84 \times 10^{-22} C^2 / Nm^2$)

A. $4\mu s$

B. $2\mu s$

C. $2\sqrt{2}\mu s$

D. $4\sqrt{2}\mu s$

Answer: d

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20. A ring of radius R has charge $-Q$ distributed uniformly over it. Calculate the charge that should be placed at the center of the ring such that the electric field becomes zero at a point on the axis of the ring at distant R from the center of the ring.

A. $\frac{Q}{2}\sqrt{3}$

B. $\frac{Q}{4}\sqrt{2}$

C. $\frac{Q}{3}\sqrt{2}$

D. $\frac{Q}{4}\sqrt{3}$

Answer: B

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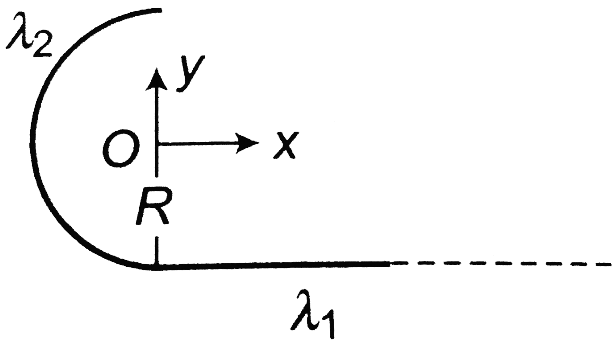
21. In a figure shown find the ratio of the linear charge densites λ_1 (on semi-infinite straight wire) and λ_2 (on semi-circular part) that is, λ_1 / λ_2 so that the field at O is along y direction.



A. 2

B. 1.5

C. 3

D. 2.5

Answer: a

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22. A sphere of radius R carries charge such that its volume charge density is proportional to the square of the distance from the centre. What is the ratio of the magnitude of the electric field at a distance $2R$ from the centre to the magnitude of the electric field at a distance of $R/2$ from the centre?

A. 2

B. 1.5

C. 3

D. 2.5

Answer: A

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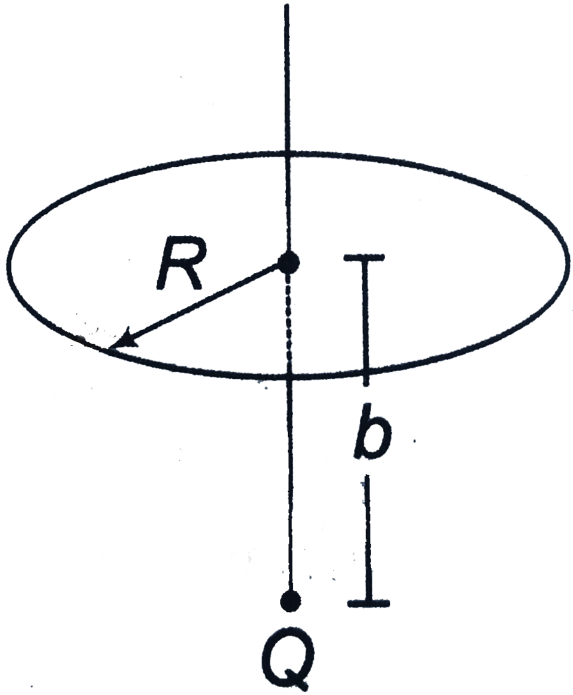
23. A point charge Q is located on the axis of a disc of radius R at a distance b from the plane of the disc (figure). Show that if one-fourth of the electric flux from the charge passes through the disc, then

$R = \sqrt{3}b.$



A. $\sqrt{5}b$

B. $\sqrt{2}b$

C. $\sqrt{3}b$

D. $2\sqrt{3}b$

Answer: c

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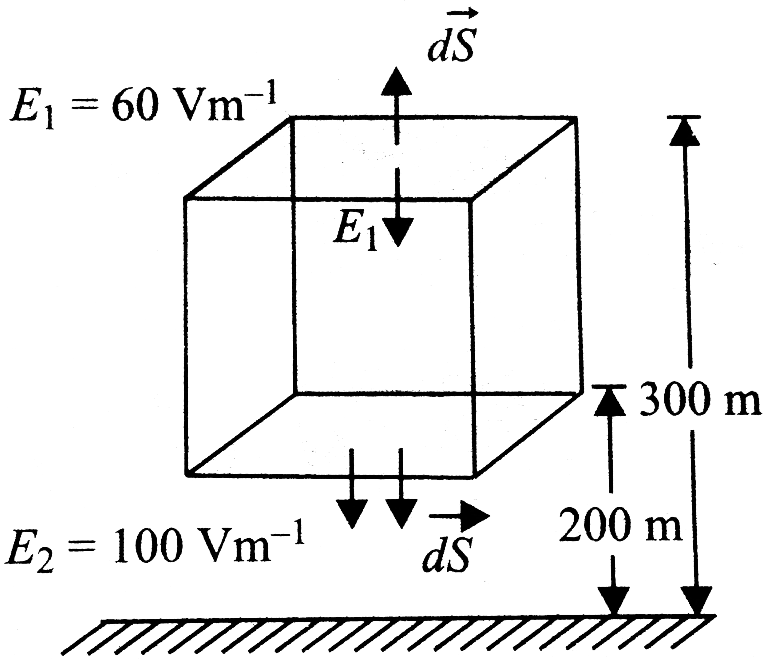
24. It has been experimentally observed that the electric field in a large region of earth's atmosphere is directed vertically down. At an altitude of 300 m, the electric field $60Vm^{-1}$. At an altitude of 200 m, the field is 100 V m^(-1), the field is $100Vm^{-1}$. Calculate the net amount of charge contained in the cube of

100 m edge, located between 200 and 300 m altitude.



A. $1.5 \times 10^5 \varepsilon_0 C$

B. $2 \times 10^5 \varepsilon_0 C$

C. $3 \times 10^5 \varepsilon_0 C$

D. $4 \times 10^5 \varepsilon_0 C$

Answer: d

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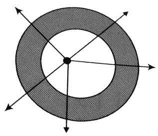
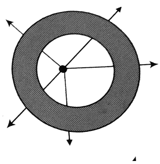
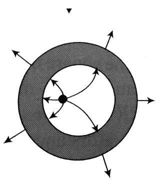
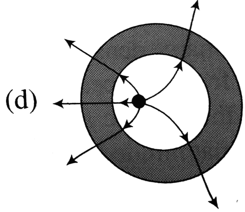
25. A metallic shell has a point charge 'q' kept inisde its cavity. Which one of the following diagrams correctly represents the electric lines of forces?

A. (a) 

B. (b) 

C. (c) 



D.

Answer: c

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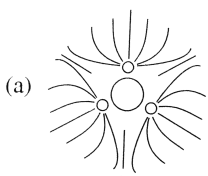
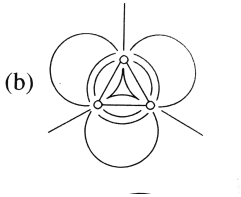
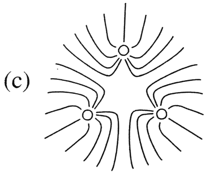
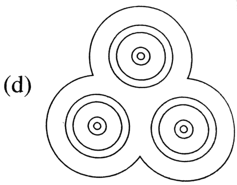
26. Three poistive charges of equal value q are placed at the vertices of an equilateral triangle. The resulting lines of force should be sketched as in



A.

B. 

C. 

D. 

Answer: c

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27. Assertion: A charged by cannot attract another uncharged body.

Reason: Oppositely charged boils attract each other.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. If Assertion is false but Reason is true.

Answer: b

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28. Assertion: A charge particle is free to move along electric field. It does not move along an electric line of force?

Reason: Its initial position decides that it will move along the line of force or nor.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the Assertion.

C. if Assertion is true, but the Reason is false.

D. If Assertion is false but Reason is true.

Answer: d

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29. Assertion: Column's law can be derived from `Gauss's law.

Reason: Gauss's law can be derived from Coulombs law.

A. if both Assertion and Reason are true and the Reason is correct explanation of the Assertion.

B. If both Assertion and Reason are true but Reason is not the correct explanation of the

Assertion.

