PHYSICS

FOR IIT JEE ASPIRANTS OF CLASS 12 FOR PHYSICS

ELECTRIC CHARGES AND FIELDS

ILLUSTRATION

1. A particle of charge q_1 and mass m is revolving around a fixed negative charge of magnitude q_2

in a circular path of radius r. Find the time period of revolution.

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2. Two point charges Q and q are placed at distance r and $\frac{r}{2}$ respectively alogn a straigt line from a third charge 4q. If q is in equilibrium determine $\frac{Q}{q}$.

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3. 2 small spheres each of mass m and carrying +q coulomb, are suspended by massles insulating threads, each of length l. Prove that $q^2 = (4mgl^2 \sin^2\theta \tan\theta) 4\pi\varepsilon_0$, where θ is angle made of strings with the vertical at equilibrium.

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4. Two identical balls each having a density ρ are suspended from as common point by two insulating strings of equal length. Both the balls have equal mass and charge. In equilibrium each string makes an angle θ with vertical. Now, both the balls are immersed in a liquid. As a result the angle θ does not change. The density of the liquid is σ. Find the dielectric constant of the liquid.

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5. A ring of radius R is with a uniformly distributed charge Q on it .A charge q is now placed in the centre of the ring .Find the increment in tension in the ring.

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6. A copper atom consists of copper nucleus surrounded by 29 electrons. The atomic weight of copper is $63.5 g mol^{-1}$. Let us now take two pieces of copper each weighing 10g. Let one electron from one piece be transferred to another for every 1000 atom in a piece.

(a) Find the magnitude of charge appearing on each piece.

(b) What will be the Coulomb force between the two pieces after the transfer of electrons if they are 10cm apart?

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7. Consider four equal charges (q, each) placed on the corners of a square with side a. Determine the magnitude and direction of the resultant force on the charge on lower right corner.

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8. Five point charges, each of value +q are placed on five vertices of a regular hexagon of side Lm. What is the magnitude of the force on a point charge of value -q coulomb placed at the centre of the hexagon?

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9. a point charge q is situated at a distance r from one end of a thin conduction rod of length L having a charge Q (uniformly distributed a long its length).find the magnitudes of electric force between the two.

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10. Two charge $+Q$ each are placed at the two vertices of an equilateral triangle of side a .The intensity of electric field at the third vertex is

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11. Two charge $+Q, -Q$ are placed at the two vertices of an equilateral triangle of side $'a'$. Then the intensity of electric field at the third vertex is

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12. An ionfinite number of charges each q are placed in the x-axis at distances of 1,2,4,8 meter from the origin. If the charges are alternately positive and negative find the intensity of electric field at origin.

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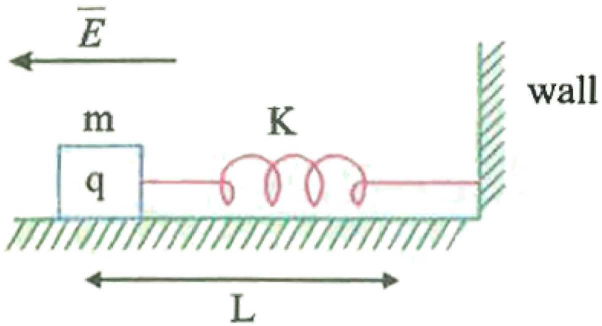
13. A point mass m and charge q is connected with a spring of negligible mass with natural length L. Initially spring is in natural length. Now a horizontal uniform electric field E is switched on as shwon. Find

a. The maximum separation between the mass and the wall

b.Find the separation of the point mass and wall at the equilibrium position of mass

c. Find the energy stored in the spring at the equilibrium position of the point mass.



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14. A block having mass $'m'$ and charge q is resting on a frictionless plane at distance L from the wall as shown in fig.Discuss the motion of the block when a uniform electric field E is applied horizontally towards the wall assuming that collision of the block with the wall is perfectly elastic.

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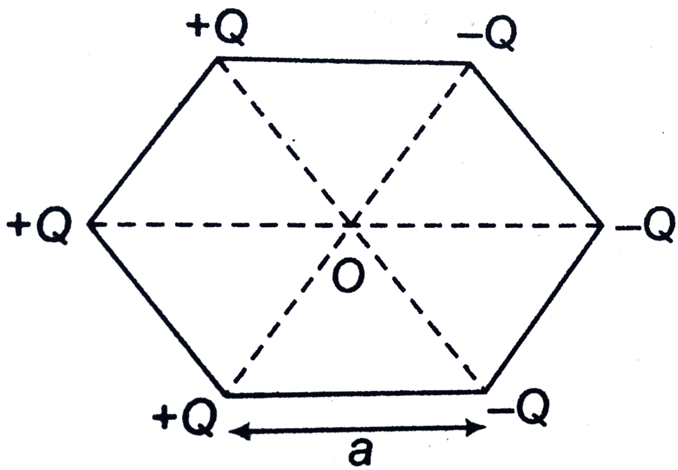
15. Six charges are placed at the vertices of a rectangular hexagon as shown in the figure. The electric field on the line passing through point

O and perpendicular to the plane of the figure as a function of distance x from point O is (xgtgta)



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16. Consider a circular arc of radius R which subtends an angle ϕ at its centre .Let us calculate the electric field strength at C

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17. An α particle is located at a point where electric field strength is $3 \times 10^4 N/C$. Calculate (a) the force on the α- particle (b) its acceleration.

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18. A pendulum bob has mass 4 mg and carrieas a charge 2×10^{-9} coulomb. It hangs in equilibrium from a massless thread of length 50 cm whose other end is fixed to a vertical wall. A horizontal electtic field of inetensity 20000 V/m exists in space. Calculate

a. Angle made by the thread with the vertical

b. Tension in the thread

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19. Along x-axis at positions $x=1, x=2, x=4.\ldots\ldots\ldots\ldots\infty$ charges q is placed. What will be electric field at x=0 due to these charges. What will be the value of electric field If the charges are alternately positive and negative.

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20. A copper ball of density $8.6gcm^{-3}$ and 1 cm in diameter is immersed in oil of density $0.8gcm^{-3}$. What is the charge on the ball, if it remains just suspended in oil in electric field of intensity $3600V/m$ acting in the upward direction ?

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21. As charge $q = 1\mu C$ is placed at point $(1m, 2m, 4m)$. Find the electric field at point $P(0, -4m, 3m)$

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22. The field lines for two point charges shown in fig.

(i) Is the field uniform?

(ii) Determine the ratio q_A / q_B.

(iii) What are the sign of q_A and q_B ?

(iv) Apart from infinity, where is the neutral point?

(v) If q_A and $q_B$are separated by a distance $10\left(\sqrt{2}-1\right)$ cm, find the position of neutral point.

(vi) where will the lines meet which are coming from A and are not meeting at q_B?

(vii) Will a positive charge follow the line of force if free to move?

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23. Calculate the electric field intensity due to an electric dipole of length 10 cm having charges of $100\mu C$ at a point 20 cm from each charge on equatorial line.

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24. A dipole of moment $\vec{p} = 10^{-7}\left(5\hat{i} + \hat{j} - 2\hat{k}\right)$ C is placed in an electric field $\vec{E} = 10^{7}\left(\hat{i} + \hat{j} + \hat{k}\right)Vm^{-1}$. Find the torque experienced .

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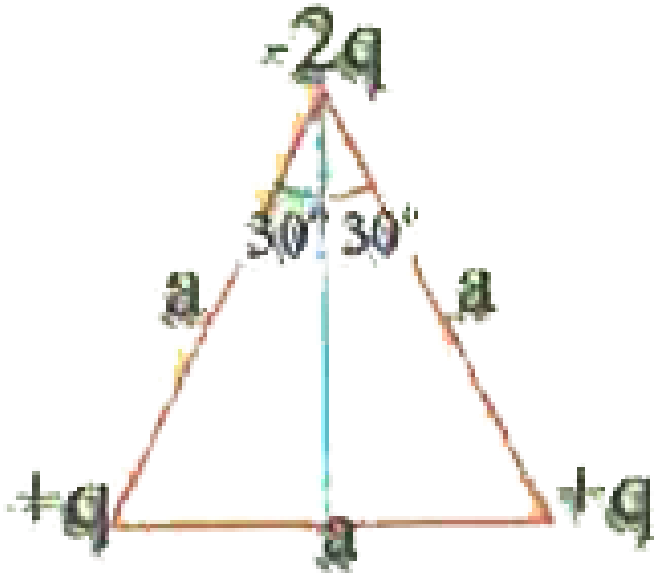
25. Three points charges =q, -2q, +q are arranged on the vertices of an equilateral triangle as shown in the figure. Find he dipole moment of the system.



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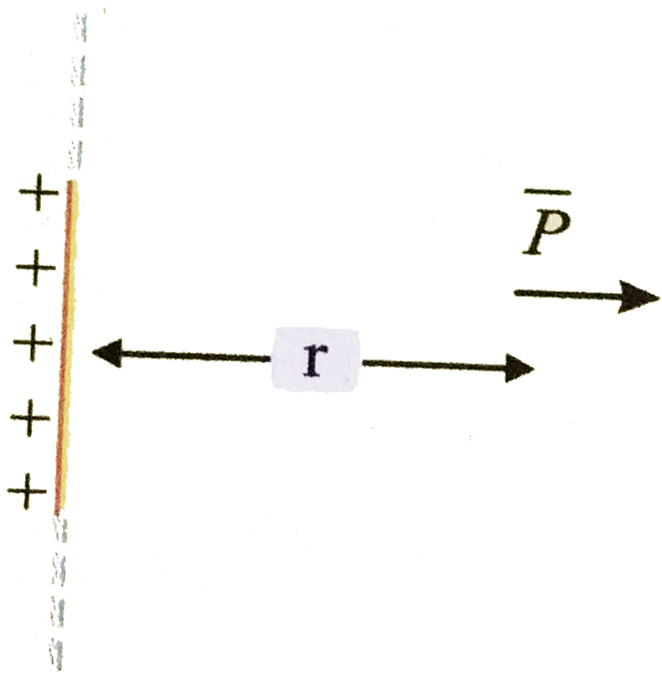
26. An electric dipole of moment p is kept at a distance r form an infinite long charged wire of linear charge density λ as shown.Find the force acting on the dipole?



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27. What is the value of electric flux in SI unit in Y-Z plane of area $2m^2$, if intensity of electric field is $\overrightarrow{E} = \left(5\hat{i} + 2\hat{j}\right)$ N//C

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28. A point charge Q is placed at the corner of a square of side a. Find the flux through the square.

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29. A point charge Q is placed at the corner of a square of side a. Find the flux through the square.

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30. A cylinder of length L and radius b has its axis coincident with x-axis. The electric field in this region is $\overrightarrow{E} = 200\hat{i}$. Find the flux through the left end of the cylinder.

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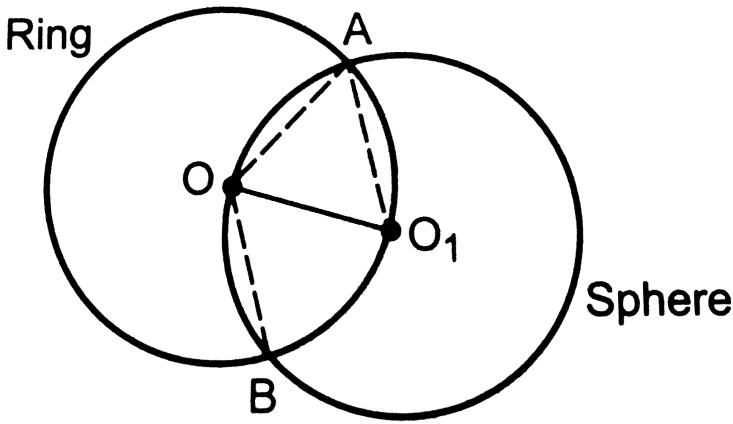
31. A Charge Q is distributed uniformly on a ring of radius r. A sphere of equal r is constructed with its centre at the periphery of the ring (figure 30.12) Find the flux of the electric field through the surface of the sphere.



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EVALUATE YOURSELF-1

1. The ratio of the force between two small spheres (with constant charges) F_1 in air and F_2 in a medium of dielectric constant k is respectively..

A. $1:k$

B. $k:1$

C. $1:k^2$

D. $K^2:1$

Answer: B

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2. A certain charge Q is divided at first into two parts, q and Q-q. later on the charges are placed at a certain distance. If he force of interaction between two charges is maximum, then

A. $\frac{Q}{q} = \frac{4}{1}$

B. $\frac{Q}{q} = \frac{2}{1}$

C. $\frac{Q}{q} = \frac{3}{1}$

D. $\frac{Q}{q} = \frac{1}{3}$

Answer: B

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3. Two identical bodies in which charges are $40\mu C$ and $-20\mu C$. They are some distance apart. Now they are touched and kept at the same distance. The ratio of the initial to the final force between them is

A. $8:1$

B. $4:1$

C. $1:8$

D. $1:1$

Answer: A

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4. Charges 4Q, q and Q and placed along x-axis at positions $x=0, x=1/2$ and $x=1$, respectively. Find the value of q so that force on charge Q is zero

A. $-q$

B. $-2q$

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

D. $4q$

Answer: A

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5. The electrostatic force between two point charges q_1 and q_2 at separation r is given by F= $k.\frac{q_1q_2}{r^2}$. The constant k

A. Depends upon system of units only

B. Depends upon medium between the charges

C. Depends on both 1 and 2

D. Is independent of both 1 and 2

Answer: C

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6. Two point charges placed at a certain distance r in air exert a force F on each other. Then the distance r at which these charges will exert the same force in a medium of dielectric constnat K is given by

A. r

B. $\frac{r}{K}$

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

D. $r\sqrt{K}$

Answer: C

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

A. only -q is 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 equilibrium.

Answer: C

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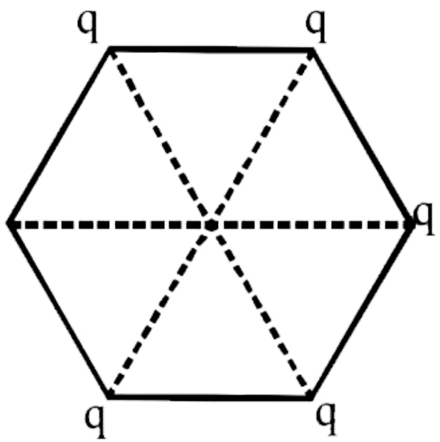
9. Five point charges, each of value +q coul, are placed on five vertices of a regular hexagon of isde L meters. The magnitude of the force on the point charge of value -q coul, placed at the centre of the hexagen is................



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

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

C. $\frac{1}{4p\varepsilon_0} \cdot \frac{q^2}{(2L^2)}$

D. $\frac{1}{4\pi\varepsilon_0} \cdot \frac{q^2}{(2L)^2}$

Answer: B

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10. A charge Q is to be divided on two objects. What shouold. be the values of the charges on the objects so that the. force between the objects can be maximum?.

