PHYSICS

RESONANCE ENGLISH

ELECTROSTATICS

Exercise

1. On moving a charge of 20 C by 2 cm, 2 J of work is done, then the potential differ rence between the point is :

A. 0.1 V

B. 8V

C. 2V

D. 0.5V

Answer: A

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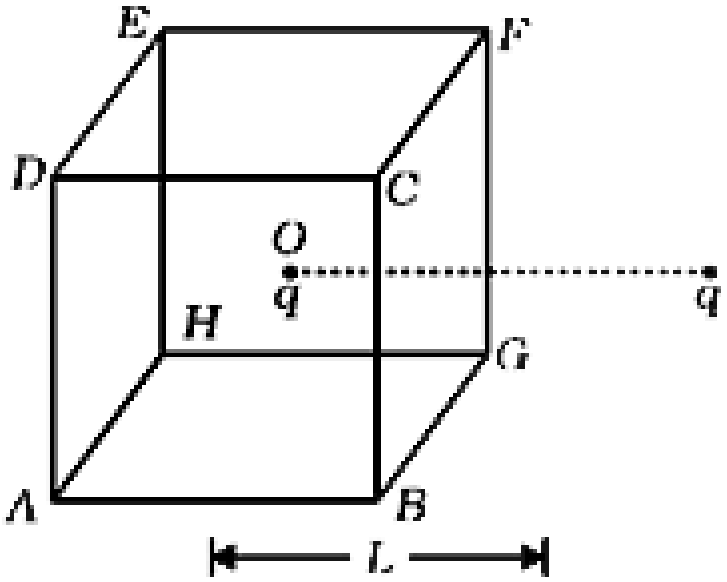
2. A charged particle q is placed at the centre O of cube of length L(ABCDEFGH). Another same charge q is placed at a distance L from

O.Then, the electric flux through ABCD is :



A. $q/4\pi\varepsilon_0 L$

B. zero

C. $q/2\pi\varepsilon_0 L$

D. $q/3\pi\varepsilon_0 L$

Answer: B

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

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

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

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

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

Answer: A

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4. 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. 2.4×10^5

B. 2.5×10^5

C. 2.6×10^5

D. 2.7×10^5

Answer: B

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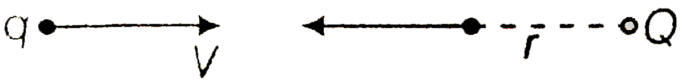
5. A charged particle is shot with speed V towards another ifxed charged particle Q .It approaches Q up to a closest distnce r and then returns.If q were given a speed 2V, the

closest distance of approach would be



A. r

B. 2r

C. r/2

D. r/4

Answer: D

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6. A point charge +Q is placed at the centroid of an equilateral triangle. When a second charge +Q is placed at a vertex of the triangle, the magnitude of the electrostatic force on the central charge is 8 N. The magnitude of the net force on the central charge when a third charge +Q is placed at another vertex of the triangle is

A. zero

B. 4N

C. $4\sqrt{2}N$

D. 8N

Answer: D

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7. Four positive charges $\left(2\sqrt{2}-1\right)Q$ are arranged at the four corners of a square. Another charge q is placed at the centre of the square. Resulting force acting on each corner charge is zero if q is

A. $-7Q/4$

B. $-4Q/7$

C. $-Q$

D. none of these

Answer: A

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

A. all the charges are in stable equilibrium

B. all the charge are in unstable equilibrium

C. only the middle charge is in stable equilibrium

D. only middle charge is in unstable equilibrium

Answer: B

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9. A simple pendulum of mass m and charge +q is suspended vertically by a massless thread of length l. At the point of suspension, a point charge +q is also fixed. If the pendulum is displaced slightly from equilibrium position, its time period will be

A. $T = 2\pi\sqrt{\frac{l}{g + \frac{kq^2}{ml^2}}}$

B. $T = 2\pi$

C. $T = 2\pi\sqrt{\frac{l}{g}}$

D. will be greater then $2\pi\sqrt{\frac{l}{g}}$

Answer: C

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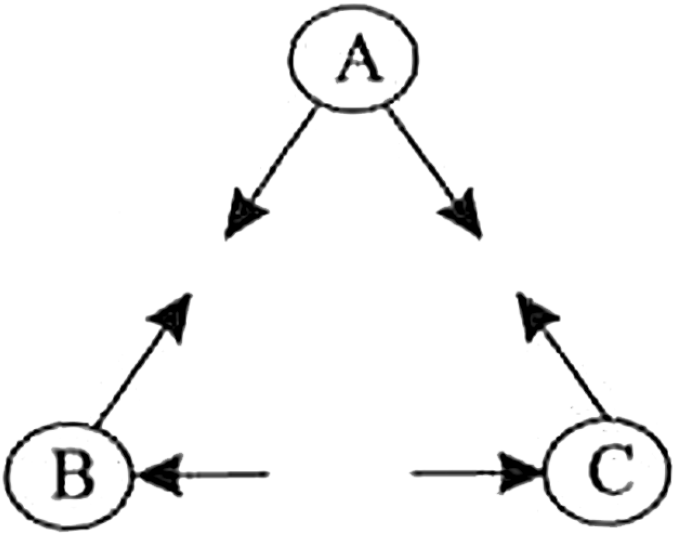
10. The diagram shows the arrangement of three small unifromly charged spheres A, B and C. The arrows indicate the direction of the electrostatic force acting between the spheres (for example, the left arrow on sphere A indicates the electrostatic force on shphere A due to sphere B). At least two of 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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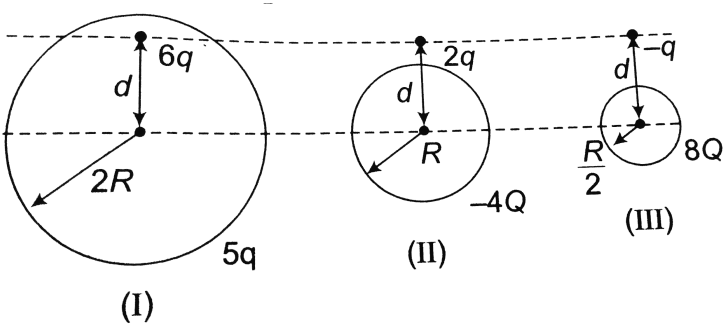
11. Figure, shown above, shows three situations involving a charged particle and a uniformly charged spherical shell. The charges and radii of the shells are indicated in the figure. If F_1, F_2 and F_3 are the magnitudes of the force on the particle due to the shell in