C. if Assertion is true, but the Reason is false.

D. If Assertion is false but Reason is true.

Answer: C

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Others

1. If a body is charged by rubbing it. Its weight

A. always decreases slightly

B. always increases slightly

C. may increase slightly or may decrease slightly

D. remains precisely the same

Answer: C

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2. In a general, metallic ropes are suspended on the carries which take inflammable material. The reason is

A. There speed is controlled

B. To keep the center of gravity of the carrier nearer to the earth

C. To keep the body of the carrier in contact with the earth

D. Nothing should be placed under the carrier

Answer: C

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3. Four metal conductors having different shapes

1. A sphere 2. Cylindrical

3.Pear 4.Lightning conductor

Are mounted on insulating stands and charged. The one which is best suited to retain the charges for a longer time is

A. 1

B. 2

C. 3

D. 4

Answer: A

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4. What is the amount of charge possessed by $1kg$ of electrons

A. $6.25 \times 10^{10} C$

B. $1.76 \times 10^{11} C$

C. $1.76 \times 10^{10} C$

D. $1.25 \times 10^{10} C$

Answer: B

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5. A polythene piece rubbed with wool is found to have negative charge of $3.6 \times 10^{-7} C$. Calculate the number of electrons transferred from wool to polythene. If an electron has a mass $9.1 \times 10^{-31} kg$, find the mass transferred to polythene.

A. $2.25 \times 10^{10} kg$

B. $6.25 \times 10^{-18} kg$

C. $2.05 \times 10^{-18} kg$

D. $4.15 \times 10^{-18} kg$

Answer: C

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6. There are two metallic spheres of same radii but one is solid and the other is hollow, then

A. Solid sphere can be given more charge

B. Hollow sphere can be given more charge

C. They can be charged equally

D. None of the above

Answer: C

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7. When a body is earth connected, electrons from the earth flow into the body. This means the body was ....

A. Unchanged

B. Charge positively

C. Charge negatively

D. an insulator

Answer: B

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8. A positively charged insulator is brought near(but does not touch) two metallic sphere that are in contact. The metallic spheres are then separated. The sphere which was initially farthest from the insulator will have:

A. no net charge

B. a negative charge

C. a positive charge

D. either a negative or a positive charge.

Answer: C

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9. Suppose we have large number of identical particles, very small in size. Any of them at $10cm$ separation repel with a force of $3 \times 10^{-10} N$. If one of them is at $10cm$ from a group of n others, how strongly do you expect it to be repelled?

A. $3 \times 10^{-10} N$

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

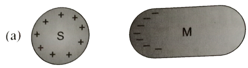
C. $\dfrac{3 \times 10^{-10}}{n} N$

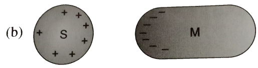
D. Can not be calculated

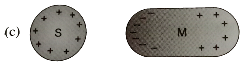
Answer: B

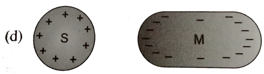
Watch Video Solution

10. An uncharged metal object M is insulated from its surroundings. A positively charged metal sphere S is then brought neat to M. Which diagram best illustrates the resultant distributions of charge on S and M

A. 

B. 

C. 

D. 

Answer: D

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11. Five balls numbered 1,2,3,4,and 5 are suspended using separated threads. The balls (1,2),(2,4) and (4,1) show electrostatic attraction while balls (2,3) and (4,5) show repulsion. Therefore, ball 1 must be

A. Positively charged

B. Negatively charged

C. Neutral

D. Made of metal

Answer: c

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12. A point charge $+q$ is placed at a distance d from an isolated conducting plane. The field at a point P

on the other side of plane is

A. directed perpendicular to the plane away from the plane

B. directed perpendicular to the plane but towards the plane

C. directed radially away from the point charge

D. directed radially towards the point charge

Answer: A

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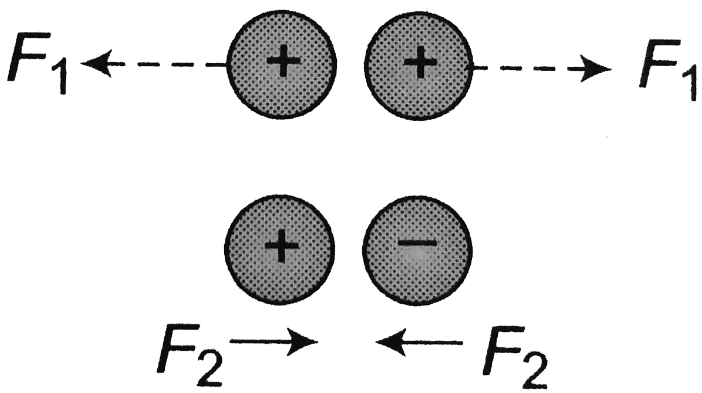
13. In two cases, two identical conducting sphere are given equal charges, in one case of the same type whereas in another case of opposite type. The distance between the spheres is not large comparing with the diameter. Let F_1 and F_2 be the magnitudes of the force of interaction between the spheres, as shown, then



A. $F_1 > F_2$

B. $F_1 = F_2$

C. $F_1 < F_2$

D. information is not sufficient to draw the conclusion

Answer: C

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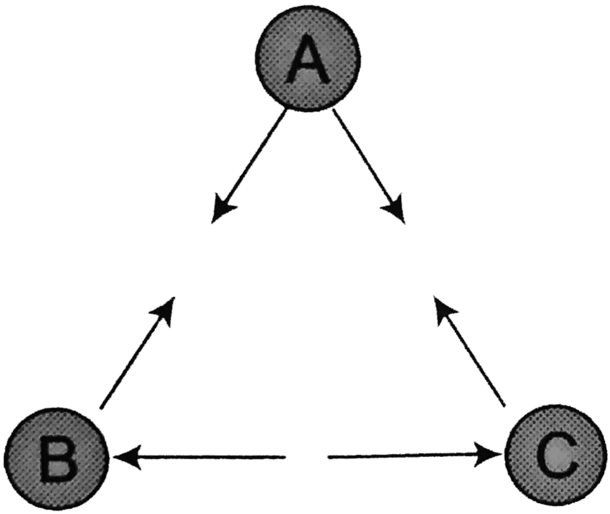
14. The diagram shows the arrangement of three small uniformly charged spheres, A, B and C. The arrow indicate the direction of the electrostatic forces acting between the spheres (for example, the left arrow on sphere A indicates the electrostatic force on sphere A due to sphere B). At least two of the spheres are positively charged. Which sphere, if any, could be negatively charged?



A. sphere A

B. sphere B

C. sphere C

D. no sphere

Answer: A

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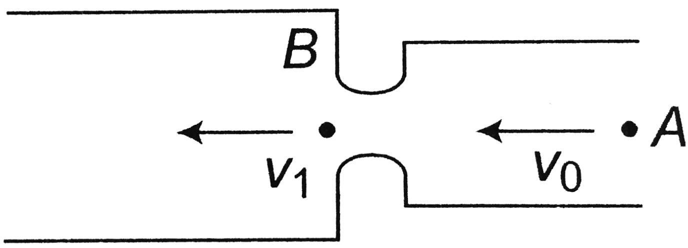
15. The velocity of an electron at point A_1 is V_0 where cross sectional areas is A. The velocity of electron just the end of contraction at point B, where cross sectional area is $2A$ is V_1. Find the correct option:



A. $V_1 < V_0$

B. $V_1 = V_0$

C. $V_1 > V_0$

D. $V_1 = \frac{V_0}{2}$

Answer: c

View Text Solution

16. A glass rod rubbed with silk is used to charge a gold leaf electroscope and the leaves are observed to diverge. The electroscope thus charged is exposed to X-rays for a short period. Then

A. The divergence of leaves will not be affected

B. The leaves will diverge further

C. The leaves will collapse

D. The leaves will melt

Answer: b

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17. One metallic sphere A is given positive charge whereas another identical metallic sphere B of exactly same mass as of A is given equal amount of negative charge. Then

A. Mass of A and mass of B still remain equal

B. Mass of A increases

C. Mass of B decreases

D. Mass of B increases

Answer: D

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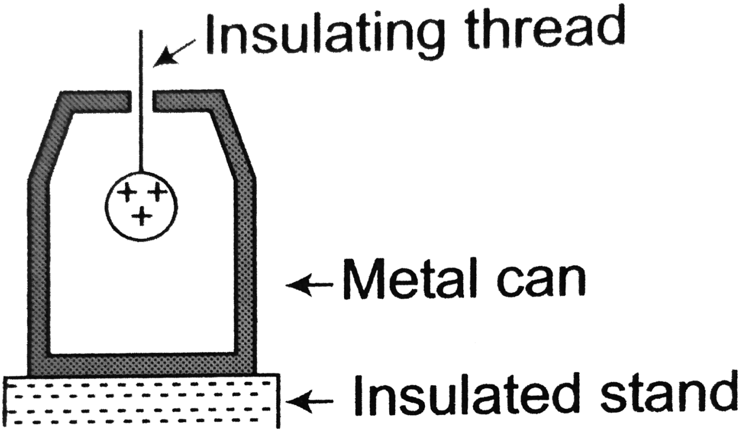
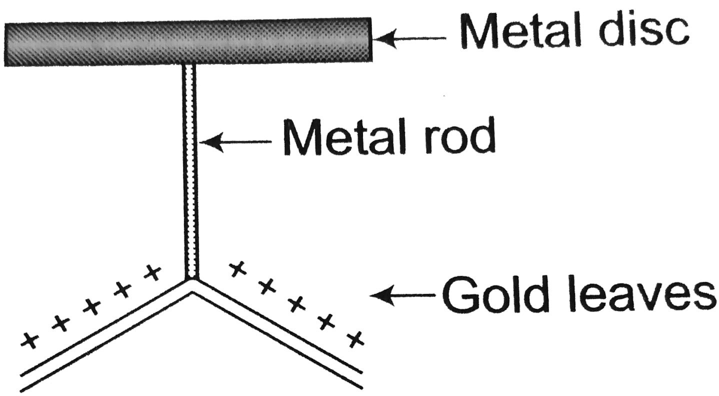
18. A charged metallic ball is lowered into an insulated metal can.