A. $\frac{2Q}{3}, \frac{Q}{3}$

B. $\frac{Q}{2}, \frac{Q}{2}$

C. $\frac{Q}{4}, \frac{2Q}{4}$

D. $\frac{Q}{5}, \frac{4Q}{5}$

Answer: B

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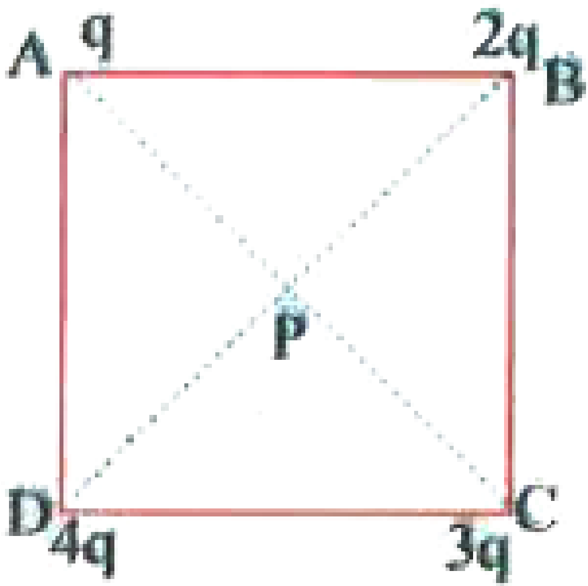
EVALUATE YOURSELF-2

1. q,2q, 3q and 4q charges are placed at the four corners A,B,C and D of a square. The field at the centre P of the square has the direction parallel to



A. AB

B. CB

C. AC

D. BD

Answer: B

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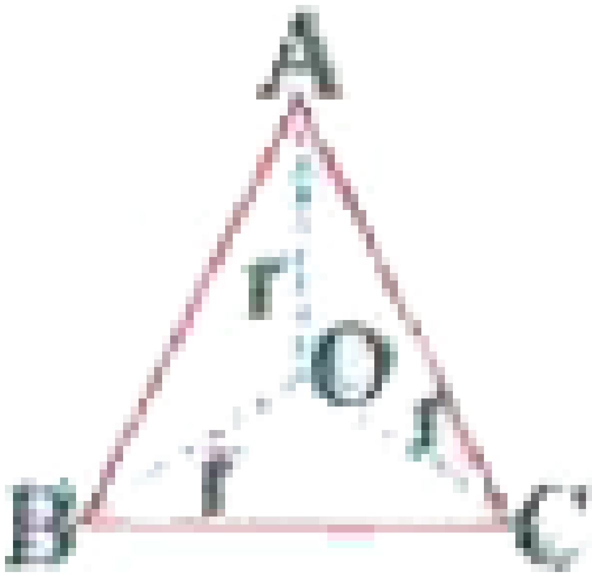
2. Three charges +Q each are placed at the corners A,B and C of an equilateral triangle. At the circumcenre, O the electric field wil be



A. $\frac{1}{4pe_0}\frac{3Q}{r^2}$

B. $\frac{1}{4pe_0}\frac{Q}{r^2}$

C. Zero

D. $\frac{1}{4pe_0}\frac{QQ}{r^2}$

Answer: C

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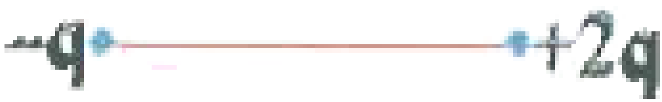
3. In the diagram shown electric field intensity will be zero at a point.



A. Betwee -q and +2q charge

B. Towards +2 cahrge on the line

C. Away from line towards +2q charge

D. Away from line towards -charge

Answer: D

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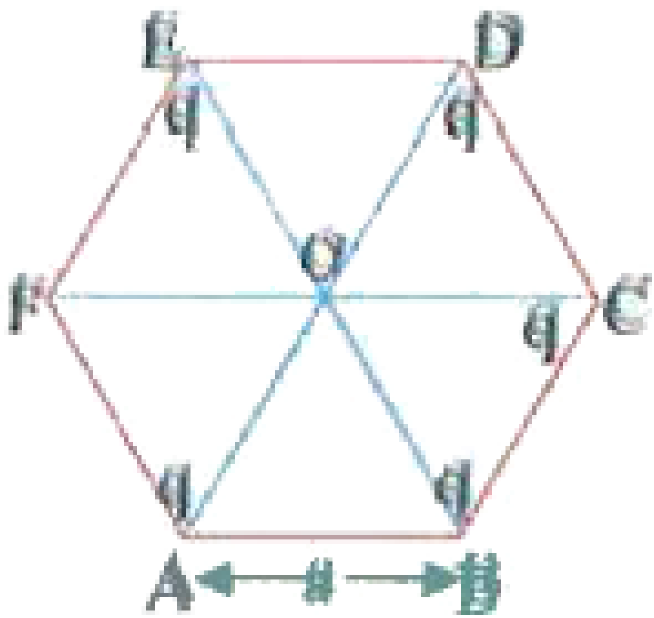
4. Five charges each equal to q are palced at the five corners, A,B,C,D and E of a regular hexagon ABCDEF of side a. Then the electric intensity at he centre O of the hexagon is



A. $\dfrac{q}{4pe_0a^2}$ along $\overrightarrow{OF}$

B. $\dfrac{q}{4pe_0a^2}$ along $\overrightarrow{FO}$

C. $\dfrac{q}{4pe_03a^2}$ along $\overrightarrow{OF}$

D. $\dfrac{5q}{4\pi e_0a^2}$ along $\overrightarrow{OF}$

Answer: A

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5. The electric field in a region is directed outward and is proportional to the distance r from the origin. Taking the electric potential at the origin to be zero

A. It is uniform in the region

B. It is proportional to r

C. It is proportional to r^2

D. It increase as one goes away from the origin.

Answer: C

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6. A circular ring of radius r carries a charge Q uniformly spread on it. A small length dl is cut off. Find the electric field at the centre due to the remaining wire.

A. $\dfrac{Q}{4\pi\varepsilon_0 r^2}$

B. $\dfrac{Qdl}{4\pi^2\varepsilon_0 r^3}$

C. $\dfrac{Qdl}{8\pi^2\varepsilon_0 r^2}$

D. $\dfrac{Qdl}{8\pi^2\varepsilon_0 r^3}$

Answer: D

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7. 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. $-E/3$

B. $-3E$

C. $E/3$

D. $-E$

Answer: C

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8. The magnitude of electric field $\vec{E}$ in the annular region of a charged cylindrical capacitor.

A. is same throughout

B. is higher near the outer cyliner than near the inner cylinder

C. varies as 1/r, whre r is the distance from the axis

D. varies as $1/r^2$ where r is the distance from the axis

Answer: C

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9. No two electric lines of force wil intersect from this which of the following statements is/are true?

A. the field is uniform at theat point of intersection

B. the field is non uniform at that point of intersection

C. the electric field is strong and may have more than one direction at the point of intersection.

D. at the point of intersection the electric field will have two different directions which is not possible.

Answer: D

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EVALUATE YOURSELF-3

1. Electric field intensity at a point varies as r^{-3} for

A. a point charge

B. An electric dipole

C. A plane infinite sheet of charge

D. A line charge of infinite length

Answer: B

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2. An electric dipole consists of two opposite charges of magnitude $q = 1 \times 10^{-6} C$ separated by 2.0cm. The dipole is placed in an external field of $1 \times 10^5 NC^{-1}$. What maximum torque does the field exert on the dipole ? How much work must an external agent do to turn the dipole end for end, starting from position of alignment $(\theta = 0^\circ)$?

A. $0.2 \times 10^{-3} N - m$

B. $1.0 \times 10^{-3} N - m$

C. $2.0 \times 10^{-3} N - m$

D. $4.0 \times 10^{-3} N - m$

Answer: C

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3. When an electric dipole is kept near a positive charge, it will experience

A. A force only

B. A torque only

C. Both force and torque

D. Neither force nor torque.

Answer: C

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4. An electric dipole is placed in a uniform electric field. It may experience

A. A force only

B. A torque only

C. Both force and torque

D. neither torque nor force

Answer: B

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5. P and Q are two points on the axis and the perpendicular bisector respectively of an electric dipole. Both the points are far way from the dipole, and at equal distances from it. If $\overrightarrow{E}_P$ and $\overrightarrow{E}_Q$ are fields at P and Q ten

A. $\overrightarrow{E}_P = \overrightarrow{E}_Q$

B. $\overrightarrow{E}_P = -2\overrightarrow{E}_Q$

C. $\overrightarrow{E}_P = 2\overrightarrow{E}_Q$

D. $\left|E_Q = \frac{1}{2}\right|E_P\Big|$, and $\overrightarrow{E}_Q$ is perpendicular to $\overrightarrow{E}_P$

Answer: B

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6. For a given dipole at a poit (away from the center of dipole) intensity of the electric field is E. Charges of the dipole are brought closer such that distance between point charges is half, and magnitude of charges are also halved. The intensity of the field now at the same point becomes

A. One fourth

B. Doubled

C. Four times

D. Halved

Answer: A

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7. Two point charges $+q$ and $-q$ are held fixed at $(-d, o)$ and $(d, 0)$ respectively of a x-y coordinate system. Then

A. The electric field $\vec{E}$ at all points on the X-axis has the same direction

B. $\vec{E}$ at all points on the Y-axis is along $\vec{i}$

C. Work has to be done in bringing a test charge from infinity to the origin slowly.

D. The dipole moment is 2qd directed along $\vec{i}$.

Answer: D

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EVALUATE YOURSELF-4

1. Electric charge is uniformly distributed along a long straight wire of radius 1 mm. The charge per cm length of the wire Q coulomb. Another cylindrical surface of radius 50 cm and length 1 m symmetrical encloses the wire as shown in the figure. The total electric flux passing through the cylindrical surface is

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

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

C. $\dfrac{100Q}{(\varepsilon_0)^2}$

D. $\dfrac{100Q}{(\pi\varepsilon_0)}$

Answer: B

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2. An electric charge q is placed at the centre of a cube of side l. The electric flux through one of its faces will be

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

B. $\dfrac{q}{6\varepsilon_0}$

C. $\frac{q}{\varepsilon_0 l^2}$

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

Answer: B

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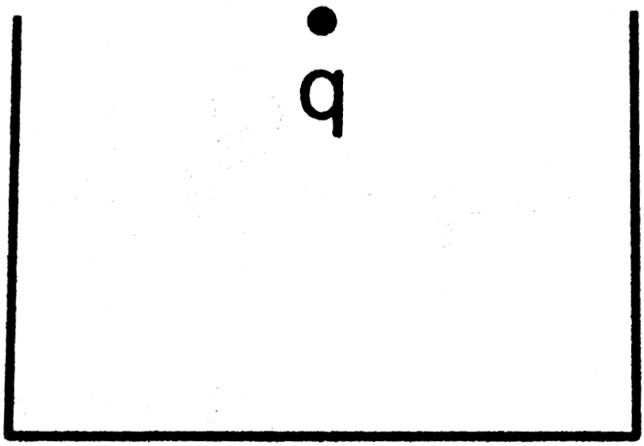
3. A charge q is placed at the centre of the open end of a cylindrical vessel . The flux of the electric field through the surface of the vessel is



A. zero

B. q / ε_0

C. $q / 2\varepsilon_0$

D. $2q / \varepsilon_0$

Answer: C

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4. A point charge q is placed at one corner of a cube of edge a. The flux through each of the cube faces is

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

B. $\frac{q}{16\varepsilon_0}$

C. $\frac{q}{24\varepsilon_0}$

D. $\frac{q}{48\varepsilon_0}$

Answer: C

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5. A hemispherical body of radius R is placed in a uniform electric field E. If the field E is parallel to the base of the hemisphere the flux linked with it is

A. $2\pi RE$

B. $2\pi R^2 E$

C. $\pi R^2 E$

D. zero

Answer: D

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6. The length and radius of a cylinder are L and R respectively. The total flux for the surface of the cylinder, when it is placed in a uniform electric field E parallel to the axis of the cylinder is

A. zero

B. $2\pi R^2 E$

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

D. $\pi R^2 E$

Answer: A

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C.U.Q

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

A. mass of A $>$ mass of B

B. mass of A $<$ Mass of B

C. mass of A= Mass of B

D. mass of A $\leq$ Mass of B

Answer: B

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2. Two spheres of equal mass A and B are given +q and -q charge respectively then

A. mass of A increases

B. mass of B increases

C. mass of A remains constant

D. mass of B decreases

Answer: B

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3. a soap bubble is given positive charge, then its radius.

A. Decreases

B. Increases

C. Remains unchanged

D. Nothing can be predicted as information is insufficient.

Answer: B

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4. Two charges are placed at a distance apart if a glass slab is placed between them force between them will

A. be zero

B. Increases

C. decreases

D. remains the same

Answer: C

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5. A negatively charged particle is situated on a striaght line joining two other charge particle stationary of motion of the negatively charged particle will depend on

A. the magnitude of charge

B. the position at which it is situated

C. both the magnitude of charge and its position

D. the magnitude of +q

Answer: B

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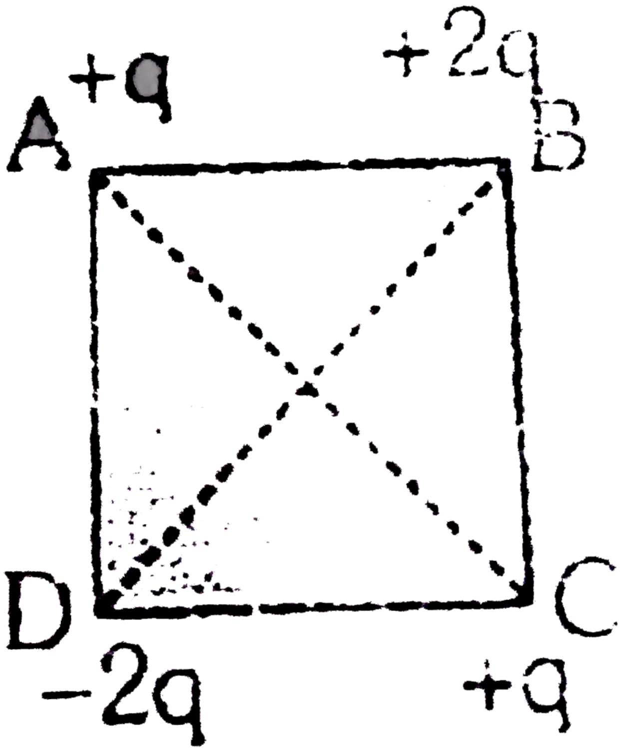
6. Four charges are arranged at the corners of a square ABCD as shown in the figure. The force on the charge kept at the centre O will be:



A. zero

B. along the diagonal AC

C. along the diagonal BD

D. perpendicular to side AB

Answer: C

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7. Two identical $+ve$ charges are at the ends of a straight line AB .Another identical $+Ve$ charge is placed at$C$ such that $AB = BC$,A,B, and C being oh the same line. Now the force on

A

A. increases

B. decreases

C. remain same

D. we cannot say

Answer: A

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8. 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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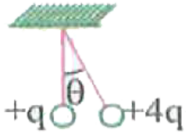
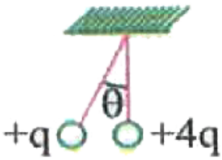
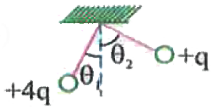
9. Two metal sphere of same mass are suspended form a common point by a light insulating string.The length of each string is same.The sphere are given electric charges $+q$ on one end and $+4q$ on the other.Which of the following diagram best shows the resulting positions of spheres?

A. 

B. 

C. 

D. 

Answer: A

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10. Two point metal charges $-q$ and $+2q$ are placed at a certain distance apart.Where should a third point charge be placed so that it is in equilibrium?

A. at the mid point on the line joining the two charges

B. on theline joining the two charges on the left of -q

C. between -q and +2q

D. at any point on the right bisector of the 1

in e joining -q and +2q.