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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12. 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. $\frac{\sigma}{\varepsilon_0 r^2}\left(b^2 - c^2\right)$

C. $\frac{\sigma}{\varepsilon_0 r}\left(a^2 + b^2\right)$

D. none of these

A. 0

B. $\frac{\sigma}{\varepsilon_0 r^2}\left(b^2 - c^2\right) r^3$

C. $\frac{\sigma}{\varepsilon_0 r}\left(a^2 + b^2\right)$

D. none of these

Answer: B

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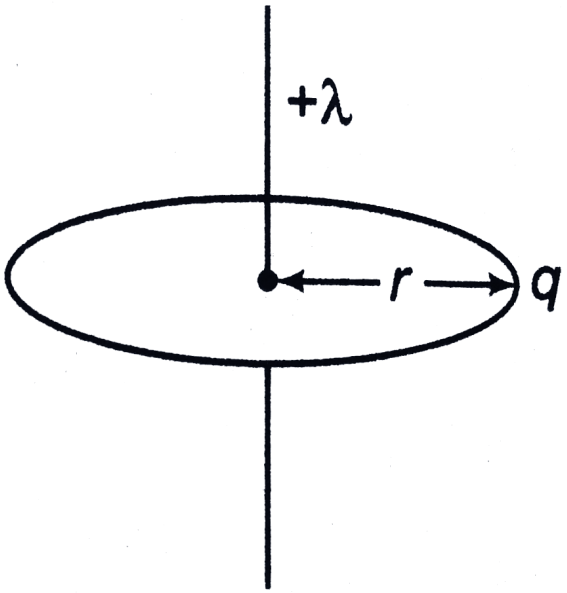
13. A particle of charge $-q$ and mass m moves in a circle of radius r around an infinitely long line charge of linear charge density $+\lambda$. Then,

time period will be



where ,

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

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

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

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

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

Answer: A

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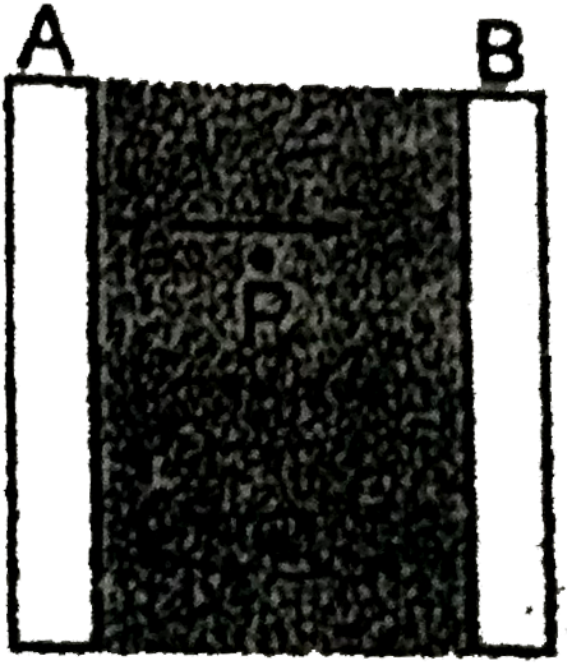
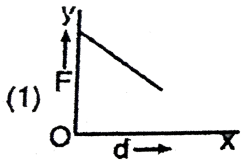
14. The figure shown represents the electric field between two large metal plates. Which of the graphs given in figure represents the force on a positve charge as it moves from point P

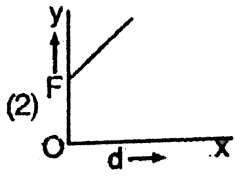
towards plate B?

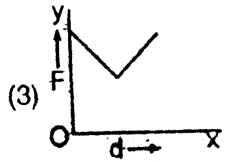


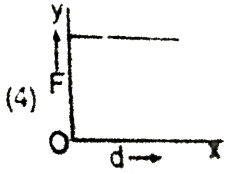
A.



B.



C. 

D. 