The ball is made to touch bottom of the can. Then it is placed on the disc of electroscope shown below. Final



A. leaves of electroscope diverges

B. leaves of electroscope converges

C. leaves of electroscope remains unaffected

D. leaves of electroscope oscillates

Answer: B

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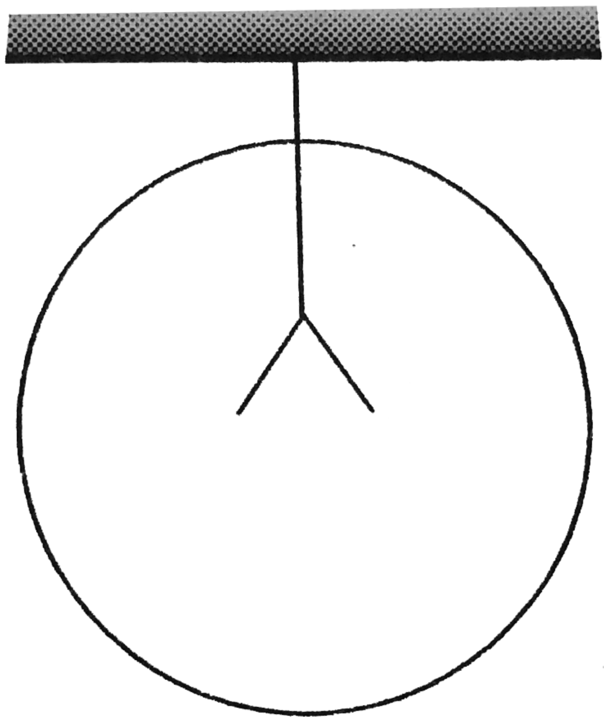
19. An electroscope is given a positive charge, causing its foil leaves to separate. When an object is brought near the top plate of electroscope, the foils separate even further. We conclude



A. that the object is positively charges.

B. that the object is electrically neutral.

C. that the object is negatively charged.

D. none of these

Answer: a

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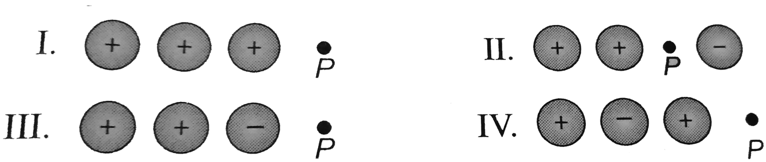
20. Given are four arrangements of three fixed electric charges. In each arrangement, a point labelled P is also identified- test charge, $+q$, is placed at point P. All of the charges are of same magnitude Q, but they can be either positive or negative as indicated. The charges and point P all lie on a straight line. The distances between adjacent items, either between two charges or between a charge and point P, all are the same. Compare forces on +q in each case.



A. $II > I > III > IV$

B. $I > II > III > IV$

C. $II > I > IV > III$

D. $III > IV > I > II$

Answer: C

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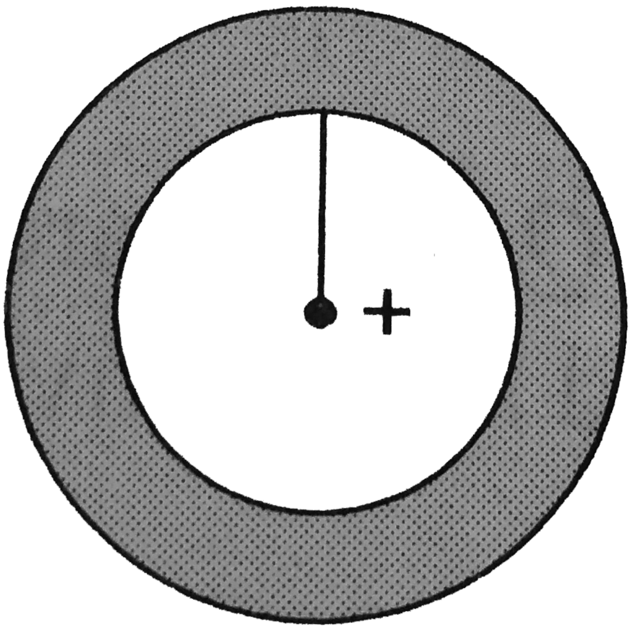
21. An electrically isolated hollow (initially uncharged), conducting sphere has a small positively charged ball suspended by an insulating rod from its inside surface (see diagram).



This causes the inner surface of the sphere to become negatively charged. When the ball is centred in the sphere, the electric field outside the conducting sphere is

A. zero

B. the same as if the sphere wasn't there

C. twice what it would be if the sphere wasn't there

D. equal in magnitude but opposite in direction to what it would be if the sphere wasn't there

Answer: B

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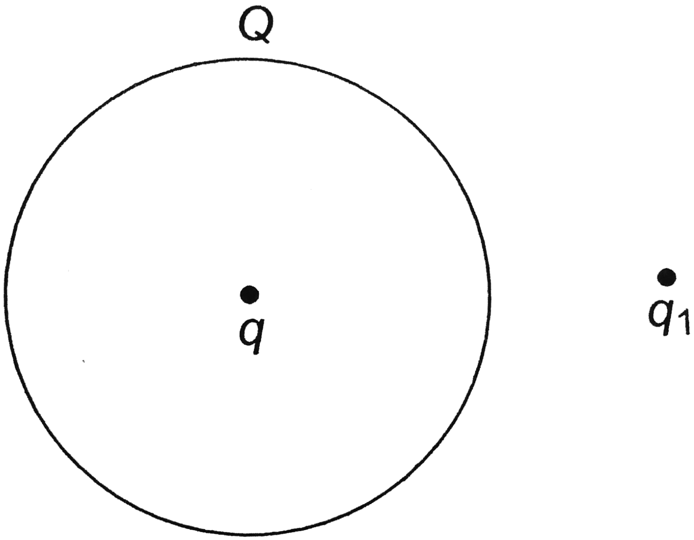
22. A thin metallic spherical shell contains a charge Q on it. A point charge q is placed at the center of the shell and another charge q_1 is placed outside it as shown in figure. All the three charges are positive



The force on the charge at the centre is

A. towards left

B. towards right

C. upward

D. zero

Answer: D

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23. A copper sphere of mass $2.0g$ contains about 2×10^{22} atoms. The charge on the nucleus of each atom is $29e(e = \text{electron charge})$. The mass of an electron is $9.11 \times 10^{-31} kg$. How much mass will the sphere lose or gain if it is given a charge of $+2\mu C$?

A. Loss a mass of $1.13 \times 10^{-14} g$

B. Gain a mass of $1.13 \times 10^{-14} g$

C. Neither gain nor lose any mass

D. Change in mass will depend upon the kinetic energy of the electrons

Answer: a

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24. Assume that each of copper atom has one free electron. Estimate the number of free electrons in $1mg$ of copper. Given that atomic weight of copper

$= 63.5$ and Avogadro number $= 6.02 \times 10^{23}$. What is the charge possessed by these free electrons?

A. $1.52C$

B. $1.76C$

C. $4.76C$

D. $1.25C$

Answer: a

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25. Estimate the number of free electrons in $1g$ of water and negative charge possessed by them. Given that Avogadro number $= 6.02 \times 10^{23}$ and molecular weight of water $= 18$

A. $6.25 \times 10^{4} C$

B. $5.35 \times 10^{4} C$

C. $1.76 \times 10^{4} C$

D. $1.25 \times 10^{4} C$

Answer: b

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26. Three point charges are placed at the corner of an equilateral triangle. Assuming only electrostatic forces are acting.

A. the system can never be in equilibrium

B. the system will be equilibrium if the charges rotate about the centre of the triangle

C. the system will be in equilibrium if the charges have different magnitudes and different signs

D. the system will be in equilibrium if the charges have the same magnitude but different signs.

Answer: A

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27. Two identical pendulums A an dB are suspended from the same point. Both are givne positive charge, with A having more charge than B. They diverge and reach equilibrium with the suspension of A and B making angles θ_1 and θ_2 with the vertical respectively.