Answer: B

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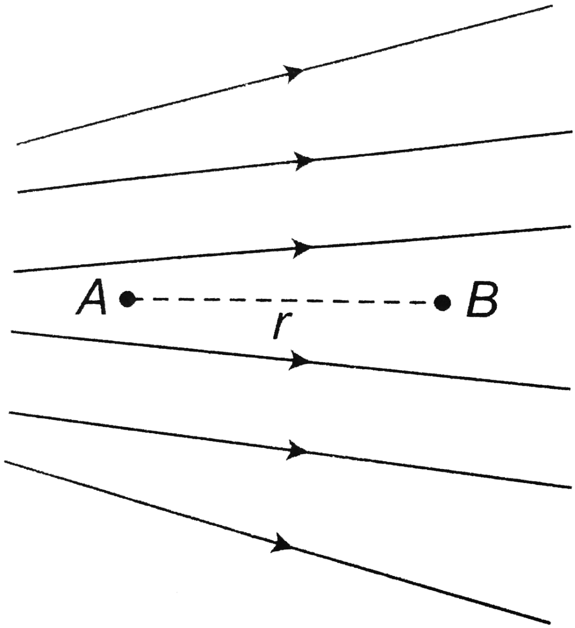
11. Figure shows the electric lines of force emerging from a charged body. If the electric field at A and B are E_A and E_B respectively and if the displacement between A and B is r then



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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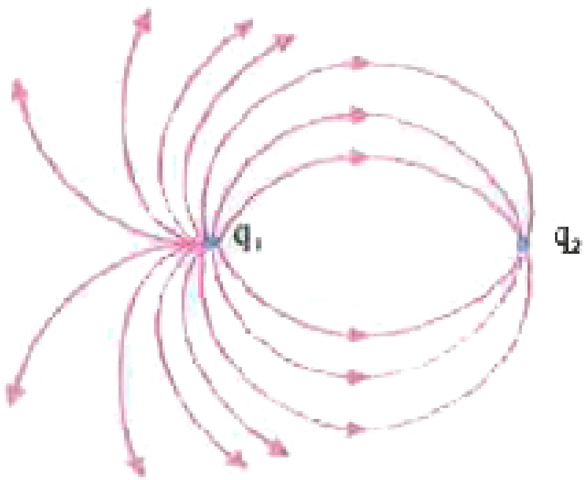
12. Figure shows lines of force for a system of two point charges. The possible choice for the charge is



A. $q_1 = 4\mu C, q_2 = -1.0\mu C$

B. $q_1 = 1\mu C, q_2 = -4\mu C$

C. $q_1 = -2\mu C, q_2 = +4\mu C$

D. $q_1 = 3\mu C, q_2 = 2\mu C$

Answer: A

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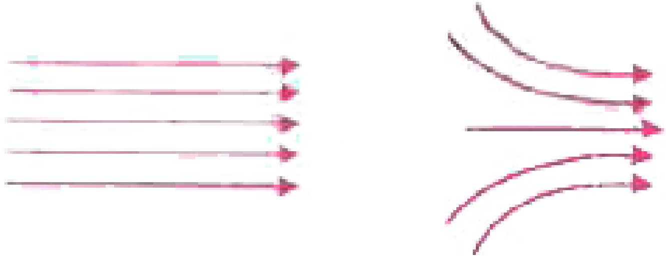
13. Drawings I and II show to samples of electric field lines



A. The electric fields in both I and I I are produced by negative charge located somewhere on the left and positive charges located somewhere on the right

B. In both I and II the electric field is the same every where

C. In both cases the field becomes stronger on moving form left to righ

D. The electric field in I is the same everywhere, but in II the electric field becomes stronger on moving from left to right.

Answer: D

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14. An electron is projected with certain velocity into an electric field in a direction opposite to the field. Then it is

A. accelerated

B. retarded

C. neigther accelerated nor retarded

D. either accelerated or retarded

Answer: A

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15. The acceleration of a charged particle at a uniform electric field is

A. proportional to its charge only

B. inversely proportional to its mass only

C. proportional to its specific charge

D. inversely proportional to specific charge

Answer: C

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16. A deuteron and an α-particle are placed in an electric field.The forces acting on them are F_1 and F_2 and their accelerations are a_1 and a_2

respectively.

(i) $F_1 = F_2$

(ii) $F_1 \neq F_2$

(iii) $a_1 = a_2$

(iv) $a_1 \neq a_2$

A. $\overline{F}_1 = \overline{F}_2$

B. $\overline{F}_1 + \overline{F}_2 = 0$

C. $|\bar{a}_1| = |\bar{a}_2|$

D. $|\bar{a}_1| \geq |\bar{a}_2|$

Answer: B

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17. The bob of a pendulum is positively charged.Another identical charge is placed at the point of suspension of the pendulum.The time period of pendulum

A. increases

B. decreases

C. become zero

D. remains the same

Answer: D

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18. Intensity of electric field inside a uniformly charged hollow sphere is

A. zero

B. non zero constant

C. change with r

D. inversely proportional to r

Answer: A

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19. A positive charge q_0 placed at a point P near a charged of metal sphere experience a force of repulsion of magnitude F, the electric field E of the charge metal, charge at P is

A. $\frac{F}{q_0}$

B. $< \frac{F}{q_0}$

C. $> \frac{F}{q_0}$

D. F

Answer: B

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20. A cube of side b has a charge q at each of its vertices. Determine the potential and electric field due to this charge array at the center of the cube.

A. zero

B. $\frac{32q}{b^2}$

C. $\frac{q}{2b^2}$

D. $\frac{q}{b^2}$

Answer: A

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21. An electron and proton are sent into an electric field .The ratio of force experienced by them is

A. $1:1$

B. $1:1840$

C. $1840:1$

D. $1:9.11$

Answer: A

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22. 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 parabola

C. the velocity of the electron will decrease

D. the velocity of the electron will increase

Answer: C

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23. A charged bead is capable of sliding freely through a string held vertically in tension .an electric field is applied parallel to the string so that the bead stays at rest at the middle of the string .If the electric field is switched off momentarily and switched on

A. the bead moves downwards and stops as soon as the field is switched on

B. the bead moved downwards when the field is swithced off and moves upwards when the field is switched on

C. the bead moves downwards with constnat acceleration till it reaches the bottom of the string

D. the bead moves downwarsa with constant velocity till it reaches the bottom of the string

Answer: D

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24. An electron is moving with constant velocity along x-axis. If a uniform electric field is applied along y-axis, then its path in the x-y plane will be

A. a straight line

B. a circle

C. a parabola

D. an ellipse

Answer: C

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25. 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. $\sqrt{M_p / M_e}$

C. $\sqrt{M_e / M_P}$

D. 1836

Answer: B

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26. Dimension of ε_0 are

A. $\left[M^{-1}L^3T^4A^2\right]$

B. $\left[M^0L^{-3}T^3A^3\right]$

C. $\left[M^{-1}L^{-3}T^3A\right]$

D. $\left[M^{-1}L^{-3}TA^2\right]$

Answer: A

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27. Two points charges q and -2q are placed some distance d apart. If the electric field at the location of q is E, that at the location of -2q is

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

B. $-2E$

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

D. $-4E$

Answer: C

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28. The field acting on the following charges is

A. electrostatic both inside and outside the cell

B. non -electrostatic bogh inside and outside the cell

C. electrostatic inside the cell and non electrostatic outside the cell

D. non electrostatic inside the cell and electrostatic outside the cell

Answer: D

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29. An electron moves with a velocity $\vec{v}$ in are electric field $\vec{E}$ if the angle between $\vec{V}$ and $\vec{E}$ is neither 0 nor π ,then path followed by the electron is

A. straight line

B. circle

C. ellipse

D. parabola

Answer: D

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30. A charged particle is free to move in an electric field

A. It will always move perpendicular to the line of force

B. It will always move along the line of force in the direction of the field.

C. It will always move along the line of force opposite to the direction of the field.

D. It will always move along the line of force in the direction of the field or opposite to the direction of the field depending on the nature of the charge

Answer: D

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31. Two parallel plates carry opposite charges such that the electric field at the space between them is in upward direction ,.An electron is shot in the space and parallel to the plates.its deflection from the original directions will be

A. upwards

B. Downwards

C. Circular

D. Does not deflect

Answer: B

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32. Due to the motion of a charge its magnitude

A. changes

B. does not changes

C. increases (or) decreases depends on its speed

D. can not be predicted

Answer: B

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33. Induction precedes attraction .Explain

A. an uncharged body can attract an uncharged body due to induction of opposite charge on it

B. a charged body can attracte an uncharged body due to induction of same charge on it

C. a charged body can attract an unchanged body due to induction of opposite charge on it.

D. a charged boy can attract another charged body due to induction of same charge on it.

Answer: C

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34. The coulomb electrostatic force is defined for

A. two sphereical charges at rest only

B. two point charges in motion

C. two pont charges at rest

D. both 2 & 3

Answer: D

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35. the electric field is given by $\overrightarrow{E} = \frac{\overrightarrow{F}}{q_0}$ here the test charge q_0 should be (a) Infinitesimally small and positive

(b) Infintestimally small and negative

A. only a

B. only b

C. a or b

D. neither a or b

Answer: A

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36. the angle between of the electric dipole moment p and the electric field E when the dipole is in stable equilibrium

A. 0

B. $\pi / 4$

C. $\pi / 2$

D. π

Answer: A

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37. Debye ' is the unit of

A. electric flux

B. electric dipolement

C. electric potential

D. electric field intensity

Answer: A

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38. The electric field at a point at a distance r from an electric dipole is proportional to ......

A. $\frac{1}{r}$

B. $\frac{1}{r^2}$

C. $\frac{1}{r^3}$

D. r^2

Answer: C

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39. An electric dipole placed with its axis in the direction of a uniform electric field experience

A. a force but not torque

B. a torque as well not force

C. a force as well as a torque

D. neither a force nor a torque

Answer: D

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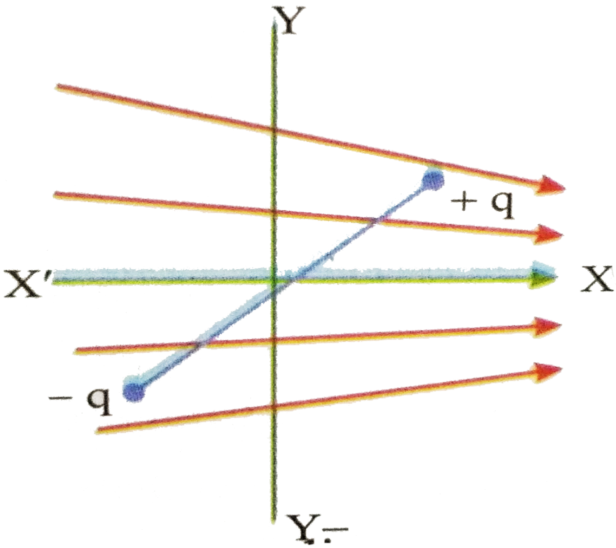
40. An electric dipole is placed in a non uniform electric field increasing along the $+ve$ direction of " X-axis " .In which direction does the dipole



A. Move along +ve direction of X-axis, rotate

clockwise

B. move along -ve direction of X-axis, rotate

clockwise

C. move along +ve direction of X- axis, rotate anti clockwise

D. move along -ve direction of X-axis, rotate anti clockwise

Answer: A

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41. An electric dipole placed in a nonuniform electric field experience

A. a force but no torque

B. a torque but no force

C. a force as well as a torque

D. neither a force nor a torque

Answer: C

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42. 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. $E_a = E_r$

B. $E_a = 2E_r$

C. $E_r = 2E_a$

D. $E_a = \sqrt{2E_r}$

Answer: B

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43. The electric potential due to an extermely short dipole at a distance r form it is proporitonal to

A. $\frac{1}{r}$

B. $\frac{1}{r^2}$

C. $\frac{1}{r^3}$

D. $\frac{1}{r^4}$

Answer: B

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44. An electric dipole when placed in uniform electric field has zero potential energy. The angle between dipole moment and electric field is ....

A. zero

B. $\pi / 2$

C. π

D. $3\pi / 2$

Answer: A

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45. What is the anle between the electric dipole moment and the elcetric field strength due to it on the equatorial line

A. 0°

B. 90°

C. 180°

D. 60°

Answer: C

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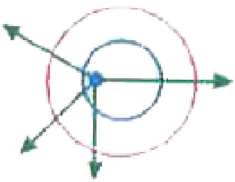
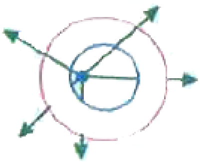
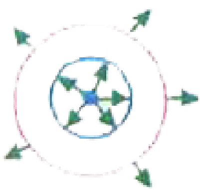
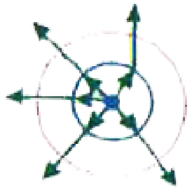
46. A metallic shell has a point charge 'q' kept inisde its cavity. Which one of the following diagrams correctly represents the electric lines of forces?

A. 

B. 

C. 

D. 

Answer: C

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47. Statement A:If an electron travels along the direction of electron field it gets accelerated

Statement B: If a proton travels along the direction of electric field it gets retarded

A. Both A and B are true

B. A is treu, B is false

C. A is false, B is true

D. Both A and B are false

Answer: D

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48. Charge cannot exist without mass but mass can exist without charge.

B: charge is invariant but mass alone may velocity

C: Charge is conserved but mass alone may not be conserved.

A. A,B,C are true

B. A,B,C are not ture

C. A,B, are only true

D. A,B are false , C is true

Answer: A

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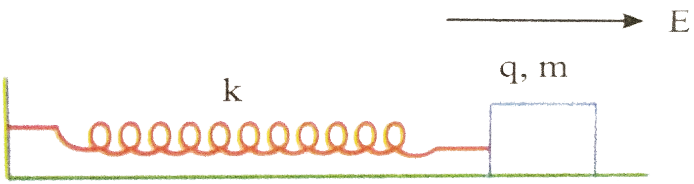
49. A block of mass m is attached to a spring of force constant k .Charges on the block is q. A horizontal electric field E is acting in the directions as shown.Block is released with the spring in unstretched position



(a) block will execute SHM

(b) time period of osciallation is $2\pi\frac{\sqrt{m}}{k}$

(c) amplitude of oscillation is $\frac{qE}{k}$

(d) Block will oscillate but not simple

harmonically

choose the correct answer

A. a and b are true

B. d is true

C. a,b,c are true

D. a,b,c,d are true

Answer: C

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50. Which of the following statements are correct?

a. The electrostatic force does not depend on medium in which the charges are placed.

b. The electrostatic force between two charges does not exist in vacuum

c. The gravitational force between masses can be usually neglected in comparison with electrostatic force

d. Any excess charge given to a conductor, not always resides on the outer surface of the conductor.

A. both a and c

B. only c

C. both c and d

D. all

Answer: B

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51. The property of the electric line of force

a. Electric lines of force are just imaginary lines

b. Electric lines of force will be parallel to the surface of conductor

c. If the lines of force are crowded, them field is strong

d. Electric lines of force are closed loops

A. both a and c

B. bothh b and d

C. only a

D. all

Answer: A

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52. Which of the following statements are correct?

a. Electric lines of force are just imaginary lines

b. Electric lines of force will be parallel to the surface of conductor.

c. If the lines of force are crowded, them field is strong

d. Electric lines of force are closed loops

A. both a and c

B. both b and d

C. only a

D. all

Answer: A

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53. A positively charged thin metal ring of radius R is fixed in the xy plane, with its centre at the origin O. A negatively charged particle P is released from rest at the point $(0, 0, z_0)$ where $z_0 > 0$. Then the motion of P is

a. Periodic for all value of z_0 satisfying $0 < z_0 < \infty$ M

b. Simple harmonic, for all values of Z_0

satisfying $0 < z_0 \leq R$

c. Approximately simple harmonic, provided

$z_0 < \ < R$

d. Such that P crosses O and continues to move

along the negative z-axis towards $z = \ - \infty$

Choose the correct answer

A. a and b are true

B. c is true

C. a,c,d are true

D. a,b,c,d are true

Answer: A

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54. A cubical Gaussian surface encloses electric flux of $30C$ per unit permittivity of a charge ,the electric flux through each face of the cube per unit permittivity is

A. 30C

B. 15C

C. 10C

D. 5C

Answer: D

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55. As one penetrates uniformly charged conducting sphere,what happens to the electric field strength

A. decreases inversely as the square of the distance

B. decreases inversely as the distance

C. becomes zero

D. increases inversely as the square of distance

Answer: C

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56. Mark the correct option

A. Gauss law is valid fro unsymmetrical charged distributions

B. Gauss law is valid only for charge palced in vacuum

C. The electric field is calculated by Gauss law is the field due to the charges outside the Gauss law is the field due to the charges outside the Gaussian surface.

D. The flux of the electric field through a closed surface due to all the charges is equal to the flux due to the charges enclosed by the surface.