Answer: D

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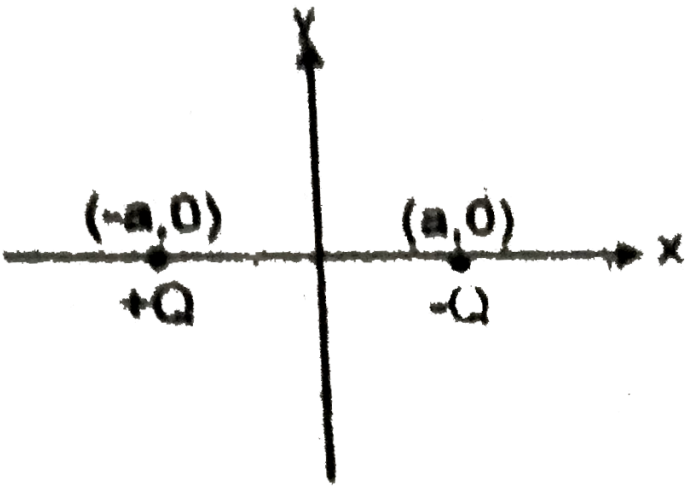
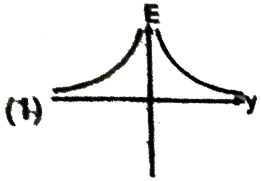
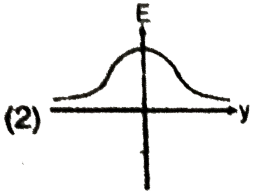
15. The variation of electric field on the y-axis as a function of 'y' is best represented by [for the given figure]:



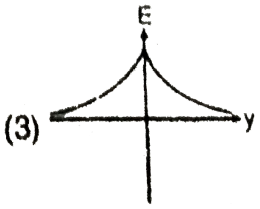


A.

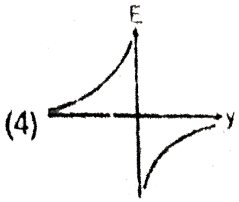


B

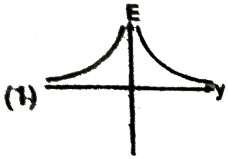
C.



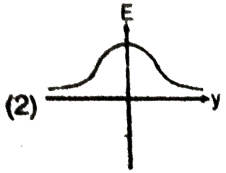
D.



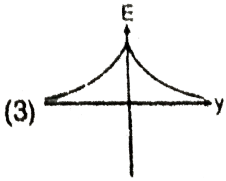
A.

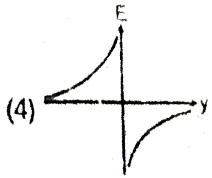


B.



C.



D. 

Answer: B

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16. A ring carries a uniform linear charge density on one half and the linear charge density of same magnitude but opposite sign on the other half.

A. The component of electric field along the axis at all points on the axis is zero

B. the electric field along the axis and on the axis is zero only at the centre

C. the resultant field at the centre is zero

D. the resultant field at all points on the axis is zero

Answer: A

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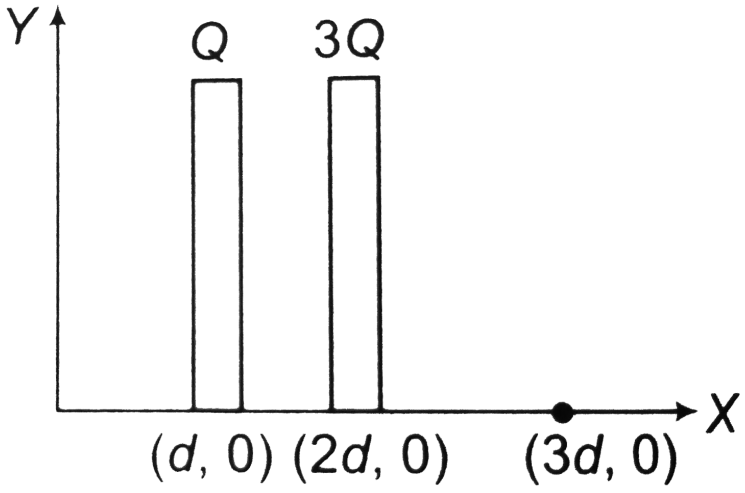
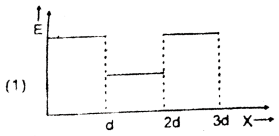
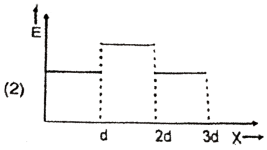
17. Two very large thin conducting plates having same cross sectional area are placed as shown in figure. They are carrying chaerges Q and $3Q$, respectivley. The variation of electric field as as function at x(for $x = 0$ to $x = 3d$) will be best represented as by



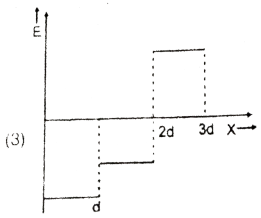
A.



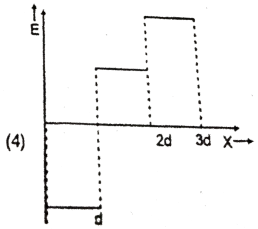
B.



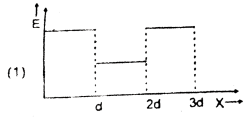
C.



D.



A.



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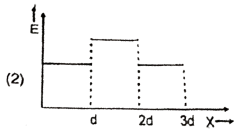
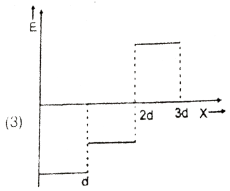
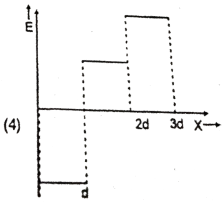


C. 

D. 