A. $\theta_1 > \theta_2$

B. $\theta_1 < \theta_2$

C. $\theta_1 = \theta_2$

D. The tension in A is greater than that in B

Answer: C

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28. Two identical small conducting spheres having unequal positive charges q_1 and q_2 are separated by a distance r. If they are now made to touch each other and then separated again to the same distance, the electrostatic force between them in this case will be

A. less than before

B. same as before

C. more than before

D. zero

Answer: c

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29. Two point charges placed at a distance r in air experience a certain force. Then the distance at which they will experience the same force in a medium of dielectric constant K is

A. r/K

B. Kr

C. $\frac{r}{\sqrt{K}}$

D. $r+\sqrt{K}$

Answer: C

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30. Two copper balls, each weighing $10g$ are kept in air $10cm$ apart. If one electron from every 10^6 atoms is transferred from one ball to the other, the coulomb force between them is (atomic weight of copper is 63.5)

A. $2.0 \times 10^{10} N$

B. $2.0 \times 10^4 N$

C. $2.0 \times 10^8 N$

D. $2.0 \times 10^6 N$

Answer: C

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31. What is the Coulomb's force between two α-particles separated by a distance of $3.2 \times 10^{-15} m$.

A. $90N$

B. $45N$

C. $60N$

D. $75N$

Answer: A

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32. Force of attraction between two point electric charges placed at a distance d in a medium is F. What distance apart should these be kept in the same medium, so that force between them becomes $F/3$?

A. $2\sqrt{3}d$

B. $3d$

C. $9d$

D. $\sqrt{3}d$

Answer: D

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33. Two identical balls each have a mass of $10g$. What charges should these balls be given so that their interaction equalizes the force of universal gravitation acting between them? The radii of the balls may be ignored in comparison to distance between them.

A. $6.34 \times 10^{-11} C$

B. $8.57 \times 10^{-11} C$

C. $6.34 \times 10^{-13} C$

D. $8.57 \times 10^{-13} C$

Answer: d

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34. Two point charges $+3\mu C$ and $+8\mu C$ repel each other with a force of $40N$. If a charge of $-5\mu C$ is added to each of them, then the force between them will become

A. $-10N$

B. $+10N$

C. $+20N$

D. $-20N$

Answer: A

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35. The distance between charges $5.0 \times 10^{-11} C$ and $-2.7 \times 10^{-11} C$ is $0.2m$. The distance at which a third charge should be placed in order that it will not experience any force along the line joining the two charges is

A. $0.44m$

B. $0.65m$

C. $0.556m$

D. $0.350m$

Answer: C

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36. Calculate the ratio of electrostatic to gravitational force between two electrons placed at certain distance in air. Given that $m_e = 9.1 \times 10^{-31} kg, e = 1.6 \times 10^{-19} C$ and $G = 6.6 \times 10^{-11} Nm^{-2}$.

A. 8.4×10^{42}

B. 3.2×10^{41}

C. 4.2×10^{42}

D. 1.2×10^{42}

Answer: c

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37. Two point charges $+9e$ and $+e$ are kept $16cm$. Apart from each other. Where should a third charge q be placed between them so that the system is in equilibrium state:

A. $24cm$ form $+9e$

B. $12cm$ from $+9e$

C. $24cm$ from $+e$

D. $12cm$ from $+e$

Answer: B

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38. Two spherical conductors B and C having equal radii and cayying equal charges on them repel each other with a force F when kept apart at some distance. A third spherical conductor having same radius as that B but uncharged is brought in contact with B, then brought in contact with C and finally removed away from both. The new force of repulsion between B and C is

A. $F/4$

B. $3F/4$

C. $F/8$

D. $3F/8$

Answer: d

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39. 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. $3F/4$

C. $F/2$

D. $F/4$

Answer: A

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40. What equal charges would have to be placed on earth and moon to neutralize their gravitational force of attraction?

Given that mass of earth $= 10^{25} kg$ and mass of moon $= 10^{23} kg$

A. $8.57 \times 10^{16} C$

B. $8.57 \times 10^{13} C$

C. $5.45 \times 10^{13} C$

D. $5.45 \times 10^{16} C$

Answer: b

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41. Three charges $4q$, Q and q are in a straight line in the position of $0. l/2$ and l respectively. The resultant force on q will be zero, if $Q =$

A. $-q$

B. $-2q$

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

D. $4q$

Answer: A

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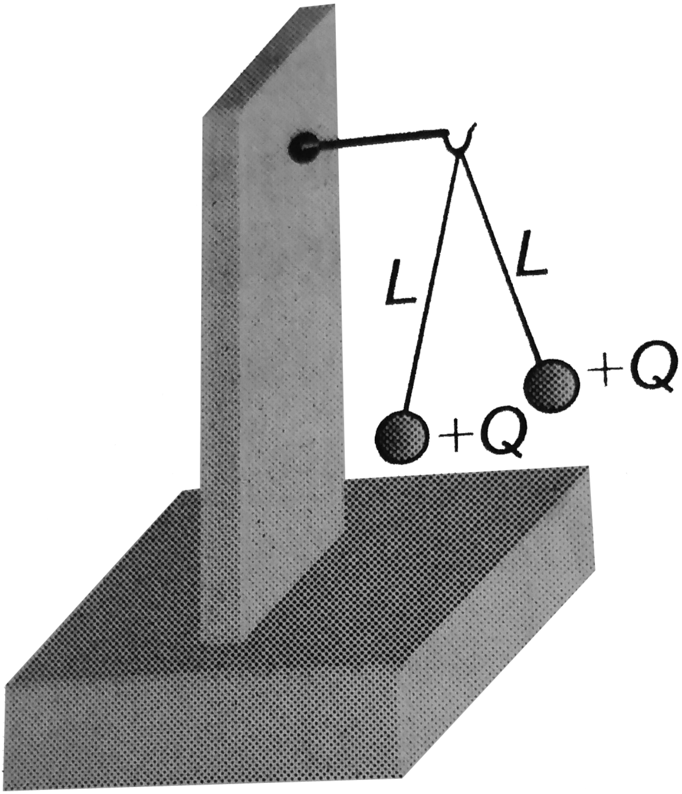
42. Two small balls having equal positive charge Q (coulomb) on each are suspended by two insulated string of equal length L meter, from a hook fixed to a stand. The whole gravity (state of weightlessness). Then the angle between the string and tension in the string is `



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

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

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

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

Answer: a

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43. Two similar spheres having $+q$ and $-q$ and $+4q$ charges are kept at a certain distance. The force acts between the two is F. If in the middle of two spheres, another similar sphere having $+q$ charge is kept,then it experience a force in magnitude and direction as

A. Zero having no direction

B. $8F$ towards $+q$ charge

C. $8F$ towards $-q$ charge

D. $4F$ towards $+q$ charge

Answer: c

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44. Point charges $+4q, -q$ and $+4q$ 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 are in equilibrium

C. All the charges are in unstable equilibrium

D. All the charges are in stable equlibrium

Answer: C

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45. Two identical balls having like charges and placed at a certain distance apart repel each other with a certain force. They are brought in contact and then moved apart to a distance equal to half their initial separation. The force of repulsion between them increases 4.5 times in comparision with the initial value. The ratio of the initial charges of the balls is

A. 2

B. 3

C. 4

D. 6

Answer: a

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46. Two charges $+4e$ and $+e$ are at a distance x apart. At what distance,a charge q must be placed from charge $+e$ so that is in equilibrium

A. $x/2$

B. $2x/3$

C. $x/3$

D. $x/6$

Answer: c

Watch Video Solution

47. Three charges $4q$, Q and q are in a straight line in the position of 0, $l/2$ and l respectively. The resultant force on q will be zero, if $Q =$

A. Q

B. $Q/2$

C. $-Q/2$

D. $-Q$

Answer: d

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48. Two equal negative charges $-q$ are fixed at points $(0, -a)$ and $(0, a)$ on y-axis. A poistive charge Q is released from rest at point $(2a, 0)$ on the x-axis. The charge Q will

A. Execute simple harmonic motion about the origin

B. Move to the origin and remains at rest

C. Move to infinity

D. Execute oscillatory but not simple harmonic motion.

Answer: d

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49. Electric charges of $1\mu C, -1\mu C$ and $2\mu C$ are placed in air at the corners A, B and C respectively of an equilateral triangle ABC having length of each side $10cm$. The resultant force on the charge at C is