Answer: D

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57. If the flux of the electric field through a closed surface is zero,

A. The electric field must be zero every where on the surface

B. The electric field must not be zero everywhere on the surface

C. The charge inside the surface must be zero

D. The charge in the vicnity of the surface must be zero

Answer: C

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58. If infinite parallel plane sheet of a metal is charged to charge density σ coulomb per square metre in a medium of dielectric constant

K. Intensity of electric field near the metallic surface will be

A. $E = \dfrac{\sigma}{\varepsilon_0 K}$

B. $E = \dfrac{\sigma}{2\varepsilon_0}$

C. $E = (\sigma_0 K)$

D. $E = \dfrac{K\sigma}{2\varepsilon_0}$

Answer: A

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59. The electric flux from a cube of edge l is ϕ. If an edge of the cube is made $2l$ and the charge enclosed is halved, its value will be

A. $\phi/2$

B. 2ϕ

C. 4ϕ

D. ϕ

Answer: A

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60. 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. $\dfrac{\phi_1 + \phi_2}{\varepsilon_0}$

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

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

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

Answer: D

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61. Electric flux at a point in an electric field is

A. positive

B. negative

C. zero

D. positive or negatie

Answer: C

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62. Electric flux over a surface in an electric field

A. positive

B. negative

C. Zero

D. positive,negative and zero

Answer: D

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63. A charge $Q$is placed at the mouth of a conical flask. The flux of the electric field through the flask is

A. zero

B. q / ε_0

C. $\frac{Q}{2\varepsilon_0}$

D. $< \frac{Q}{2\varepsilon_0}$

Answer: C

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64. A charge $Q$is placed at the mouth of a conical flask. The flux of the electric field through the flask is

A. zero

B. q/ε_0

C. $\dfrac{Q}{2\varepsilon_0}$

D. $< \dfrac{Q}{2\varepsilon_0}$

Answer: C

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65. Electric field intensity at a point due to an infinite sheet of charge having surface charge density σ is E.If sheet were conducting electric intensity would be

A. E/2

B. E

C. 2E

D. 4E

Answer: C

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66. Two thin infinite parallel plates have uniform charge densities $+\sigma$ and $-\sigma$. The electric field in the space between them is

A. σ / ε_0

B. $\sigma / 2\varepsilon_0$

C. $2\sigma / \varepsilon_0)$

D. zero

Answer: A

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67. In the above question, if the sheets were thick and conducting , value of E in the space between the two sheets would be

A. $2\sigma / \in_0$

B. $\sigma / \in_0$

C. zero

D. $4\sigma / \in_0$

Answer: 1

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68. In the above problem the value of E in the space outside the sheets is .

A. $\sigma / \in_0$

B. $\sigma / 2 \in_0$

C. zero

D. $2\sigma / \in_0$

Answer: 3

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69. The Gaussian surface for calculating the electric field due to a charge distribution is

A. any closed surfasce around the charge distribution

B. any surface near the charge distribution

C. a spherical surface

D. a closed surface at a every point of which electric field has a normal component which is zero or a fixed value.

Answer: D

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70. The electric flux over a sphere of radius $1m$ is ϕ. If radius of the sphere were doubled without changing the charge enclosed ,electric flux would become

A. 2ϕ

B. $\phi/2$

C. $\phi/4$

D. ϕ

Answer: D

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71. A charge q is placed at the centre of a cube.What is the electric flux associated with one of the faces of cube ....

A. q/ε_0

B. $(\varepsilon_0)/q$

C. $(6q)/(\varepsilon_0)$

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

Answer: D

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72. A charge Q is situated at the corner of a cube the electric flux passed through all the six faces of the cube is :

A. $Q/(\varepsilon_0)$

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

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

D. $\frac{Q}{3\varepsilon_0}$

Answer: C

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73. A charge +q is placed at the mid point of a cube of side L. The electric flux emerging from cube is

A. q / ε_0

B. $(6qL^2) / \varepsilon$

C. $\frac{q}{6L^2\varepsilon_0}$

D. Zero

Answer: A

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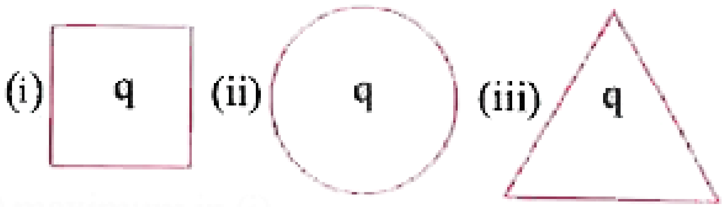
74. A charge q is enclosed as shown, below the electric flux is



A. maximum in (i)

B. maximum in (i)

C. maximum in (iii)

D. equal in all

Answer: D

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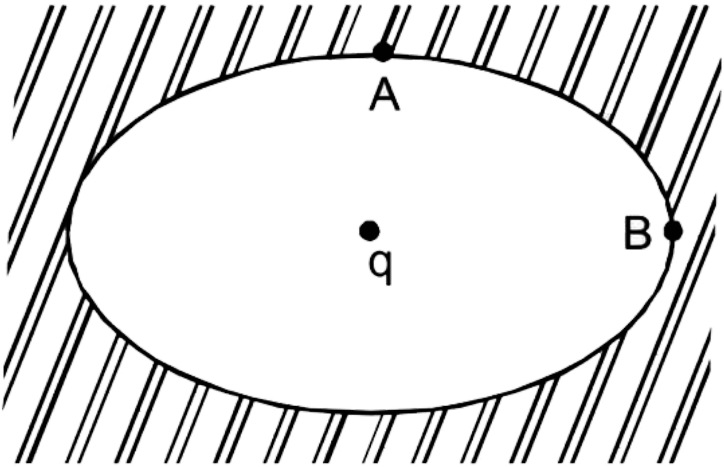
75. An ellipsoidal cavity is carved within a perfect conductor. A positive charge q is placed at the centre of the cavity. The points A and B are on the cavity surface as shown in the figure. Then



A. a,b,c,d are correct

B. a,b,c, are correct

C. only a and b are correct

D. only c and are correct

Answer: D

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76. Two infinitely long thin straight wires having uniform linear charge densities λ and 2λ are arranged parallel to each other at a distance r apart.The intensity of the electric field at a point midway between them is

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

B. $\frac{\lambda}{\pi\varepsilon_0 r}$

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

D. $\frac{3\lambda}{2\pi\varepsilon_0 r}$

Answer: B

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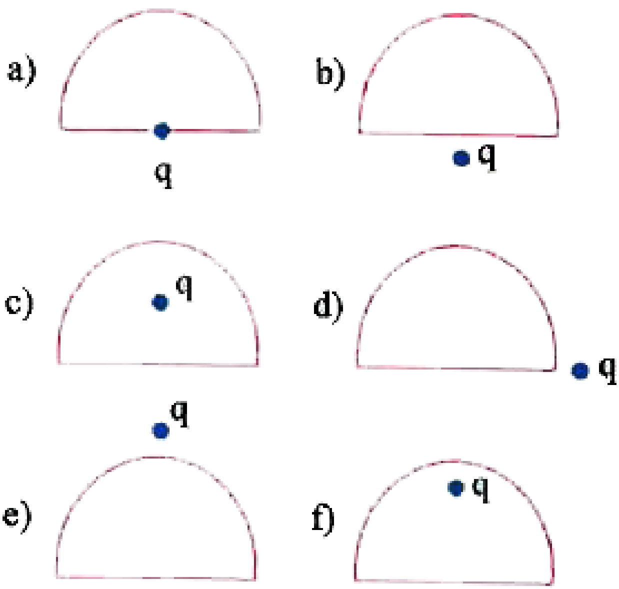
77. Find the total flux due to charge q associated with the given hemispherical surface



A. $(a)\frac{q}{2\varepsilon_0}$, $(b)0$, $(c)\frac{q}{\varepsilon_0}$, $(d)0$, $(e)0(f)\frac{q}{\varepsilon_0}$

B. $(a)0$, $(b)\frac{q}{2\varepsilon_0}$, $(c)0$, $(d)\frac{q}{\varepsilon_0}$, $(e)0(f)\frac{q}{\varepsilon_0}$

C. $(a)\frac{q}{2\varepsilon_0}$, $(b)\frac{q}{\varepsilon_0}$, $(c)0$, $(d)\frac{q}{\varepsilon_0}$, $(e)0(f)\frac{q}{\varepsilon_0}$

D. $(a)0$, $(b)\frac{q}{2\varepsilon_0}$, $(c)0(d)\frac{q}{\varepsilon_0}$, $(e)\frac{q}{\varepsilon_0}(f)\frac{q}{\varepsilon_0}$

Answer: A

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78. 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. Both A and R are true and R is the correct explanation of A.

B. Both A and R are true and R is not the correct explanation of A.

C. A is true and R is false.

D. A is false and R is true

Answer: A

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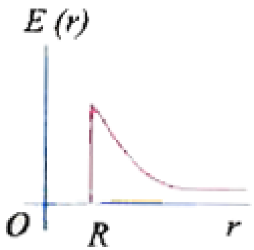
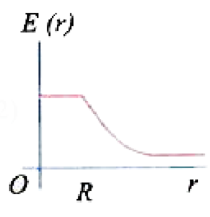
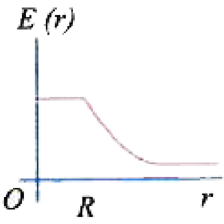
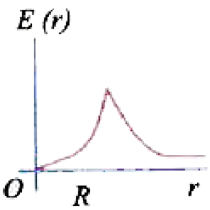
79. A thin spherical shell of radius R has charge Q spread uniformly over its surface. Which of the following graphs most closely represents the electric field E(r) produced by the shell in the range $0 \leq r < \infty$, where r is the distance from the centre of the shell?

A. 

B. 

C. 

D. 

Answer: A

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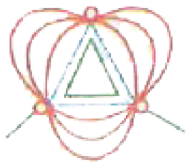
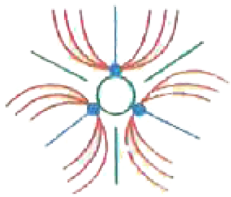
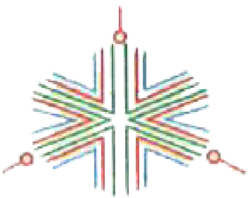
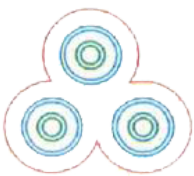
80. Three poistive charges of equal value q are placed at the vertices of an equilateral triangle.

The resulting lines of force should be sketched as in

A. 

B. 

C. 

D. 

Answer: C

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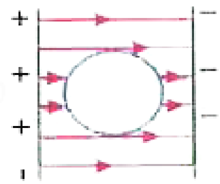
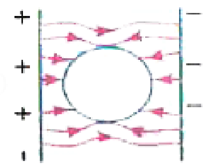
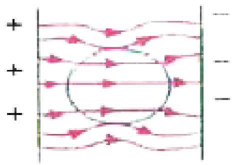
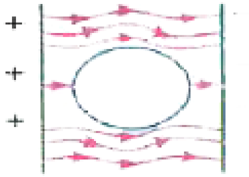
81. An uncharged metal sphere is placed between two equal and oppositely charged metal plates. The nature of lines of force will be

A. 

B. 

C. 

D. 

Answer: B

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EXERCISE -1 (C.W)

1. The quantization of charge reveals that

A. Any charge is an integral multiple of electronic charge

B. Any chargeis an half integral multiple of electronic charge

C. Charge in invariant

D. charge doesnot exist with matter

Answer: A

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2. A soap bubble is given a negative charge, then its radius

A. It bursts

B. It expands

C. It contracts

D. Can't predict

Answer: B

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3. A charge of $4 \times 10^{-9} C$ is distributed uniformly over the circumference of a conducting ring of radius 0.3m. Calculate the field intensity at a point on the axis of the ring at 0.4m from its centre, and also at the centre.

A. 40.7 v/m

B. 151.2 v/m

C. 251.2 v/m

D. 115.2 v/m

Answer: D

Watch Video Solution

4. INDUCED CHARGE ON THE SURFACE OF DIELECTRIC

A. Lesser and dissimilar

B. Lesser and similar

C. Greater and similar

D. Equal and similar

Answer: A

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5. Two identical coins be 4.5 m apart on a table. They carry similar charges. If the force of repulsion of 40/9 N, then charge on each one is

A. $100\mu C$

B. $440\mu C$

C. $110\mu C$

D. $550\mu C$

Answer: A

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6. Coulomb's law for electric charges, most closely resembles

A. The law of conservation of momentum

B. The law of conservation of energy

C. The law of conversvation of charge

D. Newton's law of gravitation

Answer: D

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7. The ratio of the force between two small conducting spheres of equal charge in (a) a medium of dielectric constant 2, and (b) air is respectively

A. $1:4$

B. $4:1$

C. $1:2$

D. $2:1$

Answer: C

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8. Two identical metals balls with charges $+2Q$ and $-Q$ are separated by some distance and exert a force F on each other . They are joined by a conducting wire , which is then removed. The force between them will now be

A. F/2

B. F/6

C. F/4

D. F/8

Answer: D

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9. Two equally charged small metal balls placed at a fixed distance experience a force F. A similar unchanged metal ball after touching one of them is placed at the middle point between the two balls. The force experienced by this ball is

A. F/2

B. 2F

C. 3F

D. 4F

Answer: A

Watch Video Solution

10. There are two charges $+2\mu$ C and -6μ C at certain separation.Then the ratio of forces acting on them will be..

A. $1:1$

B. $1:3$

C. $3:1$

D. $1:6$

Answer: A

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11. Two particles, each of mass m and carrying charge Q, are separated by some distance. If they are in equilibrium under mutual gravitational and electrostatic force then $Q / m(\in C / kg)$ is of the order of

A. 10^{-15}

B. 10^{-5}

C. 10^{-10}

D. 10^{-25}

Answer: C

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12. Two particles having charge Q_1 and Q_2 , when kept at a certain distance exert a force F on each other . If the distance between the two particles is reduced to half and the charge on each particle is doubled , the force between the particles would be

A. 4F

B. 16F

C. 32F

D. Remains unchanged

Answer: B

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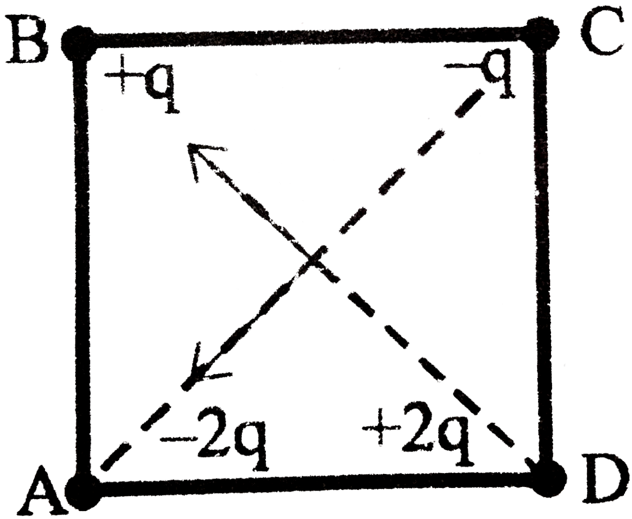
13. Four charges are arranged at the corners of a square $ABCD$, as shown. The force on a +ve charge kept at the centre of the square is -



A. zero

B. along diagonal AC

C. along diagona BD

D. perpendicular to side AB

Answer: D

Watch Video Solution

14. The electric field inside a spherical shell of uniform surface charge density is

A. constant

B. proportional to the distance form the centre

C. zero

D. none

Answer: C

Watch Video Solution

15. the electric field intensity at apoint in space is equal in magnitude to :

A. The product of potential difference and charge

B. The product of force and charge

C. The force, a unit charge would experience there

D. The force, an electron would experience there

Answer: C

Watch Video Solution

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. $\frac{1}{x}$

B. x

C. $\frac{1}{x^2}$

D. x^2

Answer: B

Watch Video Solution

17. The electric field at the surface of a charged spherical conductor is 10 kV/m. The electric field at an outward radial distance equal to the radius from its surface will be

A. 1.5 kW

B. 2.5 kV/m

C. 4kV/m

D. 5kV/m

Answer: B

Watch Video Solution

18. The electrons are accelerated through a pontential difference V by an electron gun. The electron charge and mass are e and m respectively. The maximum velocity attained by them is

A. $\frac{2m}{eV}$

B. $\frac{V^2}{2em}$

C. $\frac{2eV}{m}$

D. $\sqrt{\frac{2eV}{m}}$

Answer: D

Watch Video Solution

19. The total electric flux leaving a spherical surface of radius 1 cm and surrounding an electric dipole is

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

B. zero

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

D. infinite

Answer: B

Watch Video Solution

20. A uniform electric field $E\hat{i}$ exists in a region containing the orign of co-ordinate system. The points $A(a, 0, 0)$, $B(0, a, 0)$ and $C(0, 0, a)$ are on the co-ordinate axes. The magnitude of electric flux through the trianglular area ABC is

A. $2Ea^2$

B. $Ea^2 / 2$

C. zero

D. Ea^2

Answer: D

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21. 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. $-\frac{Q}{4}$

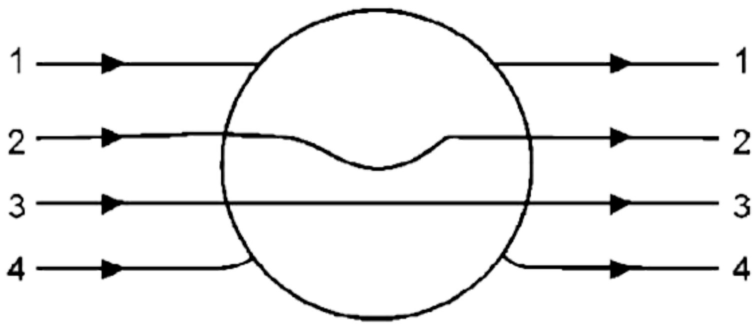
C. $+\frac{Q}{4}$

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

Answer: B

Watch Video Solution

22. A metallic solid sphere is placed in a uniform electric fied. 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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23. In the situatiioni when the Gaussian surface is so chosen that there are some charges inside and some outside, then regarding the electric field at any point and the electric flux through the Gaussaina surface, which of the following is correct?