Answer: C

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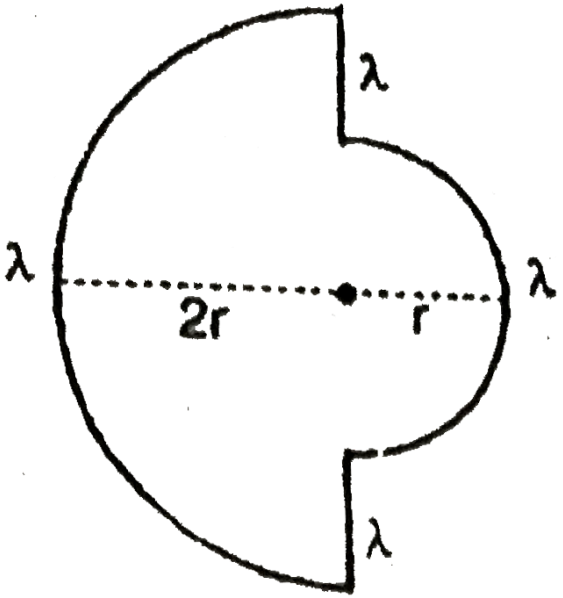
18. Two semicircular rings lying in same plane, of uniform linear charge density λ have radius r and 2r. They are joined using two straight

uniformly charged wires of linear charge density λ and length r as shown in figure. The magnitude of electric field at common centre of semi circular rings is -



A. $\frac{1}{4\pi\varepsilon_0}\frac{3\lambda}{2r}$

B. $\frac{1}{4\pi\varepsilon_0}\frac{\lambda}{2r}$

C. $\frac{1}{4\pi\varepsilon_0}\frac{2\lambda}{r}$

D. $\frac{1}{4\pi\varepsilon_0}\frac{\lambda}{r}$

Answer: D

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19. A nonuniformly charged ring is kept near an uncharged conducting solid sphere. The distance between their centres (which are on the same line normal to the plane of the ring) is 3m and their radius is 4m. If total charge on

the ring is $1\mu C$, then the potential of the sphere will be

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

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

C. $\frac{KQ}{\sqrt{R^2+l^2}}$

D. cannot determined

Answer: C

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20. A mercury drop of water has potential 'V' on its surface. 1000 such drops combine to form a new drop. Find the potential on the surface of the new drop.

A. V

B. 10V

C. 100V

D. 1000V

Answer: C

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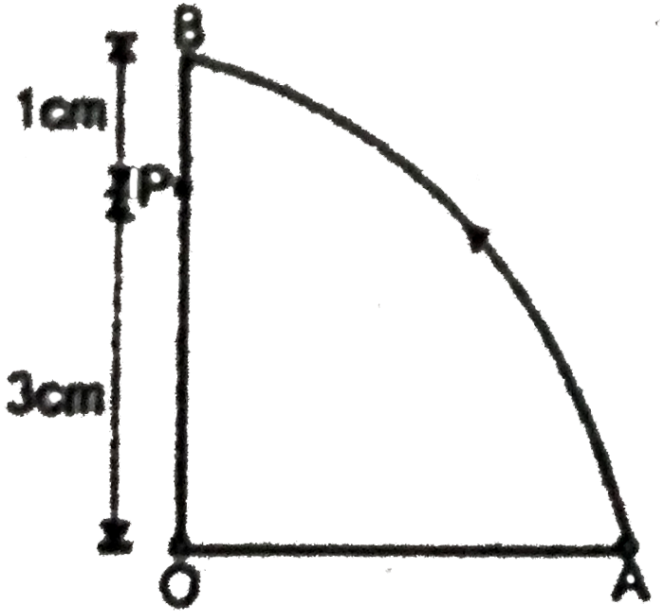
21. A point charge of 5C is placed at point P (as shown in figure). A unit positive charge is taken from A to B along the circular path shown, then the net work done by electrostatic force is : [O is the centre of the

circular path] [Where $k = 9 \times 10^9 Nm^2/C^2$]



A. $+400K$

B. $+4K$

C. $-400K$

D. $-4K$

Answer: C

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22. An electron is revolving around a proton. The total work done in one revolution by electric force on the electron will be zero if the trajectory of the electron is

A. circular only

B. elliptical only

C. any closed curve

D. not possible

Answer: C

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23. Three equal charges Q are placed at the three vertices of an equilateral triangle. What should be the va,ue of a charge, that when placed at the centroid, reduces the interaction energy of the system to zero ?

A. $\frac{-Q}{2}$

B. $\frac{-Q}{3}$

C. $\frac{-Q}{2\sqrt{3}}$

D. $\frac{-Q}{\sqrt{3}}$

Answer: D

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24. 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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25. Electric potential due to a dipole at a position $\vec{r}$ from its centre is: where $\left(K = \frac{1}{4\pi\varepsilon_0}\right.$

A. $\frac{K\vec{p}.\vec{r}}{r^3}$

B. $\frac{K.\vec{p}.\vec{r}}{r^2}$

C. $\frac{K.\vec{P}\times\vec{r}}{r^3}$

D. $\frac{K.\vec{p}\times\vec{r}}{r^2}$

Answer: A

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26. The magnitude of electric field intensity at point $B(2, 0, 0)$ due to a dipole of dipole moment $\overrightarrow{P} = \hat{i} + \sqrt{3}\hat{j}$ kept at origin is (assum that the point B is at a large distance from the dipole end $K = \dfrac{1}{4\pi\varepsilon_0}$)