A. $0.9N$

B. $1.8N$

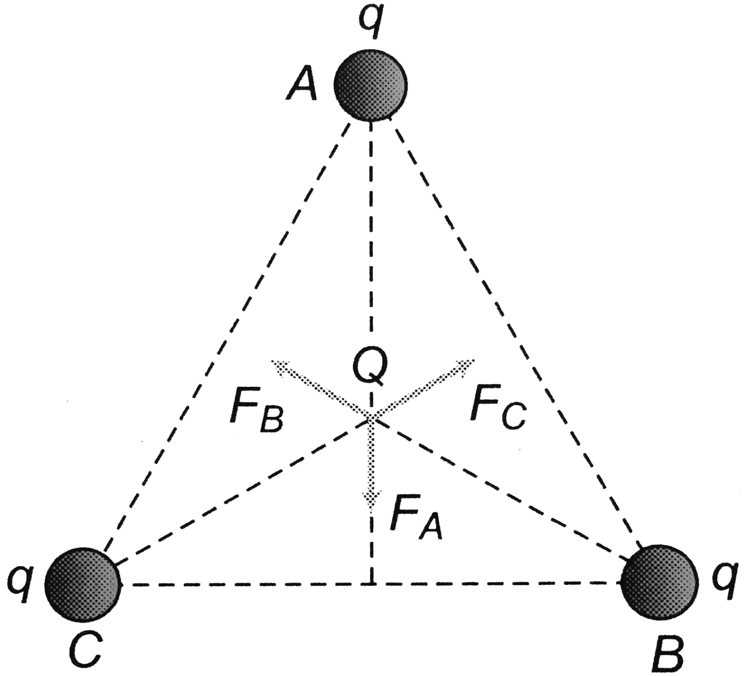
C. $2.7N$

D. $3.6N$

Answer: B

Watch Video Solution

50. Three charges each of magnitude q are placed at the corners of an equilateral triangle, the electrostatic force on the charge place at the centre is (each side of triangle is L)



A. Zero

B. $\dfrac{1}{4\pi\varepsilon_0}\dfrac{q^2}{L^2}$

C. $\dfrac{1}{4\pi\varepsilon_0}\dfrac{3q^2}{L^2}$

D. $\dfrac{1}{12\pi\varepsilon_0}\dfrac{q^2}{L^2}$

Answer: A

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51. Equal charges q are placed at the four corners $A, B, C, D$of a square of length a. The magnitude of the force on the charge at B will be

A. $\dfrac{3q^2}{4\pi\varepsilon_0 a^2}$

B. $\dfrac{4q^2}{4\pi\varepsilon_0 a^2}$

C. $\left(\dfrac{1+2\sqrt{2}}{2}\right)\dfrac{q^2}{4\pi\varepsilon_0 a^2}$

D. $\left(2+\dfrac{1}{\sqrt{2}}\right)\dfrac{q^2}{4\pi\varepsilon_0 a^2}$

Answer: c

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52. Charges $Q - q, Q, \ - q$ are placed at the corners A, B, C, D of a square respectively. If the resultant force on the charge Q is zero due to other charges, what is the relation between Q and q?

A. $Q = \ - 2\sqrt{2}q$

B. $Q = \ - 2q$

C. $Q = \ - \sqrt{2}q$

D. $Q = \ - \frac{1}{2\sqrt{2}}q$

Answer: a

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53. An infinite number of charges, each of charge $1\mu C$ are placed on the x-axis with co-ordinates $x = 1, 2, 4, 8.\ldots\infty$ If a charge of $1C$ is kept at the origin, then what is the net force action on $1C$ charge

A. $9000N$

B. $12000N$

C. $24000N$

D. $36000N$

Answer: B

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54. 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. $+\frac{Q}{4}$

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

Answer: b

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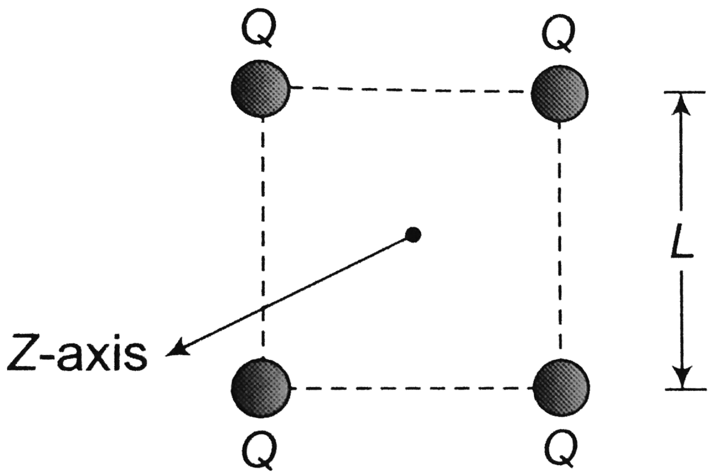
55. Four point $+ve$ charges of same magnitude(Q) are placed at four corners of a rigid square frame as shown in figure. The plane of the frame is perpendicular to z-axis. If a $-ve$ point charge is placed at a distance z away from the above frame $(z < \ < L)$ then



A. $-ve$ charge oscillates along the z axis.

B. It moves away from the frame

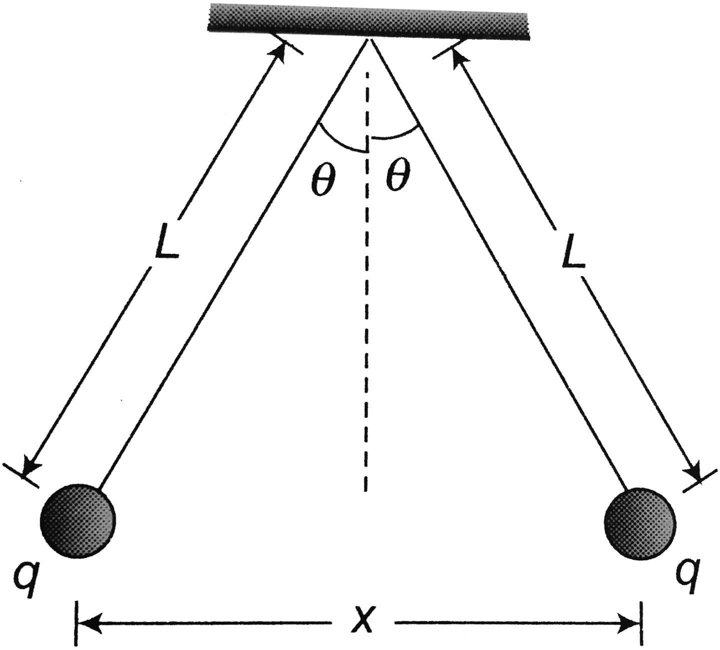
C. It moves slowly towards the frame and stays in the plane of the frame

D. It passes through the frame only once.

Answer: a

Watch Video Solution

56. In the given figure two tiny conducting balls of identical mass m and identical charge q hang from non-conducting threads of equal length L. Assume that θ is so small that than $\theta \approx \sin\theta$, then for equilibrium x is equal to



A. $\left(\frac{q^2 L}{2\pi\varepsilon_0 mg}\right)^{\frac{1}{3}}$

B. $\left(\frac{qL^2}{2\pi\varepsilon_0 mg}\right)^{\frac{1}{3}}$

C. $\left(\frac{q^2 L^2}{4\pi\varepsilon_0 mg}\right)^{\frac{1}{3}}$

D. $\left(\frac{q^2 L}{4\pi\varepsilon_0 mg}\right)^{\frac{1}{3}}$

Answer: a

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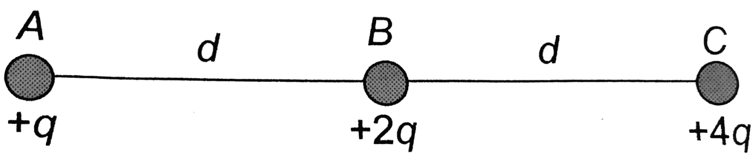
57. Three charges $+q, +2q$ and $4q$ are connected by strings as shown in the figure.What is ratio of tensions in the strings AB and BC