A. The field is due to the outside charges and flux depends on the inside charges

B. The field is due to all the charges and flux depends on the inside charges

C. The field is due to all the charges and flux depends on the outside charges

D. The field is due to the inside charges and flux depends on the outside charges

Answer: B

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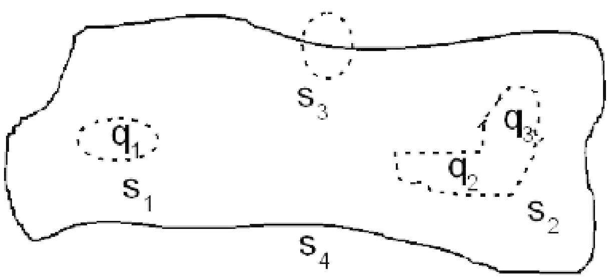
24. Three charges $q_1 = 1\mu c$, $q_2 = 2\mu c$ and $q_3 = -3\mu c$ and four surfaces S_1, S_2, S_3 and S_4 are shown. The flux emerging through surface S_2 in $N - m^2 / C$ is-



A. $36\pi \times 10^3$

B. $-36\pi \times 10^3$

C. $36\pi \times 10^9$

D. $-36\pi \times 10^9$

Answer: B

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EXERCISE -1 (H.W)

1. One million electrons are added to glass rod. The total charge on the rod is

A. $10^{-13}C$

B. $-1.6 \times 10^{-13}C$

C. $+1.6 \times 10^{-12}C$

D. $10^{-12}C$

Answer: B

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2. A body has a charge of 9.6×10^{-20} coulomb.It is

A. possible

B. not possible

C. may (or) may not possible

D. data not sufficient

Answer: B

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3. A force of $4N$ is acting between two charges in air.If the space between them is completely filled with glass $(\varepsilon_r = 8)$ then the new force will be

A. 2N

B. 5N

C. 0.2N

D. 0.5 N

Answer: D

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4. There are two charge $+1\mu c$ and $+2\mu c$ kept at certain separation ,the ratio of electrostatic forces acting on them will be in the ratio

A. $1:2$

B. $2:1$

C. $1:1$

D. $1:4$

Answer: C

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5. Two identical metal spheres posses $+60C$ and $-20C$ of charges .They are brought in contact and then separated by $10cm$ .the force between them is

A. $36 \times 10^{13} N$

B. $36 \times 10^{14} N$

C. $36 \times 10^{12} N$

D. $3.6 \times 10^{12} N$

Answer: A

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6. Two charges +8q and -2q are fixed on X-axis at origin and $x = +a$ locations. A third charge +q is to be located on X-axis (other than infinitely far away) so that it is in equilibrium.

The location of the third charge is correctly represented by

A. $x = 2a$

B. $x = 3a/2$

C. $x = -a$

D. $x = 3a$

Answer: A

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7. Three charge $-q$, $+q$ and $-q$ are placed at the corners of an equilateral triangle of side a The resultant electric force an a charge $+q$ placed at a the centroid O of the triangle is

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

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

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

D. $\dfrac{3q^2}{2\pi\varepsilon_0 a^2}$

Answer: D

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8. A charge of $+2\mu C$ is placed at $x=0$ and a charge of $-32\mu c$ at $x=60$ .A third charge $-Q$ be placed on the x axis such that it experiences no force .The distance of the point from $+2\mu C$ is (in cm)

A. -20

B. 20

C. 15

D. 10

Answer: A

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9. Two charges of $50\mu C$ and $100\mu C$ are separated by a distance of $0.6m$ .The intensity of electric filed at a point midway between them is

A. $50 \times 10^6 V / m$

B. $5 \times 10^6 V / m$

C. $10 \times 10^6 V / m$

D. $10 \times 10^6 V/m$

Answer: B

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10. 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. $\overrightarrow{E}$

B. $-\overrightarrow{E}$

C. $+\frac{\overrightarrow{E}}{3}$

D. $-\frac{\overrightarrow{E}}{3}$

Answer: C

Watch Video Solution

11. A mass m carrying a charge q is suspended from a string and placed in a uniform horizontal electric field of intensity E.The angel made by the string with the vertical in the equilibrium position is

A. $\theta = \tan^{-1}\frac{mg}{Eq}$

B. $\theta = \tan^{-1}\frac{m}{Eq}$

C. $\theta = \tan^{-1}\frac{Eq}{m}$

D. $\theta = \tan^{-1}\frac{Eq}{mg}$

Answer: D

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12. A protons of mass m charge c is released form rest in a uniform electric field of strength

E .The time taken by it to travel a distance d in the field is

A. $\sqrt{\frac{2de}{mE}}$

B. $\sqrt{\frac{2dm}{Ee}}$

C. $\sqrt{\frac{2dE}{me}}$

D. $\sqrt{\frac{2Ee}{dm}}$

Answer: B

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13. An infinite number of charges each of magnitude q are placed on x-axis at distance of 1, 2, 4, 8, ... Meter from the origin respectively. Find intensity of the electric field at origin.

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

B. $\frac{q}{6\pi\varepsilon_0}$

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

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

Answer: A

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14. v34.2

A. $\frac{1}{\varepsilon_0}\sigma^2 R^2$

B. $\frac{1}{\varepsilon_0}\sigma^2 R$

C. $\frac{1}{\varepsilon_0}\frac{\sigma^2}{R}$

D. $\frac{1}{\varepsilon_0}\frac{\sigma^2}{R^2}$

Answer: A

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15. The electric field at a point due to an electric dipole, on an axis inclined at an angle $\theta(<90^\circ)$ to the dipole axis, is perpendicular to the dipole axis, if the angle θ is

A. $\tan^{-1}(2)$

B. $\tan^{-1}(\sqrt{2})$

C. $\tan^{-1}(1/\sqrt{2})$

D. Zero

Answer: B

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16. A charged spherical conductor has a surface charge density of $0.7C/m^2$ .When its charge is increased by $0.44C$ the charge density changes by $0.14C/m^2$ the radius of the sphere is

A. 5 cm

B. 1.0 cm

C. 0.5 cm

D. 5 cm

Answer: C

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17. The electric field in a region of space is given by $E = \left(5\hat{i} + 2\hat{j}\right) N / C$. The electric flux due to this field through an area $2m^2$ lying in the YZ plane, in S.I. unit is :-

A. 10

B. 20

C. $10\sqrt{2}$

D. $2\sqrt{29}$

Answer: A

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18. Number of electric lines of force emerging from $1C$ of positive charge in vacuum is

A. 8.85×10^{-12}

B. 9×10^{9}

C. $1/4\pi \times 9 \times 10^{9}$

D. 1.13×10^{11}

Answer: D

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19. A charge of $5C$ is placed at the center of a spherical gaussian surface of radius $5cm$ the electric flux through the surface is $\frac{1}{\varepsilon_0}$ times of

A. $0.1N - m^2 / C$

B. $0.5N - m^2 / C$

C. $1N - m^2 / C$

D. $5N - m^2 / C$

Answer: D

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20. In a region where intensity of electric field is $5NC^{-1}40$ lines of electric force are crossing $10NC^{-1}$ will be

A. 20

B. 80

C. 100

D. 200

Answer: B

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21. An electron is placed at the centre of a Conducting sphere of radius 0.2 metre having a charge 5×10^{-2} coulomb.The force on the electron is

A. zero

B. $11 \times 10^{9} N$

C. $22.5 \times 10^{9} N$

D. $2.5 \times 10^9 N$

Answer: A

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22. Eight charges, 1muC, -7muC , -4muC, 10muC, 2muC, -5muC, -3muC, and 6muC`, are situated at the eight cornersof a cube of side 20 cm. A spherical surface of radius 80 cm encloses this cube. The center of the sphere coincides with the center of the cube. Then, the total outgoing flux from the spherical surface (in units of Vm) is

A. $36\pi \times 10^3$

B. $684\pi \times 10^3$

C. zero

D. $72\pi \times 10^3$

Answer: C

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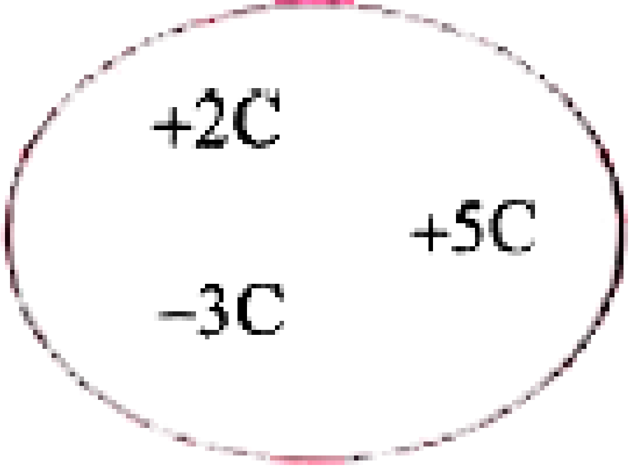
23. Calculate the net flux emergin from given enclosed surface Nm^2C^{-1}



A. 4.5×10^{11}

B. 45×10^{12}

C. zero

D. 1.12×10^{12}

Answer: A

Watch Video Solution

24. A charge q is located at the centre of a cube.

The electric flux through any face is

A. q / ε_0

B. $Q / 2\varepsilon_0$

C. $Q / 4\varepsilon_0$

D. $Q / 6\varepsilon_0$

Answer: D

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25. The electric field near a conducting surface having a uniform surface charge density σ is given by

A. σ / ε_0

B. $\sigma / 2\varepsilon_0$

C. $\sigma / \varepsilon_0 r$

D. $\sigma / 2\varepsilon_0 r$

Answer: A

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26. A cylinder of length L and radius b has its axis coincident with the x-axis. The electric field in the region $\overrightarrow{E} = 200\hat{\imath}$. Find the flux through (i) the left end of cylinder (ii) the right end of cylinder (iii) the cylinder curved surface, (iv) the closed surface area of the cylinder .

A. (i)

$$-100\pi b^2 (ii) 100\pi b^2 (iii) 50\pi b^2 (iv) 50\pi b^2$$

B. $(i) - 200\pi b^2 (ii) 200\pi b^2 (iii) 0 (iv) 0$

C.

$$(i) - 100\pi b^2 (ii) 100\pi b^2 (iii) 100\pi b^2 (iv) 100\pi b^2$$

D.

$$(i) - 200\pi b^2 (ii) 200\pi b^2 (iii) 200\pi b^2 (iv) 200\pi b^2$$

Answer: B

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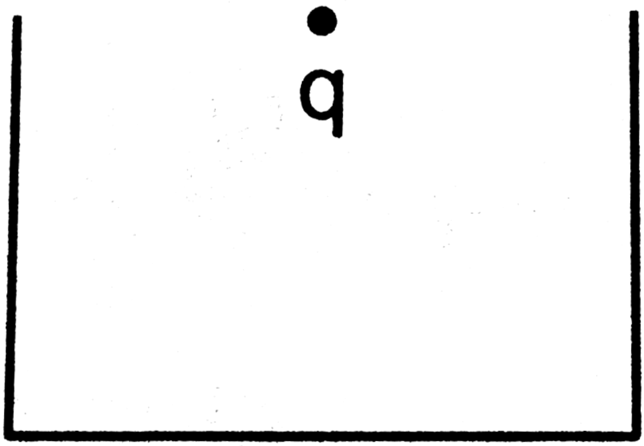
27. A charge q is placed at the centre of the open end of a cylindrical vessel . The flux of the electric field through the surface of the vessel is



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

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

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

D. zero

Answer: A

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EXERCISE -2 (C.W.)