A. $\dfrac{\sqrt{13}K}{8}$

B. $\dfrac{\sqrt{13}k}{4}$

C. $\dfrac{\sqrt{7}k}{8}$

D. $\dfrac{\sqrt{7}k}{4}$

Answer: C

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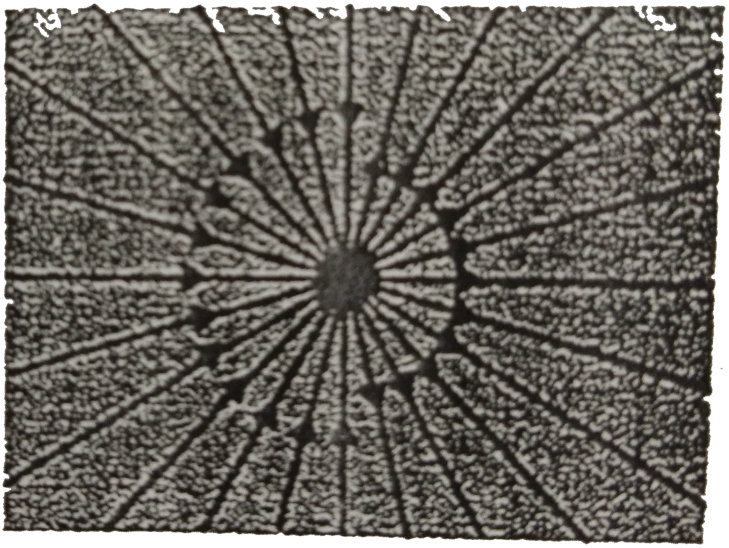
27. Consider the four field patterns shown. Assuming there are no charges in the regions shown, which of the patterns represents a

possible electrostatic field:



(a)

A. a

B. b

C. c

D. d

Answer: B

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28. If the net electric field flux passing through a closed surface is zero, then the electric field at the surface will be

A. 0

B. same at all places

C. depends upon the location of points

D. infinite

Answer: C

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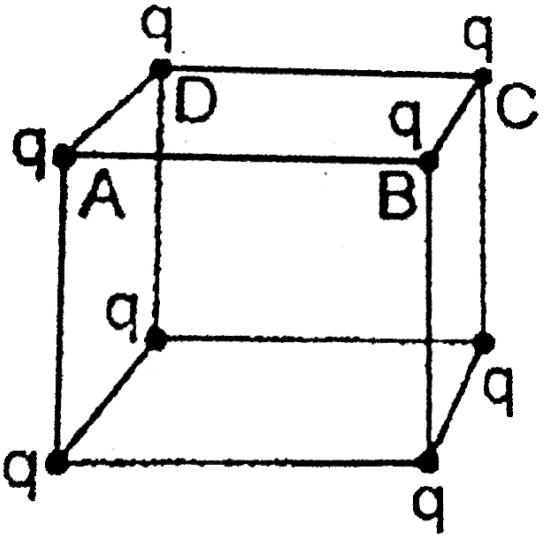
29. Eight point charges (can be assumed as small spheres uniformly charged and their centres at the corner of the cube) having values q each are fixed at vertices of a cube. The electric flux through square surface ABCD

of the cube is



A. $\frac{q}{24 \in_0}$

B. $\frac{q}{12 \in_0}$

C. $\frac{q}{6 \in_0}$

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

Answer: C

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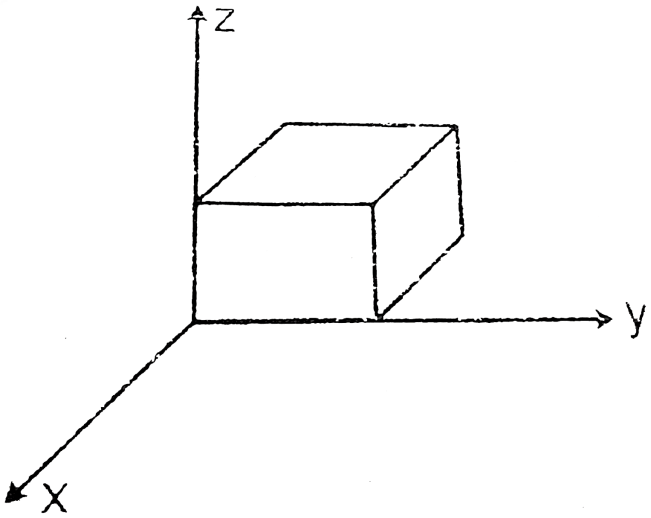
30. Figure above shows a closed Gaussian surface in the shape of a cube of edge length 3.0 m. There exists an electric field given by $\vec{E} = [(2.0 \times + 4.0)i + 8.0j + 3.0k]N/C$, where x is in metres in the region is which it lies. The net charge in coulombs enclosed by

the cube is equal to



A. $-54 \in_0$

B. $6 \in_0$

C. $-6 \in_0$

D. $54 \in_0$

Answer: D

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31. Electrical potential V in space as a function of co-ordinates is given by , $V = \frac{1}{x} + \frac{1}{y} + \frac{1}{z}$ then the electric field intensity at $(1, 1, 1)$ is given by:

A. $\hat{i} + \hat{j} + \hat{k}$

B. $\hat{i} + \hat{j} - \hat{k}$

C. $\hat{i} - \hat{j} + \hat{k}$

D. $-\hat{i} + \hat{j} + \hat{k}$

Answer: B

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32. S_1: In a metallic body total number of electrons is very large in comparison with non metallic solid body of same mass.