A. $1:2$

B. $1:3$

C. $2:1$

D. $3:1$

Answer: B

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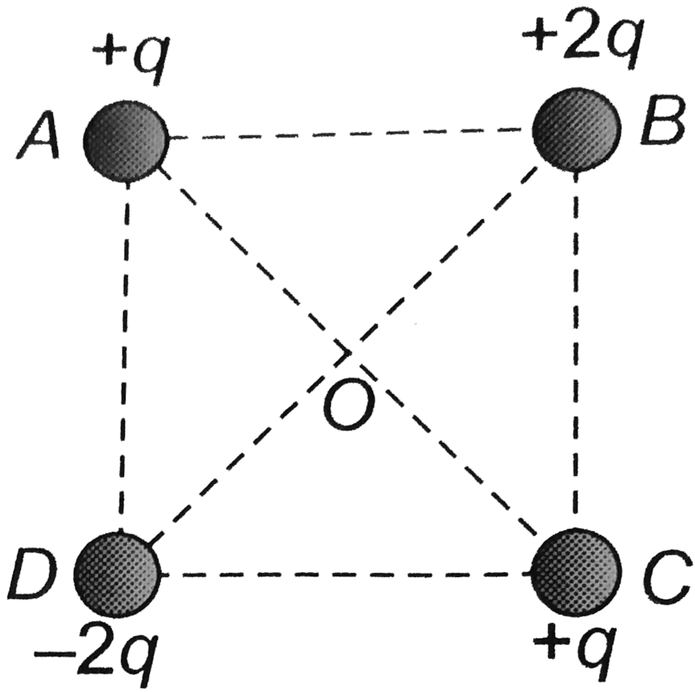
58. Four charges are arranged at the corners of a square $ABCD$, as shown in the adjoining figure, The

force on a positive charge kept at the centre O is



A. Zero

B. Along the diagonal AC

C. Along the diagonal BD

D. Perpendicular to side AD

Answer: C

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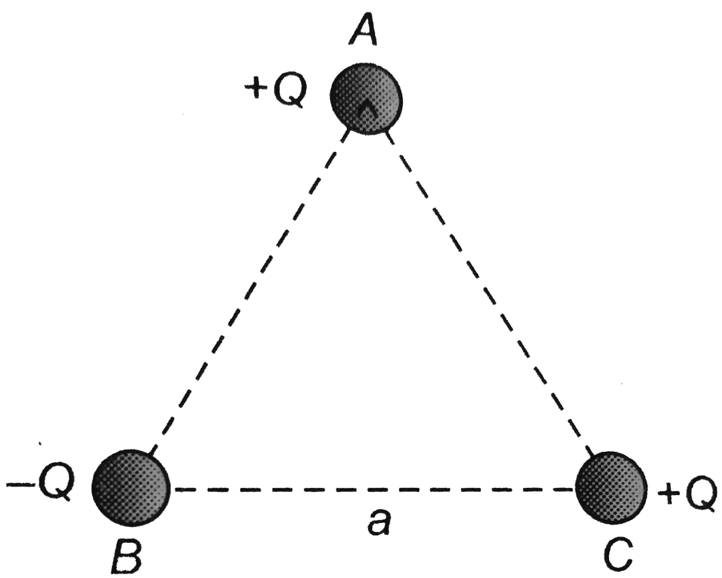
59. Three charges are placed at the vertices of an equilateral trianlge of side a as shown in the following figure. The force experienced by the charge placed at the vertex A in a direction normal to BC is



A. $Q^2 / (4\pi\varepsilon_0 a^2)$

B. $\sqrt{3}Q^2 / (4\pi\varepsilon_0 a^2)$

C. Zero

D. $Q^2 / (2\pi\varepsilon_0 a^2)$

Answer: c

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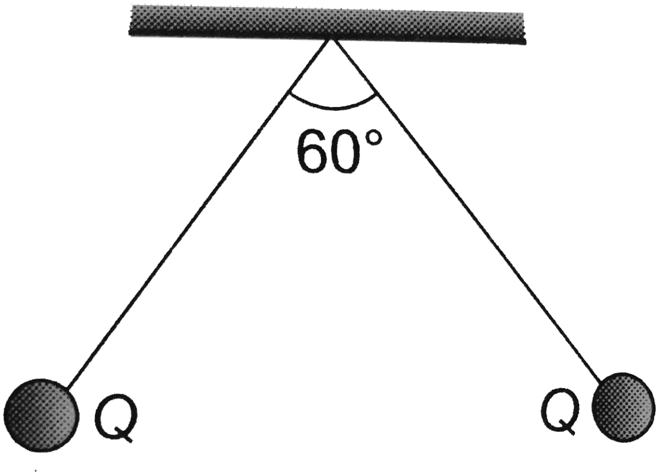
60. Two small spherical balls each carrying a charge $Q = 10\mu C$(10 micro=coulomb) are suspended by two insulating threads of equal lengths $1cm$ each, from a point fixed in the ceiling. It is found that in equilibrium threads are sepreated by an angle 60°

between them, as shown in figure. What is the tension

in the threads

(Given $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 Nm / C^2$)



A. $18N$

B. $1.8N$

C. $0.18N$

D. None of the above

Answer: b

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61. 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 si

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

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

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

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

Answer: b

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62. The distance between two equal balls having unlike charges is $2cm$. The radii of the balls are much less than the distance between them. The balls attract each other with a force of 36×10^{-5}N. After the ball have been connected by a wire and latter has been removed, the balls repel each other with a force of 20.25×10^{-5}N. Determine the original charges on the balls

A. $+8 \times 10^{-9}$ and $-2 \times 10^{-9}C$

B. -6×10^{-9} and $+1.5 \times 10^{-9}C$

C. $+4 \times 10^{-9}C$ and $-1 \times 10^{-9}C$

D. $-8 \times 10^{-9}C$ and $+2 \times 10^{-9}C$

Answer: a

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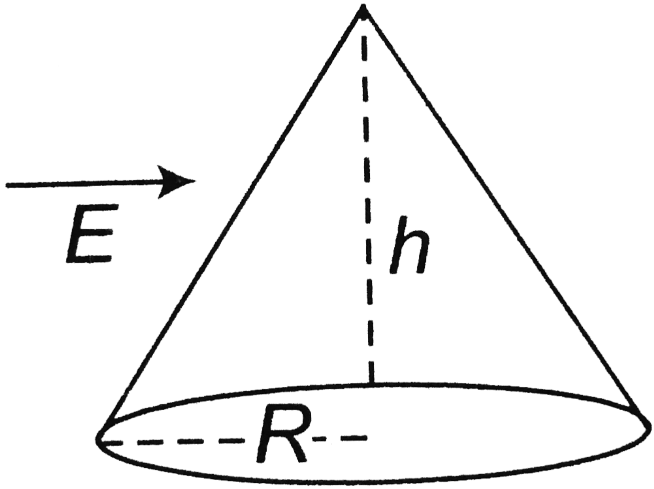
63. A cone lies in a uniform electric field E as shown in figure. The electric flux entering the cone is



A. $E\pi R^2$

B. ERh

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

D. Eh^2

Answer: B

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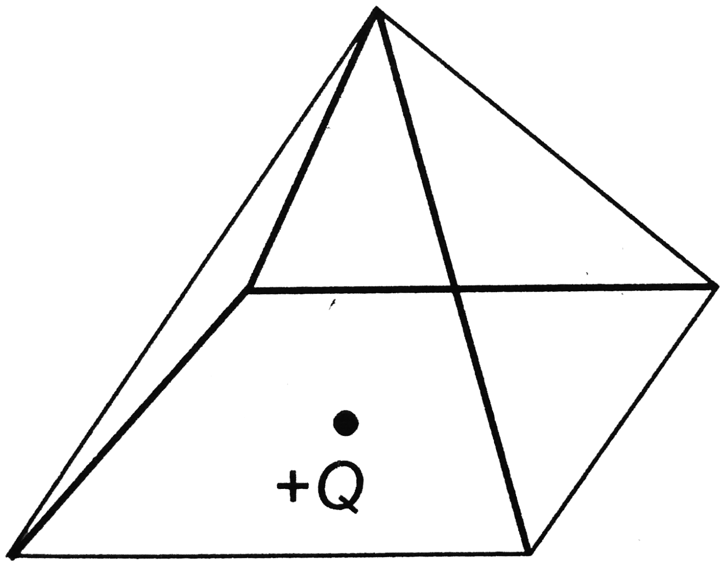
64. A point charge $+Q$ is positioned at the centre of the base of a square pyramid as shown. The flux through one of the four identical upper faces of the pyramid is



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

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

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

D. None of these

Answer: C

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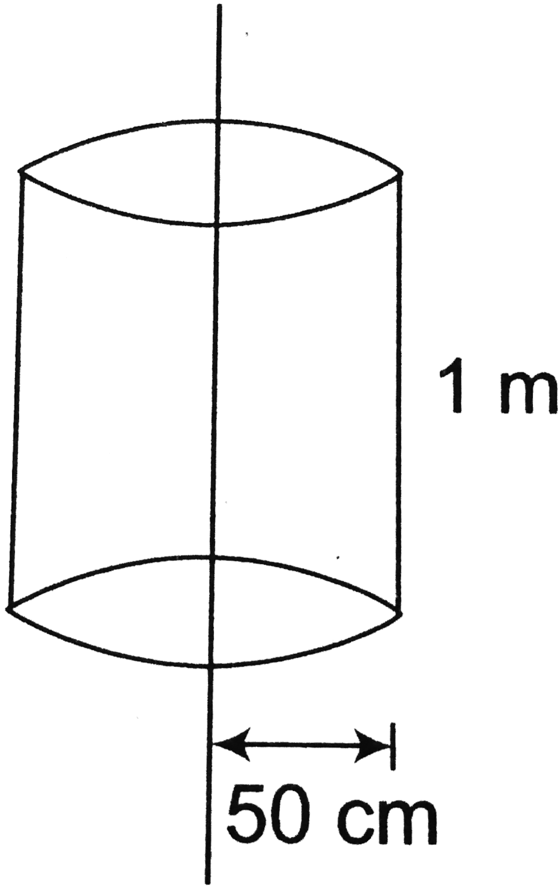
65. Electric charge is uniformly distributed along a along straight wire of radius $1mm$. The charge per centimeter length of the wire is Q coulomb. Another cyclindrical surface of radius $50cm$ and length $1m$ symmetrically enclose the wire ask shown in figure. The total electric flux passing through 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: B