1. Two spheres A and B are charged with the charges of +10 and +20 coulomb respectively and separated by a distance of 80 cm. The electric field at point on the line joining the centres of the two spheres will be zero at a distance from the sphere A :

A. 45 cm

B. 33 cm

C. 60 cm

D. 20 cm

Answer: B

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2. If infinite parallel plane sheet of a metal is charged to charge density σ coulomb per square metre in a medium of dielectric constant

K. Intensity of electric field near the metallic surface will be

A. $E = \dfrac{\sigma}{\varepsilon_0 K}$

B. $E = \dfrac{K}{2\varepsilon_0}$

C. $E = \dfrac{\sigma}{2\varepsilon_0 K}$

D. $E = \dfrac{K\sigma}{2\varepsilon_0}$

Answer: C

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3. You are travelling in a car during a thunder storm. In order to protect yourseft from lightening, would you prefer to :

A. Stand under the tree

B. Remain in the car

C. Get out and run from the car

D. Get out and be flat on the ground

Answer: B

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4. Two particles of mass m and $2m$ with charges 2q and q are placed in a uniform electric field E and allowed to move for same time. Find the ratio of their kinetic energie

A. $1:2$

B. $2:1$

C. $1:8$

D. $8:1$

Answer: B

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5. 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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6. Two parallel plates carry opposite charges such that the electric field at the space between them is in upward direction ,,An electron is shot in the space and parallel to the plates.its deflection from the original directions will be

A. Circular

B. Parabola

C. Downwards

D. Upwards

Answer: B

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7. A metallic sphere has a charge of $10\mu C$. A unit negative charge is brought from A to B both $100cm$ away from the sphere but A being east of it while B being on west. The net work done is

A. 1/5 ergs

B. $-1/10$ ergs

C. 2/50 ergs

D. zero

Answer: D

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8. Twosmall neutral conducting spheres are taken and their centres are separated by a distance 2a. If n electrons are removed from one of them and deposited on the other, what is the magnitude of electric intensity due to the system at a point on the line joining the centres of the spheres and at a distance d from the midpoint of the line joining the two spheres? (e is quantum of charge)

A. $\frac{2\mathrm{nea}}{2pe_0d^3}$

B. $\frac{2n^2e^2a}{2pe_0d^3}$

C. $\frac{4\mathrm{nea}}{4pe_0d^3}$

D. $\frac{4n^2e^2a}{4pe_0d^3}$

Answer: C

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9. 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. zero

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

C. σ / ε_0

D. $2\sigma / \varepsilon_0$

Answer: D

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10. The electrostatic field due to a charged conductor just outside the conductor is

A. Zero and paralel to the surface at every point inside the conductor

B. Zero and is normal to the surface at every point inside the conductor

C. Parallel to the surface at every point and zero inside the conductor

D. Normal to the surface at every point and zero inside the conductor.

Answer: D

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11. The electric potential at a point in free space due to a charge Q coulomb is $Q \times 10^{11}$ volts. The electric field at that point is

A. $12\pi\varepsilon_0 Q \times 10^{22}$ volt/m

B. $4\pi\varepsilon_0 Q \times 10^{22}$ volt/m

C. $12\pi\varepsilon_0 Q \times 10^{20}$ volt /m

D. $4\pi\varepsilon_0 Q \times 10^{20}$volt/m

Answer: B

Watch Video Solution

12. 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. oscillaste but not execute S.H.M

B. executes S.H.M about of origin

C. executes S.H.m. along x-axis

D. move towards origin and will becomes stationary

Answer: A

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13. Two stationary particles each of +q are placed at a distacne apart. Now a negatively charged particle is placed in a straight line joining two charge. The direction of motion of the negatively charged particle will depend on

A. The position at which it is situated

B. The magnitude of its cahrge

C. The magnitude of +q charge

D. The magnitude of the both the charges

Answer: A

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14. A ring with a uniform charge Q and radius R, is placed in the yz plane with its centre at the origin

A. The field at the origin is zero

B. The potential at the orgin is $\sqrt{\frac{kQ}{R}}$

C. The field at the point (x,0,0) is $\frac{kQ}{x^2}$

D. The field at the point (x,0,0) is $\frac{kQ}{R^2 + x^2}$

Answer: A

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

A. $\frac{Q}{4\pi\varepsilon_0 r_1^2}$

B. $\frac{Qr_1^2}{4\pi\varepsilon_0 R^4}$

C. $\dfrac{Qr_1^2}{3\pi\varepsilon_0 R^4}$

D. Zero

Answer: C

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16. F_g and F_e represent gravitational and electrostatic force respectively between electrons situated at a distance 10 cm. The ratio of F_g / F_e is of the order of

A. 10^{43}

B. 10^{1}

C. 10^{0}

D. 10^{-43}

Answer: D

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17. The electronic charge is 1.6×10^{-19} coulomb. If a body carries a negative charge of 9.6×10^{-10} coulombs, what is the number of excess electrons on the body?

A. 6×10^{9}

B. $1/6 \times 10^{-29}$

C. 6×10^{29}

D. 6×10^{29}

Answer: A

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18. 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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19. A point positive charge of Q' units is moved round another point positive charge of Q units in circular path. If the radius of the circle r is the work done on the charge Q' in making one complete revolution i-

A. $\frac{Q}{4pe_0 r}$

B. $\frac{QQ'}{4pe_0 r}$

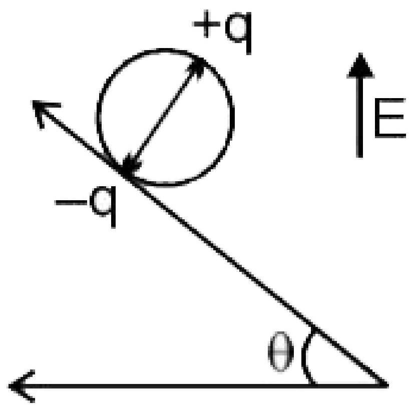
C. Zero

D. $\frac{Q'}{4pe_0 r}$

Answer: C

Watch Video Solution

20. A wheel having mass m has charges +q and – q on diametrically opposite points. It remains in equilibrium on a rough inclined plane in the presence of uniform vertical electric field E =



A. $\dfrac{mg}{q}$

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

C. $\frac{mg\cos\theta}{2q}$

D. Zero

Answer: B

Watch Video Solution

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

A. $K\frac{e^2}{r^2}\hat{r}$

B. $-K\frac{e^2}{r^2}\hat{r}$

C. $-K\frac{e^2}{r^3}\hat{r}$

D. $K\frac{e^2}{r^3}\overrightarrow{r}$

Answer: B

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22. Two metal plates having a.p.d 600 volts are 2 cm apart. It is found that a particle of mass 1.96×10^{-12} g remains suspended in the electric field. The intensity of elelctric is

A. $1.96 \times 10^{-120 \times 600}$ volts/m

B. 3×10^4 volts /

C. 3×10^2 volts /m

D. 12×10^4volts/m

Answer: B

Watch Video Solution

23. A is a spherical conductor placed concentrically inside a hollow spherical conductor B. A is given +q charge and B is earthed. The n the electric intensity is not zero

A. Inside A

B. Outside B

C. On the surface of B

D. Between A and B

Answer: D

Watch Video Solution

24. An electron moving with a speed of $5 \times 10^6 m / s$ is shot parallel to the electric field of strength 1×10^3 N/C arranged so as to retard its motion. How far will the electron travel in the field before coming (momentarily) to rest? ($m_e = 9.1 \times 10^{-31} kg$)

A. 7m

B. 70m

C. 7cm

D. 0.7cm

Answer: C

Watch Video Solution

25. Given : $\overrightarrow{E}=\left(10\hat{i}+7\hat{j}\right)Vm^{-1}$. The electric flux through $1m^2$ area is XZ plane is

A. 10 Vm

B. 7Vm

C. 100 Vm

D. 49Vm

Answer: B

Watch Video Solution

26. Charge Q is given by the displacement $r = a\hat{i} + b\hat{j}$ in an electrif field $E = E_1\hat{i} + E_2\hat{j}$.

The work done is

A. $Q(E_1 a + E_2)$

B. $Q\sqrt{(E_1 a)^2 + (E_2)^2}$

C. $Q(E_1 + E_2)$

D. $Q\sqrt{(E_1^2 + E_2^2)}\sqrt{a^2 + 1}$

Answer: A

Watch Video Solution

27. A positive point charge $50\mu C$ is located in the plane xy at a point with radius vector $\overrightarrow{r}_0 = 2\hat{i} + 3\hat{j}$. The electric field vector $\overrightarrow{E}$ at a point with radius vector $\overrightarrow{r} = 8\hat{i} - 5\hat{j}$, where r_0 and r are expressed in meter, is

A. 1200 V/m

B. $4 \times 10^{-2} V/m$

C. $900V / m$

D. $4500V / m$

Answer: D

Watch Video Solution

28. The height of a tower is h. The acceleration due to gravity is g. Everywhere in the surroundings of the twowr there is a uniform electric field of intensity E in the horizontal direction away from the tower. A particle of mass m and carryign a charge q is dropped from the top of tower. The distance of the partile when it reaches the ground from the foot of the tower (neglect the effect of air on the motion of the particle)

A. $\frac{qEh}{mg}$

B. $\frac{qEhg}{m}$

C. $\frac{mg}{qEH}$

D. $\frac{m}{qEgh}$

Answer: A

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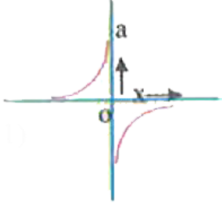
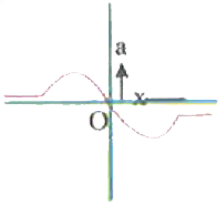
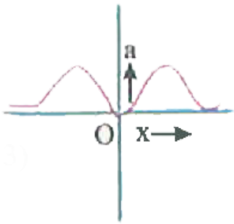
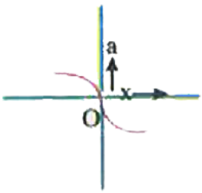
29. Two identical positive charges are fixed on the y-axis, at equal distances from the origin O. A particle with a negative charges starts on the x-axis at a large distance from O. moves along the x-axis passes through O, and moves far away from O on the other side. Its acceleration a is taken as positive along its direction of motion. Plot acceleration a of the particle against its x-coordinate.

A. 

B. 

C. 

D. 

Answer: B

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30. v1

A. will be less than in copper

B. Will be more than in copper

C. Will be equal to that in copper

D. Will not be connected with copper

Answer: C

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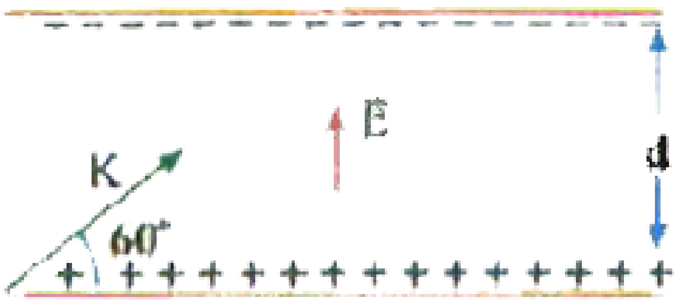
31. An electron of kinetic energy K is projected between two charged plats at an angle 60° as shown in figure. If electrons doesn't reach to the upper plate just before striking then the magnitude of electric field will be more than:



A. $\frac{K}{ed}$

B. $\frac{2K}{ed}$

C. $\frac{K}{2ed}$

D. $3\frac{K}{4ed}$

Answer: D

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32. Electric field intensity at a point varies as r^{-3} for

A. A point charge

B. An electric dipole

C. A plane infinite sheet of charge

D. A line charge of infinite length

Answer: B

Watch Video Solution

33. An electric dipole is placed at an angle of 30° to a non-uniform electric field. The dipole will experience

A. A translational force only in a direction normal to the direction of the field

B. A torques as well as a translational force

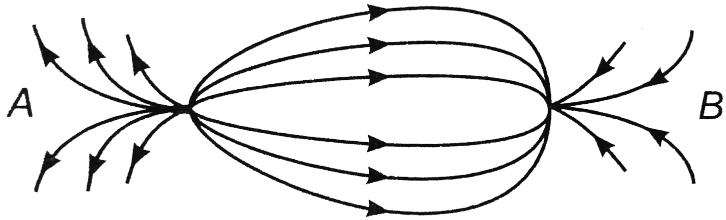
C. A torque only

D. A translational force only in the direction of the field.

Answer: B

Watch Video Solution

34. 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 and $|A| > |B|$

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

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

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

Answer: A

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

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

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

Answer: D

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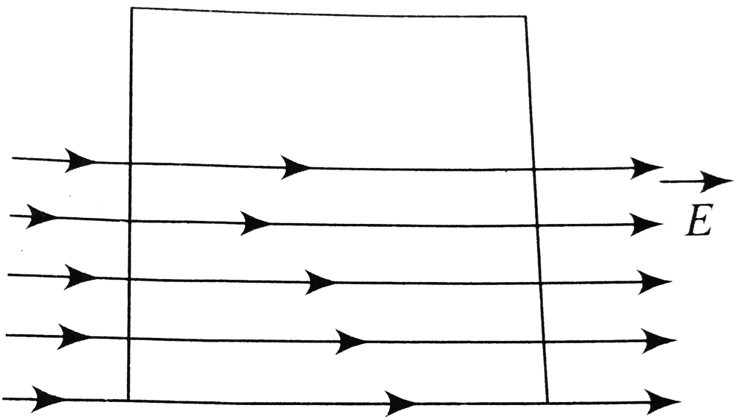
36. A square surface of side $L m$ is in the plane of the paper. A uniform electric field $\overrightarrow{E}(V/m)$, also in the plane of the paper, is limited only to the lower half of the square surface (see figure). The electric flux in SI units associated with the surface is:



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

B. $EL^2/2$

C. zero

D. EL^2

Answer: C

Watch Video Solution

37. 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. $0 \text{volt} m^{-1}$

B. $\sigma / 2\varepsilon_0 \text{volt} m^{-1}$

C. $\sigma / \varepsilon_0 \text{volt} m^{-1}$

D. $z\sigma / \varepsilon_0 \text{volt} m^{-1}$

Answer: C

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38. The Electric field at a point is

A. always continuous

B. continuous if ther is no charge at that point.

C. discontinuous only if there is a negative charge at that point.

D. discontinuous if there is a charge at that point.

A. A,C are true

B. All are true

C. B,D are true

D. B,C are true

Answer: C

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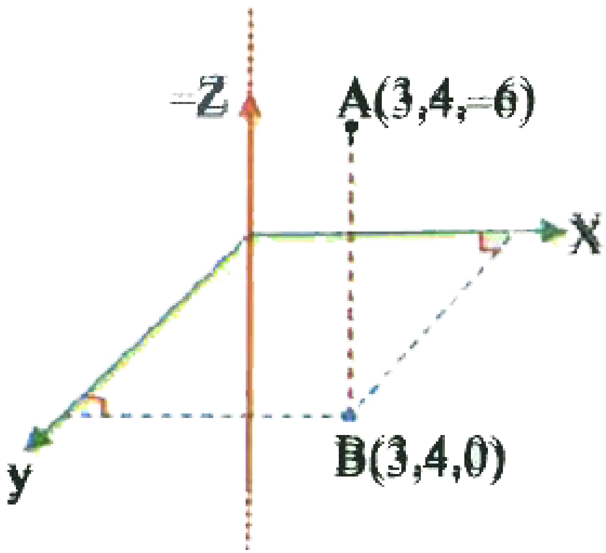
39. Find ratio of electric at point A and B. Infinitely long uniformly charged wire with linear charge density λ is kept along z-axis:



A. $1:2$

B. $1:6$

C. $6:1$

D. $1:1$

Answer: D

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EXERCISE -2 (H.W)

1. Two charge when kept at a distance of $1m$ apart vacuum have a some force of repulsion .if the force of repulsion between these two charges be same ,when placed in an oil of dielectric constant 4 the distance of separation is

A. 0.25 m

B. 0.4 m

C. 0.5 m

D. 0.6 m

Answer: C

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2. The excess (equal to number) number of electrons that must be placed on each of two small spheres spaced $3cm$ apart with force of repulsion between the spheres of be $10^{-19}N$ is

A. 25

B. 225

C. 625

D. 1250

Answer: C

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3. Two small conducting spheres each of mass $9 \times 10^{-4} kg$ are suspended from the same point by non conducting strings of length $100 cm$,They are given equal and similar charges until the strings are equally inclined at 45° each to the vertical,The charge on each sphere is ....

A. 1.4×0^{-6}

B. 1.6×10^{-6}

C. 2×10^{-6}

D. 1.96×10^{-6}

Answer: A

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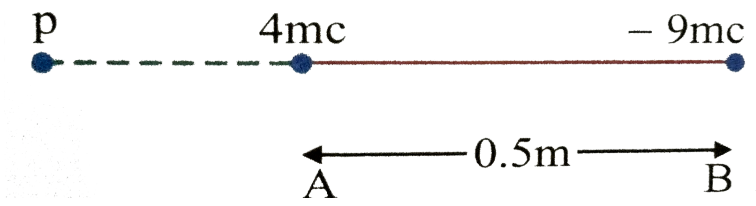
4. Two point charges of magnitude $4\mu C$ and $-9\mu C$ are 0.5 apart .the electric intensity is zero at a distance xm from A and ym form B .x

and y are respectively



A. 0.5 m, 1.0m

B. 1.0 m, 1.5 m

C. 2.0 m, 1.5 m

D. 1.5 m, 2.0 m

Answer: B

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5. A charge $+q$ is fixed to each of three corners of a square .On the empty corner a charge Q is placed such that there is no net electrostatic force acting on the diagonally opposite charge then

A. $Q = -2q$

B. $Q = -2\sqrt{2}q$

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

D. $Q = -4q$

Answer: B

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6. Electrical force between two point charge is $200N$, if we increase 10% charge on one of the charge and and decrease 10% charge on other then electrical force between them for the same direction becomes.