S_2: An uncharged conductor kept near a charged body is attracted by that body

whether the charge on the body is positve or negative.

S_3: The electric field produced by an infinitely large sheet is same on both sides.

A. TTF

B. FTF

C. TTT

D. FFF

Answer: B

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33. S_1: When a positively charged particle is released in an electric field , in its subsequent motion,it may or may not move along the electric field line passing through the point it has been released.

S_2: In electrostatic, conductors are always equipotential surfaces.

S_3: The flux through a closed Gaussian surface is non-zero. The electric field at some point on the Gaussian surface may be zero.

A. TTF

B. FTF

C. TTT

D. FFF

Answer: C

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34. A point charge q is located at the centre fo a thin ring of radius R with uniformly distributed charge $-q$, find the magnitude of the electric field strength vectro at the point

lying on the axis of the ring at a distance x from its centre, if $x > > R$.

A. $\frac{QR^2}{8\pi\varepsilon_0 x^4}$

B. $\frac{3QR^2}{8\pi\varepsilon_0 x^4}$

C. $\frac{5QR^2}{8\pi\varepsilon_0 x^4}$

D. $\frac{7QR^2}{8\pi\varepsilon_0 x^4}$

Answer: B

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35. Two small balls having equal positive charge Q (coulumb) on each suspended by two insulating strings of equal length L (metre) from a hook fixed to a stand. The whole set-up is taken in a satellite into space where there is no gravity (state of weightlessness). Then tension (newtons) in each string is:

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

B. $\frac{Q^2}{8\pi \in_0 L^2}$

C. $\frac{Q^2}{12\pi \in_0 L^2}$

D. $\frac{Q^2}{16\pi \in_0 L^2}$

Answer: D

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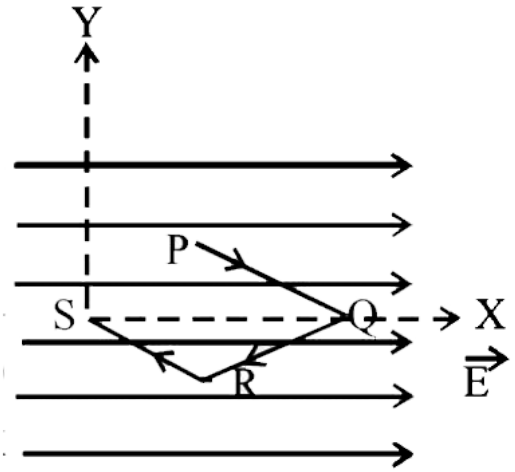
36. A point charge q moves from point P to pont S along the path PQRS (fig.) in a uniform electric field E pointing parallel to the poistive direction of the X-axis. The coordinates of the points P, Q, R and S are(a, b, O), (2a, O, O)(a, -b, $\underline{O}$) and `(O, O, O) respectively. The work done by

the field in the above process is given by the expresison.....



A. $qE\sqrt{a^2+b^2}$

B. qEb

C. $-qEa$

D. qEa

Answer: C

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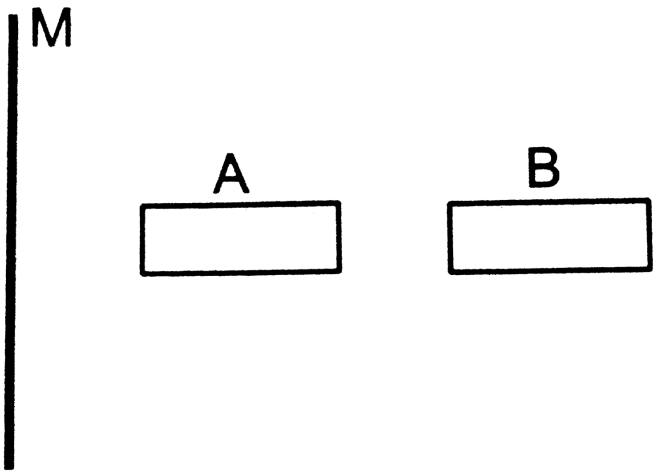
37. A large nonconducting sheet M is given a uniform charge density. Two unchared small metal rods A and B are placed near the sheet

as shown in figure



A. M attracts A

B. A attract B

C. M attracts B

D. B repels A

Answer: B

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38. At a distance of$5cm$ and $10cm$ from surface of a uniformly charge solid sphere, te potentials are $100V$ and $75V$ respectivley. Then

A. $\left(\frac{1}{3}\right) \times 10^{-9}C$

B. $\left(\frac{2}{3}\right) \times 10^{-9}C$

C. $\left(\frac{5}{3}\right) \times 10^{-9}C$

D. $\left(\frac{7}{3}\right) \times 10^{-9}C$

Answer: C

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39. An electric dipole is kept in the electric field produced by a point charge

A. dipole will experience a force

B. dipole will experience a torque

C. it is impossible to find a path (not closed) in the field on which work

required to move the dipole is zero.