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66. A cyclinder of radius r and length l is placed in an uniform electric field in such a way that the axis of the cyclinder is parallel to the field. The flux of the field through the cyclindrical surface is

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

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

C. $\frac{2\pi rl}{\varepsilon_0}$

D. zero

Answer: D

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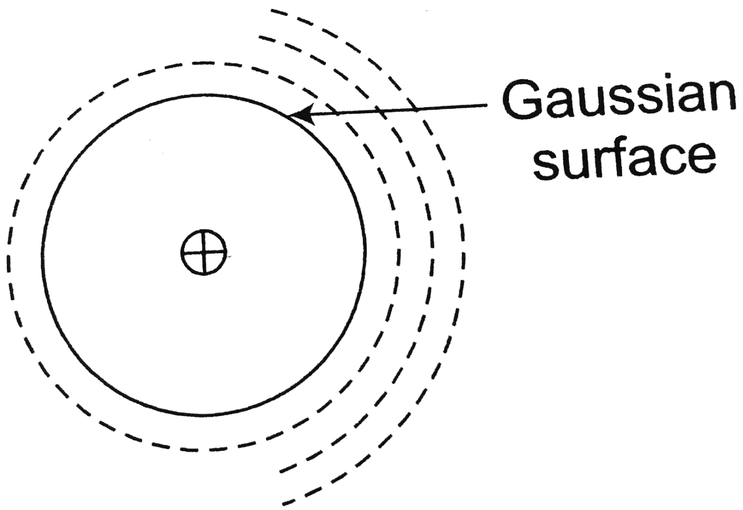
67. A charge q is enclosed by an imaginary Gaussian surface.



If radius of surface is increasing at a rate $\frac{dr}{dt} = K$, then

A. flux linked with surface is increasing at a rate $\frac{d\phi}{dt} = K$

B. flux linked with surface is decreasing at a rate $\frac{d\phi}{dt} = -K$

C. flux linked with surface is decreasing at a rate $\frac{d\phi}{dt} = \frac{1}{K}$

D. flux linked with surface is $\frac{q}{\varepsilon_0}$

Answer: d

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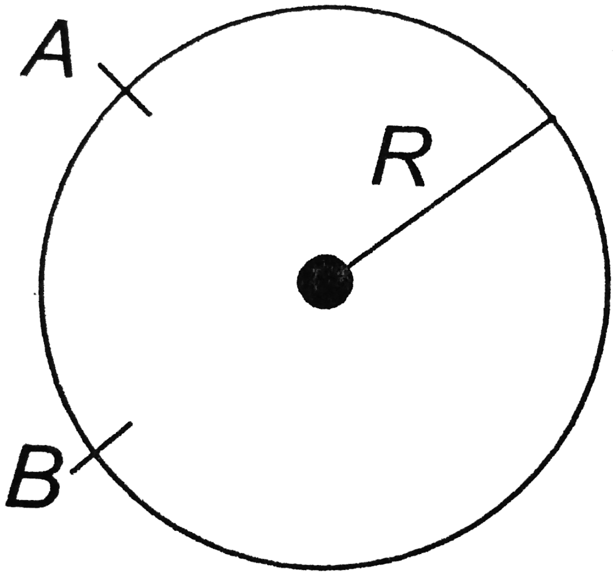
68. A spherical shell of radius R has two holes A and B through which a ring having charge $+q$ passes through without touching the shell. The flux through spherical shell is $\frac{q}{3\varepsilon_0}$. Find the radius of the ring.



A. $R\sqrt{2}$

B. $2R$

C. $0.5R$

D. R

Answer: D

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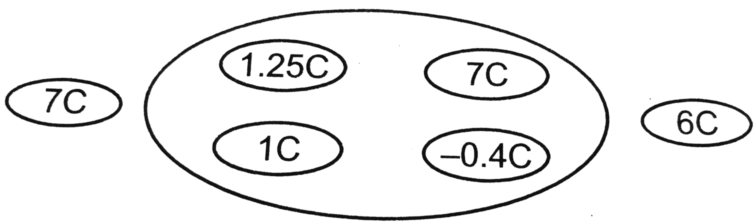
69. What is the electric flux linked with closed surface?



A. $10^{11} N - m^2 / C$

B. $10^{12} N - m^2 / C$

C. $10^{10} N - m^2 / C$

D. $8.86 \times 10^{13} N - m^2 / C$

Answer: B

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70. Electric field at a point varies as r^0 for

A. An electric dipole

B. A point charge

C. A plane infinite sheet of charge

D. A line charge of infinite length

Answer: C

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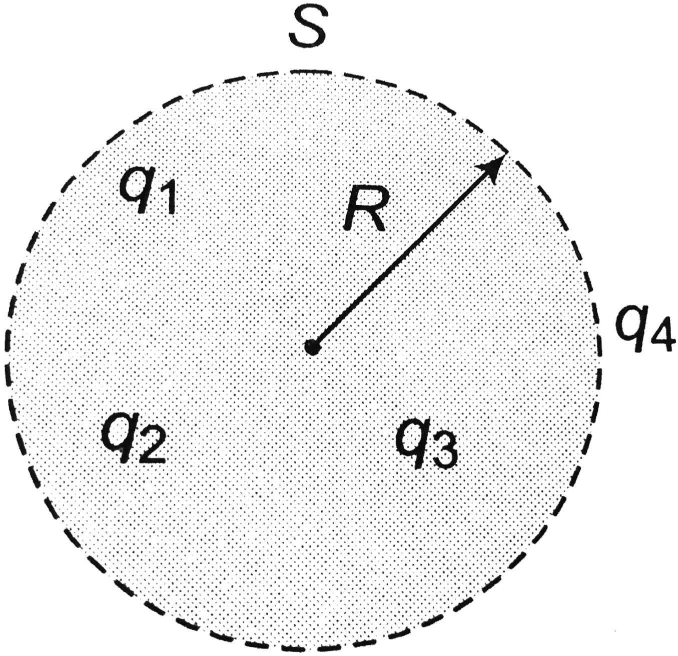
71. q_1, q_2, q_3 and q_4 are point charges located at point as shown in the figure and S is a spherical Gaussian surface of radius R. Which of the following is true according to the Gauss's law



A. $\oint_s \left(\vec{E}_1 + \vec{E}_2 + \vec{E}_3\right) . d\vec{A} = \frac{q_1 + q_2 + q_3}{2\varepsilon_0}$

B. $\oint_s \left(\vec{E}_1 + \vec{E}_2 + \vec{E}_3\right) . d\vec{A} = \frac{(q_1 + q_2 + q_3)}{\varepsilon_0}$

C.

$$\oint_s \left(\vec{E}_1 + \vec{E}_2 + \vec{E}_3\right) . d\vec{A} = \frac{(q_1 + q_2 + q_3 + q_4)}{2\varepsilon_0}$$

D. None of these

Answer: B

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72. 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. $\dfrac{(-4 \times 10^3)}{\varepsilon} C$

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

Answer: D

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73. If a spherical conductor comes out from the closed surface of the sphere then total flux emitted from the surface will be

A. $\frac{1}{\varepsilon_0}$(the angle enclosed by surface)

B. $\varepsilon_0 \times$ (the angle enclosed by surface)

C. $\frac{1}{4\pi\varepsilon_0} \times$ (the angle enclosed by surface)

D. 0

Answer: A

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74. If the electric flux entering and leaving an enclosed surface respectively is ϕ_1 and ϕ_2, the electric charge inside the surface will be