A. 198 N

B. 100 N

C. 200 N

D. 99 N

Answer: A

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7. N fundamental charges each of charge q are to be distributed as two point charges separated by a fixed distance ,then the maximum to minimum force bears a ratio (N is even and greater than 2)

A. $\dfrac{(N-1)^2}{4N^2}$

B. $\dfrac{4N^2}{(N-1)}$

C. $\dfrac{N^2}{4(N-1)}$

D. $\dfrac{2N^2}{(N-1)}$

Answer: C

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8. A particle A having a charge of 2.0×10^{-6} C and a mass of 100 g is placed at the bottom of a smoth inclined plane of inclination 30°. Where should another particle B, having same charge and mass, be placed on the incline so that it may remain in equilibrium?

A. 27 cm

B. 16 cm

C. 30 cm

D. 45 cm

Answer: A

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9. Two identical particles of charge q each are connected by a massless spring of force constant k .They are placed over a smooth horizontal surface .They are released when unstretched .If maximum extension of the spring is r,the value of k is :(neglect gravitational effect)

A. $k=\frac{q}{r}\sqrt{\frac{1}{\pi\varepsilon_0 r}}$

B. $k=\frac{1}{4\pi\varepsilon_0}\frac{q^2}{l^2}\times\frac{1}{r}$

C. $k=\frac{2q}{r}\sqrt{\frac{1}{\pi\varepsilon_0 r}}$

D. $k=\frac{q}{r}\sqrt{\frac{2}{\pi\varepsilon_0 r}}$

Answer: B

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10. Point charge of $3 \times 10^{-9} C$ are situated at each of three corners of a square whose side is $15 cm$. The magnitude and direction of electric field at the vacant corner of the square is

A. 2296 V/m along the diagonal

B. 9622 V/m along the diagonal

C. 22.0 V/m along the diagonal

D. zero

Answer: A

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11. A large flat metal surface has a uniform charge density $+\sigma$. An electron of mass m and charge u and returns to it at point B. Disregard gravity . The maximum value of AB is

A. $\frac{v m \varepsilon_0}{\sigma e}$

B. $\frac{v^2 m \varepsilon_0}{e \sigma}$

C. $\frac{v^2 e}{\varepsilon_0 \sigma m}$

D. $\frac{v^2 \sigma e}{\varepsilon_0 m}$

Answer: B

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12. n charges $Q, 4Q, 9Q, 16Q\ldots.$ are placed at distance of $1, 2, 3\ldots..$ metre form a point 0, on the same straight line .The electric intensity at 0 is

A. $\frac{Q}{4\pi\varepsilon_0 n^2}$

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

C. Infinity

D. $\dfrac{nQ}{4\pi\varepsilon_0}$

Answer: D

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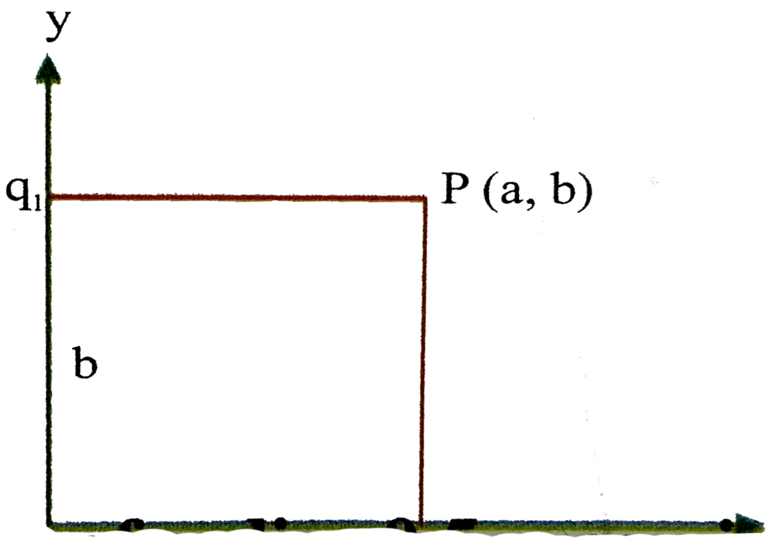
13. Two point charge $q_1 = 2\mu C$ and $q_2 = 1\mu C$ are placed at distance $b = 1$ and $a = 2cm$ from the origin on the y and x axes as shown in figure .The electric field vector at point $(a), (b)$

will subtend on angle θ with the "x-axis" given by



A. $\tan\theta = 1$

B. $\tan\theta = 2$

C. $\tan\theta = 3$

D. $\tan\theta = 4$

Answer: B

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14. A regular pentagon has four charges each +q at four of its vertices. At the centre of the pentagon, a charge +q is kept. If the distance of a vertex from the center is a the magnitude of the net force acting on the charge at the center is

A. $\frac{q^2}{4pe_0a^2}$

B. zero

C. $\frac{4q^2}{4pe_0a^2}$

D. $\frac{2q^2}{4pe_0a^2}$

Answer: A

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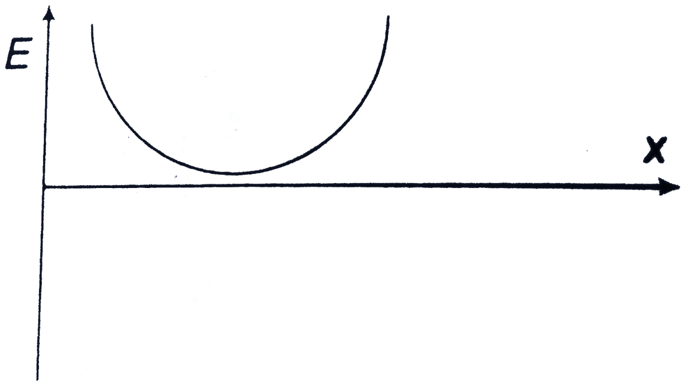
15. Two point charges a and b whose magnitude are same, positioned at a certain distance along the positive x-axis from each other a is at origin. Graph is drawn between electrical field strength and distance x from a. E is taken positive if it is along the line joining from a to b Fro the graph it ca be decided that



A. a is positive, b is negative

B. a and b both are positive

C. a and b both are negative

D. a is negative, b is positive

Answer: A

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16. Find out electridc filed intensity at point $A(1, 0, 2)$ due to a point charge $-20\mu C$ situated at pont $B(0, \sqrt{2}, 1)$:

A. $-22.5 \times 10^3\left(\hat{i} - \sqrt{2}\hat{j} + \hat{k}\right)$

B. $8.5 \times 10^3\left(\hat{i} + \sqrt{2}\hat{j} + \hat{k}\right)$

C. $22.5 \times 10^3\left(\hat{i} + \sqrt{2}\hat{j} - \hat{k}\right)$

D. $8.5 \times 10^3\left(\hat{i} - \sqrt{2}\hat{j} + \hat{k}\right)$

Answer: A

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17. An electric dipole consists of two opposite charges of magnitude $1\mu C$ separated by a distance of $2cm$.The dipole is placed in an electric filled $10^{-5}Vm^{-1}$.The maximum torque that the field exert on the dipole is

A. $10^{-3}Nm$

B. $2 \times 10^{-13}Nm$

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

D. $4 \times 10^{-3}Nm$

Answer: B

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18. An electric dipole is formed by two particles fixed at the ends of a light rod of length I. The mass of each particle is m and charges are $-q$ and $+q$The system is suspended by a torsion less thread in an electric field of intensity E that the dipole axis is parallel to the field if it is slightly displaced the period of angular motion is

A. $\dfrac{1}{2\pi}\sqrt{\dfrac{2qE}{ml}}$

B. $2\pi\sqrt{\dfrac{ml}{qE}}$

C. $2\pi\sqrt{\dfrac{ml}{qE}}$

D. $\dfrac{1}{2\pi}\sqrt{\dfrac{ml}{4qE}}$

Answer: C

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19. For an electric dipole consisting of a positive and equal negative charges seperated by a finite distance, the number of axial and equatorial lines respectively

A. 1,1

B. 1,2

C. 1,3,

D. $1, \infty$

Answer: D

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20. Two equal charges q of opposite sign are separated by a small distance $2a$,The electric intensity E at a point on the perpendicular bisector of the line joining the two charges at a very large distance r form the line is

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

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

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

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

Answer: B

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21. 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. 4×10^3

B. -4×10^3

C. $-\dfrac{\pi R^2 - \pi R}{E}$

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

Answer: D

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22. A cylinder of radius R and length L is placed in the uniform electric field E parallel to the cylinder axis.The total flux from the two flat surface of the cylinder is given by

A. $2\pi R^2 E$

B. $\frac{\pi R^2}{E}$

C. $\frac{\pi R^2 - \pi R}{E}$

D. zero

Answer: D

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23. A cube of arranged such that its length ,breadth ,height are along X, Y, Z directions one of its corners is situated at the origin Length of each side of the cube is $25cm$ .The components of electric field are $E_x = 400\sqrt{2}N/C$,$E_y = 0$ and $E_z = 0$

respectively.Flux coming out of the cube at one end will be

A. $25\sqrt{2}Nm^2/C$

B. $5\sqrt{2}Nm^2/C$

C. $250\sqrt{2}Nm^2/C$

D. $25Nm^2/C$

Answer: A

Watch Video Solution

24. v33.2

A. $2\pi R^2 E$

B. $\pi R^2 E$

C. $4\pi R^2 E$

D. $6\pi R^2 E$

Answer: B

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25. A sheet of semi circular paper (radius R) is turned around the centre in to a cone as shown. If a point charge +q is kept at the vertex of thecone, the electric flux that comes out of the base of the cone is

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

B. $\frac{q\left(2-\sqrt{3}\right)}{4\varepsilon_0}$

C. zero

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

Answer: B

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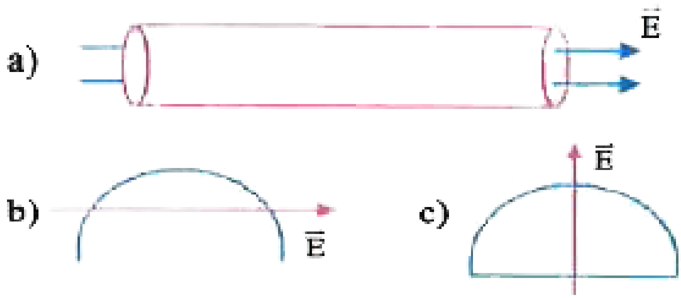
26. In a uniform electric field find the total flux associated with the given surfaces (R is radius)



A. $a=0, b=0, c=0$

B. $a=0, b=\left(\pi R^2 E\right), c=0$

C. $a=2\pi RE, b=\left(\pi R^2 E\right), c=0$

D. $a=\pi R^2 E, b=0, c=0$

Answer: A

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27. An infinitely long thin straight wire has uniform linear charge density of $1/3\text{coul}m^{-1}$ .Then the magnitude of the electric intensity at a point $18cm$ away is

A. $0.33x10^{11}NC^{-1}$

B. $3 \times 10^{11}NC^{-1}$

C. $0.66 \times 10^{11}NC^{-1}$

D. $1.32 \times 10^{11} NC^{-1}$

Answer: A

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28. Consider two concentric spherical surface S_1 with radius a and S_2 with radius $2a$,both centred on the origin. There is a charge $+q$ at the origin, and no other charges.Compare the flux ϕ_1 through S_1 with the flux ϕ_2 through S_2.

A. $\phi_1 = 4\phi_2$

B. $\phi_1 = 2\phi_2$

C. $\phi_1 = \phi_2$

D. $ph_1 = \phi_2 / 2$

Answer: C

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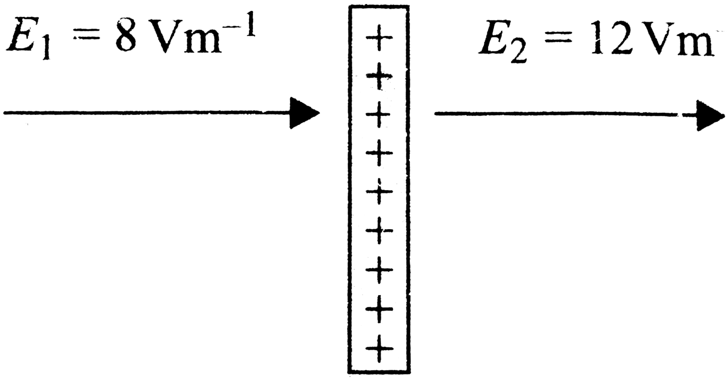
29. The electric field on two sides of a large charged plate is shown in figure. The charge density on the plate in SI units is given by $(\varepsilon_0$ is the permittivity of free space in SI units).



A. $2\varepsilon_0$

B. $4\varepsilon_0$

C. $10\varepsilon_0$

D. Zero

Answer: D

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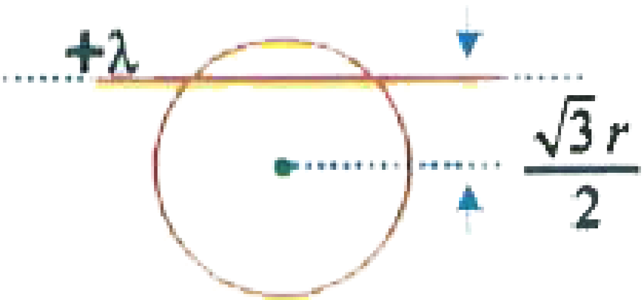
30. A Gausian sphere of radius r intercepts a line with a uniform charge density +1 as shown. The line is at a distance `root 3'r/2 from the centre of the sphere. What is the electric flux associated with the Gaussian sphere?



A. $\frac{r\lambda}{\varepsilon_0}$

B. $\frac{\sqrt{3}r\lambda}{2\varepsilon_0}$

C. $\frac{\sqrt{3}r\lambda}{\varepsilon_0}$

D. $\frac{r\lambda}{2\varepsilon_0}$

Answer: A

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31. A cube of side l is p laced in a uniform field E, where $E = E\hat{i}$. The net electric flux through the cube is

A. zero

B. $l^2 E$

C. $4l^2E$

D. $6l^2E$

Answer: A

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32. A charge +q is placed at the mid point of a cube of side L. The electric flux emerging from cube is

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

B. zero

C. $\frac{6qL^2}{\varepsilon_0}$

D. $\frac{q}{6L^2\varepsilon_0}$

Answer: A

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33. An injfinite large sheet has charg density $\sigma c / m^2$ Find electric field at a distance d perendicular to the sheet.

A. σ / ε_0

B. $\sigma / 2\varepsilon_0$

C. $\sigma / \varepsilon_0 r$

D. $\sigma / 2\varepsilon_0 r$

Answer: B

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34. A charge of 8.85C is placed at the centre of a spherical Gaussian surface of radius $5cm$ .The electric flux through the surface ..

A. 10^{12} V/m

B. 10^{-12}V/m

C. 10^8 V/m

D. 10^{10}V/m

Answer: D

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35. 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. 4×10^3

B. -4×10^3

C. $\dfrac{(-4 \times 10^3)}{\varepsilon_0}$

D. $-4 \times 10^{-3} \varepsilon_0$

Answer: D

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36. The total flux linked with unit negative charge put in air is

A. $\frac{1}{\varepsilon_0}$ out wards

B. $\frac{1}{\varepsilon_0}$ inwards

C. $\frac{1}{4\pi\varepsilon_0}$ outwards

D. $\frac{1}{4\pi\varepsilon_0}$ inwards

Answer: B

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EXERCISE -3

1. The total electric flux through a cube when a charge 8q is placed at one corner of the cube is

A. $\frac{q}{8\varepsilon_0}$

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

C. $\frac{Q}{2\varepsilon_0}6a^2$

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

Answer: A

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2. Domestic electrical wiring has three wires

A. positive, negatie and neutrual

B. positive, negative and earth

C. live, neutral and earth

D. positive, negative and live

Answer: C

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

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

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

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

Answer: A

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5. Two copper balls, each weighing $10g$ are kept in air $10cm$ apart. If one electron from every 10^{6} atoms in trandferred 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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6. If 10^{10} electrons are acquired by a body every second, the time required for the body to get a total charge of C will be

A. 2h

B. 2days

C. 2 yr

D. 20 yr

Answer: D

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7. A ball with charge $-50e$ is placed at the centre of a hollow spherical shell has a net charge of $-50e$. What is the charge on the shell's outer surface ?