D. dipole can be in stable equilibrium

Answer: A

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40. The electric potential decreases uniformly from 180V to 20V as one moves on the X-axis from $x = -2cm$ to $x = +2cm$. The electric field at the origin:

A. must be equal to 40 V/cm

B. may be equal to 40 V/cm

C. may be less than 30 V/m

D. may be less than 40 V/cm

Answer: B

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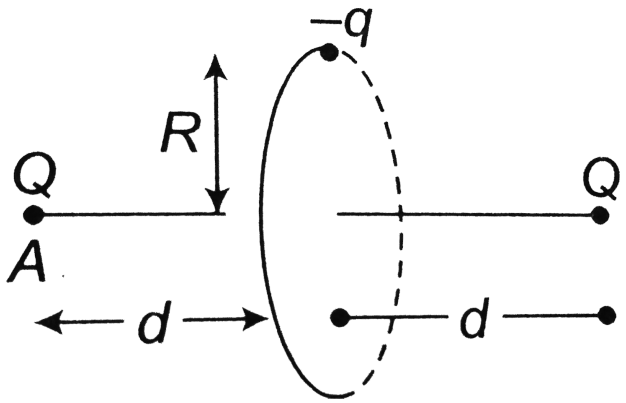
41. Two positive point charges each of magnitude $10C$ are fixed at positions A &B at a seperation $2d = 6m$. A negatively charged

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. 100

B. 200

C. 300

D. 400

Answer: D

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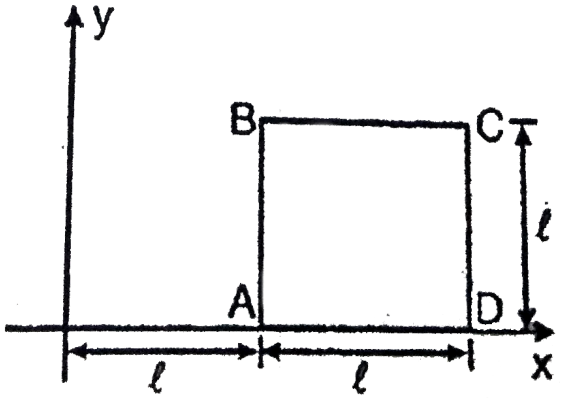
42. A square loop of side 'l' having uniform linear charge density 'λ' is placed in 'xy' plane as shown in the figure. There is a non uniform electric field $\vec{E} = \frac{a}{l}(x+l)\hat{i}$ where a is a constant. Then resultant electric force on the

loop if $l = 10cm, a = 2N/C$ and charge density $\lambda = 2\mu C/m$ is:



A. $4 \times 10^{-6} N$

B. $4 \times 10^{-5} N$

C. $3 \times 10^{-6} N$

D. $3 \times 10^{-5} N$

Answer: A

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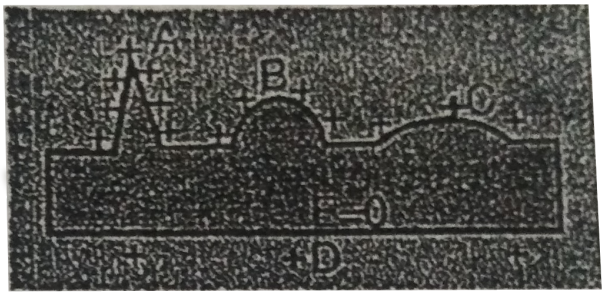
43. In the following figure an isolated charged conductor is shown. The correct statement will be -



A. $E_A > E_B > E_C > E_D$

B. $E_A < E_B < E_C < E_D$

C. $E_A = E_B = E_C = E_D$

D. $E_B = E_C$ and $E_A > E_D$

Answer: B

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44. If the above question, the potential has correct relations as given=

A. $V_A > V_B > V_C > V_D$

B. $V_A > V_B \geq V_C > V_D$

C. $V_D = V_C = V_B = V_A$

D. $V_C < V_B > V_A > V_D$

A. $V_A > V_B > V_C > V_D$

B. $V_A > V_B \geq V_C > V_D$

C. $V_D = V_C = V_B = V_A$

D. $V_C < V_B > V_A > V_D$

Answer: C

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45. In the above question, the surface charge densities have the correct relation is-

A. $\sigma_A > \sigma_B > \sigma_C > \sigma_D$

B. $\sigma_A = \sigma_B = \sigma_C = \sigma_D$

C. $\sigma_D > \sigma_C > \sigma_B > \sigma_A$

D. $\sigma_C < \sigma_B > \sigma_A > \sigma_D$

A. $\sigma_A > \sigma_B > \sigma_C > \sigma_D$

B. $\sigma_A = \sigma_B = \sigma_C = \sigma_D$

C. $\sigma_D > \sigma_C > \sigma_B > \sigma_A$

D. $\sigma_C < \sigma_B > \sigma_A > \sigma_D$

Answer: A

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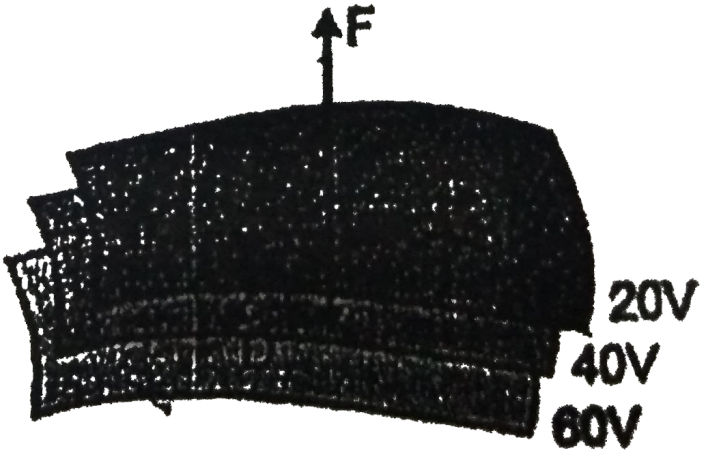
46. A family of equipotential surface are shown. The direction of the electric field at point A is along-