A. $(\phi_1 + \phi_2)\varepsilon_0$

B. $(\phi_2 - \phi_1)\varepsilon_0$

C. $(\phi_1 + \phi_2) / \varepsilon_0$

D. $(\phi_2 - \phi_1) / \varepsilon_0$

Answer: B

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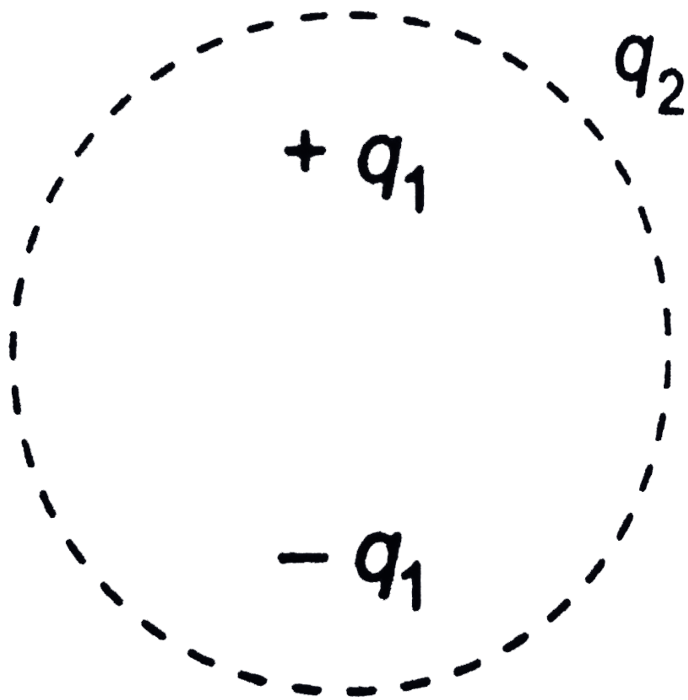
75. Consider the charge configuration and a spherical Gaussian surface as shown in the figure. When calculating the flux of the electric field over the spherical surface, the electric field will be due to.



A. q_2

B. Only the positive charges

C. All the charges

D. $+q_1$ and $-q_1$

Answer: C

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76. An electric dipole is put in north-south direction in sphere filled with water. Which statement is correct?

A. Electric flux is coming towards sphere

B. Electric flux is coming out of sphere

C. Electric flux entering into sphere and leaving the sphere are same

D. Water does not permit electric flux to enter into sphere

Answer: C

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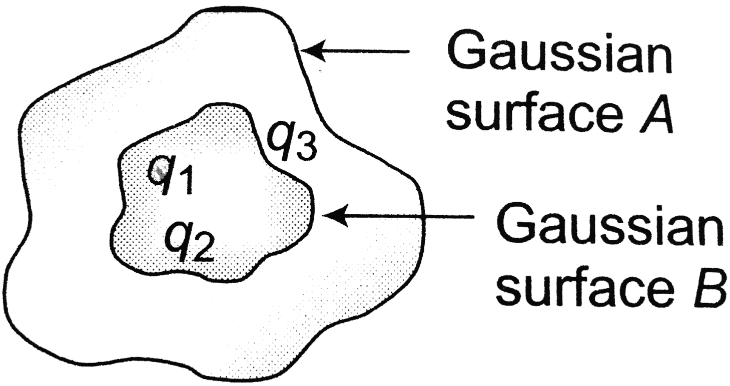
77. The electric flux for Gaussian surface A that enclose the charge particles in free space is (given

$q_1 = -14nC, q_2 = 78.85nC, q_3 = -56nC)$



A. $10^3 Nm^2 C^{-1}$

B. $10^3 CN^{-1} C^{-2}$

C. $6.32 \times 10^3 Nm^2 C^{-1}$

D. $6.32 \times 10^3 CN^{-1} m^{-2}$

Answer: A

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78. A solid metallic sphere has a charge $+3Q$. Concentric with this sphere is a conducting spherical shell having charge $-Q$. The radius of the sphere is a and that of the spherical shell is $b(b > a)$ What is the electric field at a distance $R(a < R < b)$ from the centre

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

B. $\dfrac{3Q}{2\pi\varepsilon_0 R}$

C. $\dfrac{3Q}{4\pi\varepsilon_0 R^2}$

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

Answer: C

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79. An electric field given by $\overrightarrow{E} = 4\hat{i} + 3(y^2 + 2)\hat{j}$ passes through Gaussian cube of side $1m$ placed at origin such that its three sides represents x, y and z axis. This net charge enclosed within the cube is

A. $4\varepsilon_0$

B. $3\varepsilon_0$

C. $4\varepsilon_0$

D. zero

Answer: B

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80. A point charge q is placed at a distance $a/2$ directly above the center of a square of side a. The electric flux through the square is

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

B. $\frac{q}{\pi\varepsilon_0}$

C. $\frac{q}{4\varepsilon_0}$

D. $\frac{q}{6\varepsilon_0}$

Answer: D

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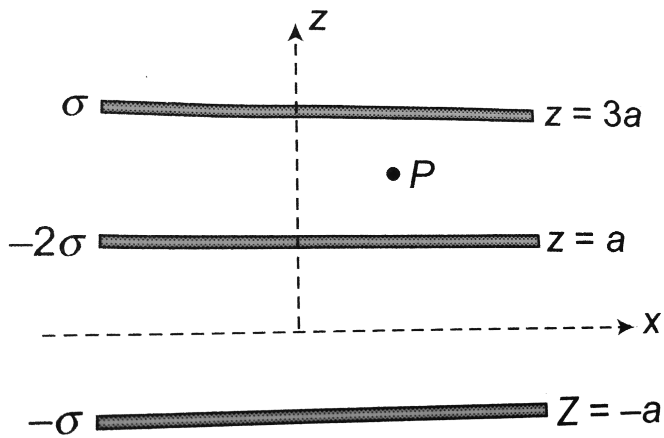
81. Three infinitely long charge sheets are placed as shown in figure. The electric field at point P is



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

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

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

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

Answer: B

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82. Two infinitely long parallel conducting plates having surface charge densities $+\sigma$ and $-\sigma$ respectively, are separated by a small distance. The medium between the plates is vacuum. If ε_0 is the dielectric permittivity of vacuum, then the electric field in the region between the plates is

A. $0 \text{ volts}/meter$

B. $\frac{\sigma}{2\varepsilon_0} \text{volts}/meter$

C. $\frac{\sigma}{\varepsilon_0} \text{volts}/meter$

D. $\frac{2\sigma}{\varepsilon_0} \text{volts}/meter$

Answer: C

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83. At a point $20cm$ from the centre of a uniformly charged dielectric sphere of radius $10cm$, the electric field is $100V/m$. The electric field at $3cm$ from the centre of the sphere will be

A. $150V/m$

B. $125V/m$

C. $120V/m$

D. Zero

Answer: c

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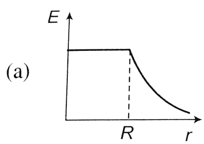
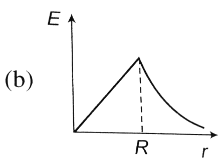
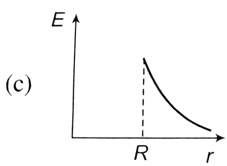
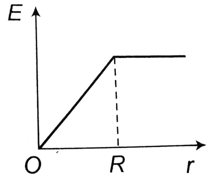
84. The electric field due to uniformly charged sphere of radius R as a function of the distance from its centre is represented graphically by

A. 

B. 

C. 

(d)



D.

Answer: B

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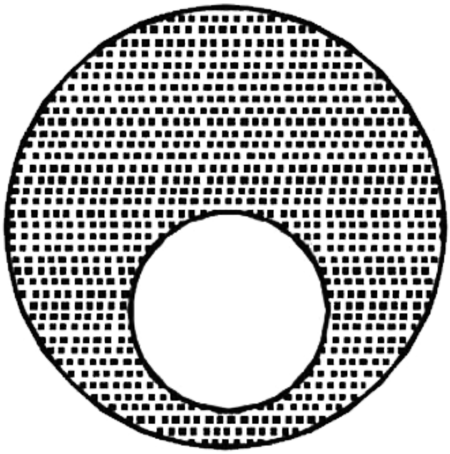
85. A spherical portion has been removed from a solid sphere having a charge distributed uniformly in its volume as shown in the figure. The electric field inside the emptied space is



A. zero everywhere

B. non-zero and uniform

C. non-uniform

D. zero only at its centre

Answer: B

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86. The number of electric field lines crossing an area ΔS is n_1 when $\Delta \overrightarrow{S} || \overrightarrow{E}$, while number of field lines crossing same area is n_2 when $\Delta \overrightarrow{E}$ makes an angle of 30° with $\overrightarrow{E}$, then :

A. $n_1 = n_2$

B. $n_1 > n_2$

C. $n_1 < n_2$

D. cannot say anything

Answer: B

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87. In a region of space the electric field in the x-direction and proportional to x i.e., $\overrightarrow{E} = E_0 x \hat{i}$. Consider an imaginary cubical volume of edge a with its sides parallel to the axes of coordinates. The charge inside this volume will be

A. zero

B. $\varepsilon_0 E_0 a^3$

C. $\dfrac{1}{\varepsilon_0} E_0 a^3$

D. $\dfrac{1}{6} \varepsilon_0 E_0 a^3$

Answer: b

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