A. AB

B. AC

C. AD

D. AF

Answer: D

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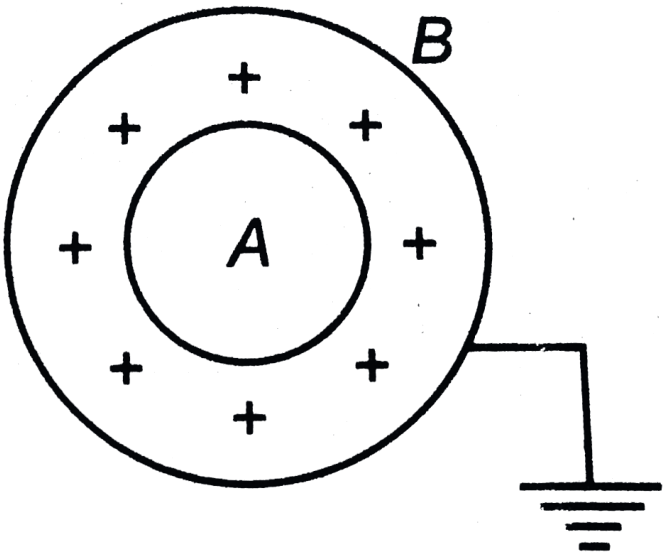
47. A and B are two concentric spherical shells.

If A is given a charge $+q$ while B is earthed as

shown in figure then



A. A and B both will have the same charge densities

B. the potential inside A and outside B will zero

C. the electric field between A and B is non zero

D. the electric field inside A and outside B is non zero

Answer: C

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48. Mark the wrong statement-

A. Equipotential surface never cross each other

B. for a uniformly charged nonconducting sphere, the electric potential at the centre of the sphere is 1.5 times that at the surface

C. if potential in a certain region in non zero constant, then the electric field in that region will also be non zero constant

D. Inside a spherical uniformly charged shell, the electric field is zero but the electric potential is the same as that at the surface.

Answer: C

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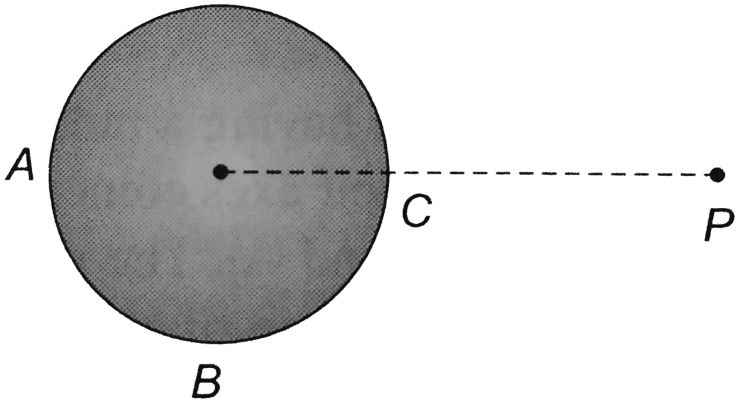
49. A hollow conducting sphere is placed in an electric field produced by a point charge placed at P as shown in figure.

Let V_A, V_B, V_C be the potentials at points A, B and C respectively. Then



A. $V_C > V_B$

B. $V_B > V_C$

C. $V_A > V_B$

D. $V_A = V_B$

Answer: D

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50. A point charge is kept at the centre of a metallic insulated spherical shell. Then

A. Electric field out side the sphere is zero

B. electric field inside the sphere is zero

C. Net induced charge on the sphere is zero

D. Electric potential inside the sphere is zero

Answer: C

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51. STATEMENT 1: When a negative charge -q is released at a distance R from the centre and along the axis of a uniformly and positvely charged fixed ring of radius R, the negative charge does oscillation but not SHM.

STATEMENT 2: The force on negative charge is always towards the centre of the ring but it is not proportional to the displacement from the centre of the ring.

A. Statement-1 is true, Statement-2: is true, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true, Statement-2: is true, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is true but statement-2 is false

D. Statement-1 is false, Statement-2 is true

Answer: A

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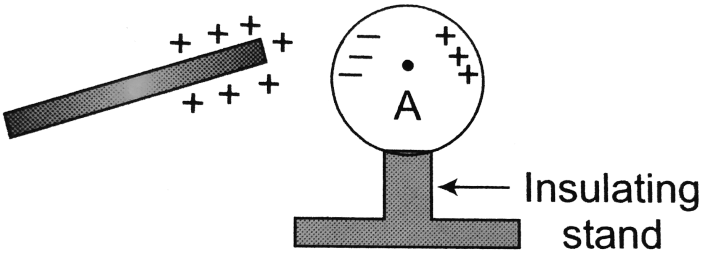
52. Assertion: A positively charged rod is held near a neutral conducting solid sphere as illustrated below. The sphere lies on a insulated stand. The potential of ground (or

earth) is zero. The potential at point A (point A need not be centre of the sphere) is higher compared to potential of gound (earth).



Reason: In this situation of assertion, the potential at the centre of conducting sphere is positive. the solid sphere being conducting, potential at each point in the sphere is same.

A. Statement-1 is true, Statement-2: is true, Statement-2 is a correct explanation for Statement-1.

B. Statement-1 is true, Statement-2: is true, Statement-2 is NOT a correct explanation for Statement-1.

C. Statement-1 is true but statement-2 is false

D. Statement-1 is false, Statement-2 is true

Answer: A

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