A. $-50e$

B. zero

C. $-100e$

D. $+100e$

Answer: C

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8. When 10^{19} electrons are removed from a neutral metal plate through some process, then the charge on it becomes

A. $-1.6C$

B. $+1.6C$

C. $10^{+19}C$

D. $10^{-19}C$

Answer: B

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

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

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

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

D. None of the above

Answer: D

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

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

B. zero

C. $2F$

D. $\sqrt{2F}$

Answer: B

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

A. always along a line a force

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

C. along a line of force, if it has same initial velocity in the direction of an acute angle with the line of force

D. None of the above

Answer: B

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12. 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. 7m

B. 0.7mn

C. 7cm

D. 0.7 cm

Answer: C

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13. 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. $\dfrac{Eq^2m}{2t^2}$

B. $\dfrac{2E^2t^2}{mq}$

C. $\dfrac{E^2q^2t^2}{2m}$

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

Answer: C

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14. At which distance along the centre axis of a uniformly charged plastic disc of radius R is the magnitude of the electric field equal to one-half the magnitude of the field at the centre of the surface of the disc ?

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

B. $\frac{R}{\sqrt{3}}$

C. $\sqrt{2}R$

D. $\sqrt{3R}$

Answer: B

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15. An electron of mass m and charge q is accelerated from rest in a uniform electric field of strength E. The velocity acquired by it as it travels a distance l is

A. $\sqrt{\dfrac{2Eql}{m}}$

B. $\sqrt{\dfrac{2Eq}{ml}}$

C. $\sqrt{\dfrac{2Em}{ql}}$

D. $\sqrt{\dfrac{2Em}{ql}}$

Answer: A

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16. Two parallel infinite line charges $+\lambda$ and $-\lambda$ are placed with a separation distance R in free space. The net electric field exactly mid-way between the two line charges is

A. zero

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

C. $\dfrac{\lambda}{\pi\varepsilon_0 R}$

D. $\dfrac{1}{2\pi\varepsilon_0 R}$

Answer: B

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17. The ionisation potential of mercury is 10.39 V. How far an electron must travel in an electric field of $1.5 \times 10^6 V / m$ to gain sufficient energy to ionise mercury ?

A. $\dfrac{10.39}{1.6 \times 10^{-19}} m$

B. $\dfrac{10.39}{2 \times 1.6 \times 10^{-19}} m$

C. $10.39 \times 1.6 \times 10^{-19} m$

D. $\dfrac{10.39}{1.5 \times 10^6} m$

Answer: D

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18. The electric field and the potential of an electric dipole vary with distance r as

A. $\frac{1}{r}$ and $\frac{1}{r^2}$

B. $\frac{1}{r^2}$ and $\frac{1}{r}$

C. $\frac{1}{r^2}$ and $\frac{1}{r^3}$

D. $\frac{1}{r^3}$ and $\frac{1}{r^2}$

Answer: D

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19. The electric dipole moment of an electron and a proton 4.3 nm apart, is

A. $6.88 \times 10^{-28} Cm$

B. $2.56 \times 10^{-29} C^2 / m$

C. $3.72 \times 10^{-14} C / m$

D. $1.1 \times 10^{-46} C^2 / m$

Answer: A

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20. The electrostatic potential of a uniformly charged thin spherical shell of charge Q and radius R at a distance r from the centre

A. $\frac{Q}{4\pi\varepsilon_0 r}$ for points outside and $\frac{Q}{4\pi\varepsilon_0 R}$ for points inside the shell

B. $\frac{Q}{4\pi\varepsilon_0 r}$ for both points inside and outside the shell

C. zero for points outside and $\frac{Q}{4\pi\varepsilon_0 r}$ for points inside the shell

D. zero for both points inside and outside the sell

Answer: A

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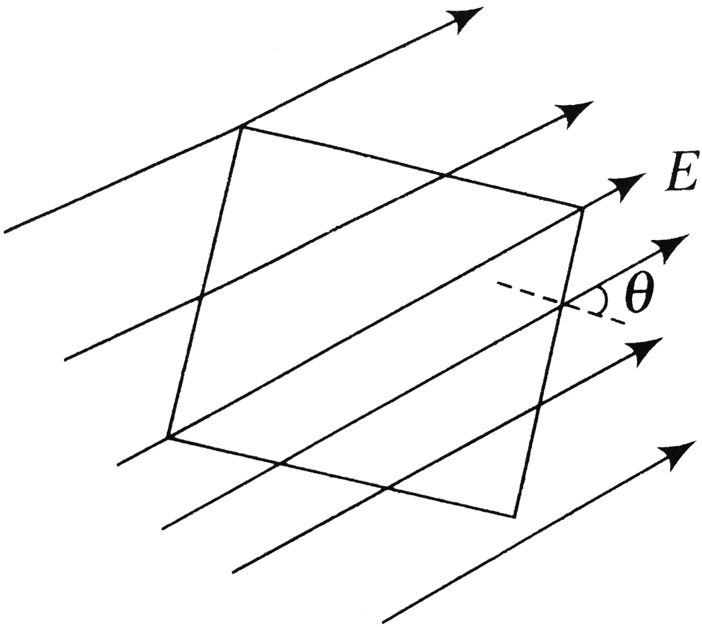
21. A square surface of side L metre in the plane of the paper is placed in a uniform electric field $E(\text{volt}/m)$ acting along the same place at an anlge θ with the horizontal side of the square as shown in figure. The electric flux linked to the surface in uint of $V - m$ is



A. EL^2

B. $EL^2 \cos q$

C. $EL^2 \sin q$

D. zero for both points inside and outside the sell

Answer: D

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22. The charge given to any conductor resides on its outer surface because

A. the free charge tends to be in its minimum potential energy state

B. the free charge tends to be in its minimum kinetic energy state

C. The free charge tends to be in its maximum potential energy state

D. the free charge tends to be in its maximum kinetic energy state

Answer: A

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

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

C. $\frac{F}{8}$

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

Answer: D

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24. 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. 0.44 m

B. 0.65 m

C. 0.556 m

D. 0.350 m

Answer: C

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25. A charged oil drop is suspended in a uniform filed of $3 \times 10^{4} v / m$ so that it neither falls nor rises. The charge on the drop will be (Take the mass of the charge $= 9.9 \times 10^{-15} kg$ and $g = 10 m / s^2$)

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

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

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

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

Answer: A

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26. One of the following is not a property of field lines

A. field lines are continuous curves without any breaks

B. two field line cannot cross eac outer

C. field lines start at positive charges and end at negative charges

D. they form closed loops

Answer: D

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27. A point charge Q is placed at one of the vertices of a cubical block. The electric flux flowing through this cube is

A. $\frac{Q}{6\varepsilon_0}$

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

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

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

Answer: C

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28. Gauss's law is valid for

A. any closed surface

B. only regular closed surfaces

C. any open surface

D. only regular open surfaces

Answer: A

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29. v34.1

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

B. $\frac{+Q}{2\varepsilon_0}$

C. $\frac{+Q}{4\varepsilon_0}$

D. $\frac{+Q}{8\varepsilon_0}$

Answer: C

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30. A comb run through one's dry hair attracts small bits of paper. This is due to

A. comb is a good conductor

B. paper is a good conductor

C. the atoms is the paper get polarised by the charged comb

D. the comb possesses magnetic properties

Answer: C

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31. Each of the two point charges are doubled and their distance is halved. Force of interaction becomes n times where n is

A. 5

B. 1

C. 0.16666666666667

D. 16

Answer: D

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32. A cylindrical conductor is placed near another positively charged conductor. The net charge acquired by the cylindrical conductor will be

A. positive onluy

B. negative only

C. zero

D. either positive or negative

Answer: C

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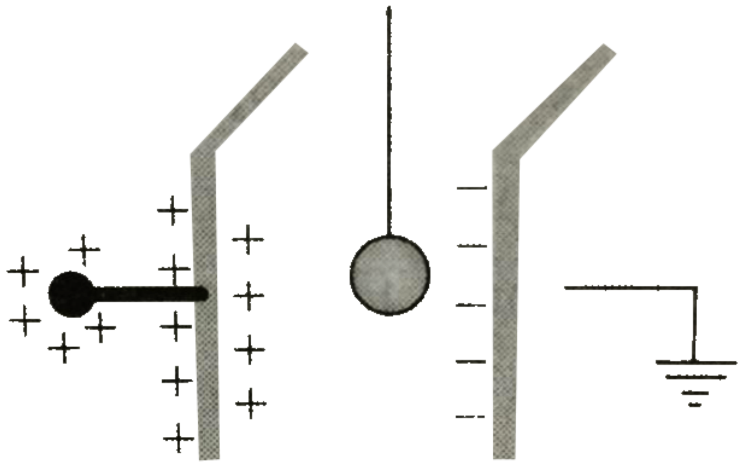
33. A table tennis ball covered with a conducting paint is suspended by a silk thread so that it hangs between tow metal plates. One plate is earthed, when the other plate is connected to a high voltage generator, what will happen to the ball.



A. is attracted to the high voltage plate and stays there

B. hangs without moving

C. swings backward and forward hitting each plate in turn

D. is repelled to the earthed plate and stays there

Answer: C

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34. What is charge on 90 kg of electrons?

A. $1.58\,'\,10^{13}$

B. $2.3 \cdot 10^{12}$

C. $2.53 \cdot \ '10^{12}$

D. None of these

Answer: A

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35. When the distance between two charged particles is halved, the force between them will become

A. remains same

B. increases four times

C. reduce four times

D. None of the above

Answer: A

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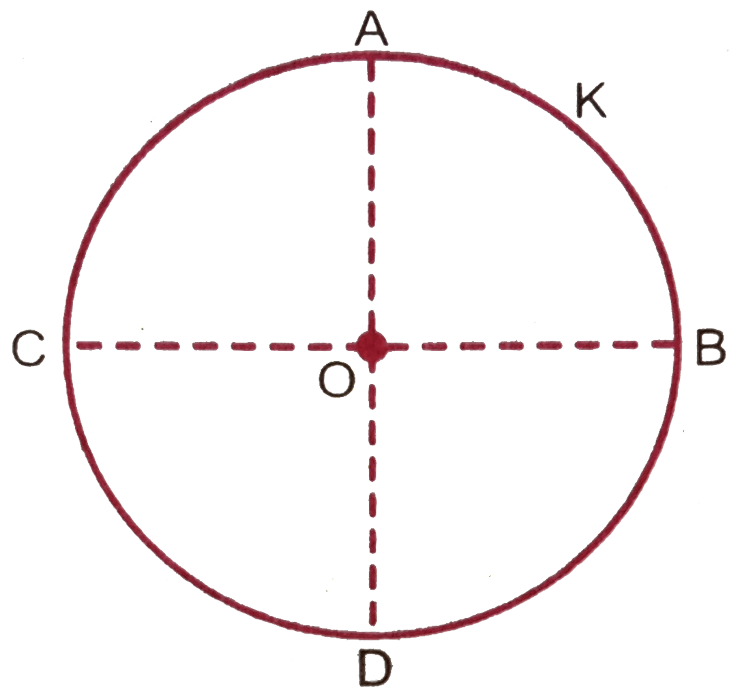
36. A thin conducting ring of radius R is given a charge $+Q$, Fig. The electric field at the center O of the ring due to the charge on the part AKB of the ring is E. The electric field at the center due to the charge on part $ACDB$ of the ring is



A. 3E along KO

B. E along OK

C. E along KO

D. 3E along OK

Answer: B

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37. 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. $\dfrac{q}{4p\varepsilon_0 R^2}$

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

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

Answer: D

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38. A charge Q is uniformly distributed over a large plastic plate. The electric field at a point P close to the centre of the plate is $10 Vm^{-1}$. If the plastic plate is replaced by a copper plate of the same geometrical dimension and carryin the same charge Q_1 the electric field at the point P will become

A. $5Vm^{-1}$

B. zero

C. $10Vm^{-1}$

D. $20Vm^{-1}$

Answer: C

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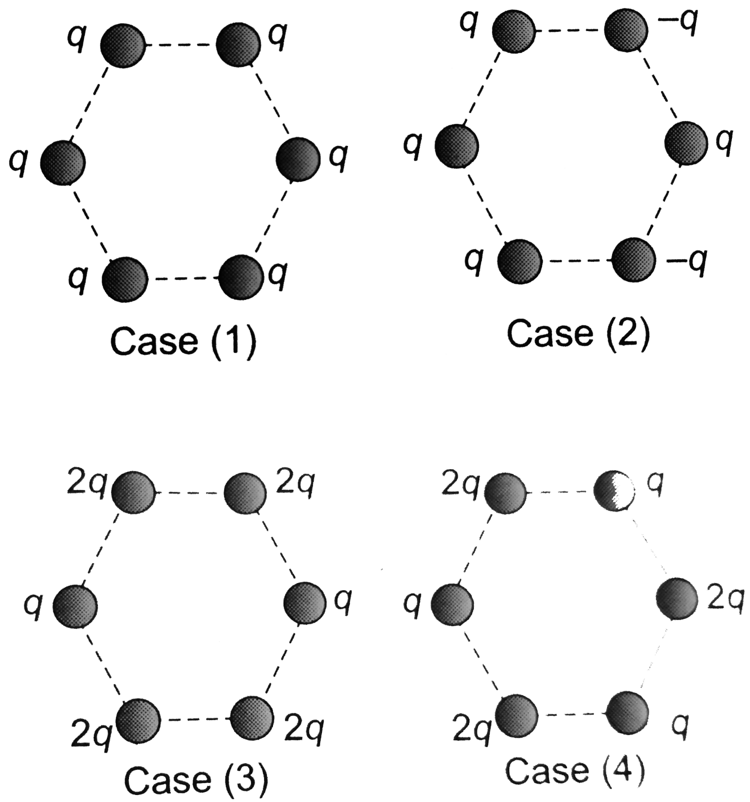
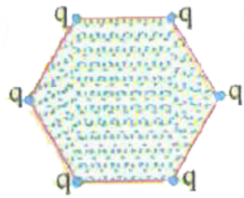
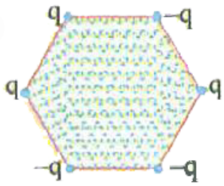
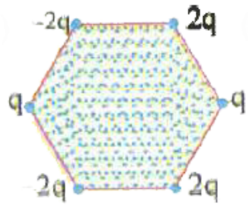
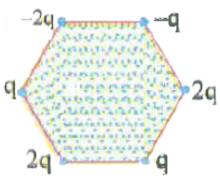
39. Figure below show regular hexagons with charges at the vertices. In which of the following cases the electric field at the centre is not zero



A. 

B. 

C. 

D. 

Answer: A

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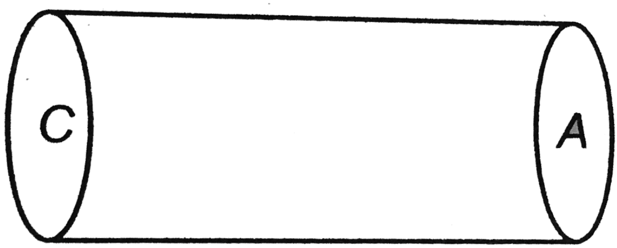
40. A hollow cylinder has a charge qC within it. If ϕ is the electric flux in unit of voltmeter associated with the curved surface B the flux linked with the plance surface A in unit of voltmeter will be



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

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

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

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

Answer: A

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41. When air is replaced by a dielectric medium of constant K, the maximum force separated by a distance

A. increases K^{-1} times

B. increases K times

C. decreases K times

D. remains constant

Answer: C

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42. 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. Both assertion and reason are true and the reason is the correct explanation of the assertion

B. Both assertion and reason are true but the reason is not the correct explanation of the assertion.

C. Assertion is true but reaso is false

D. Both assertion and reason are false

Answer: A

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43. Two point charge $+2C$ and $+6C$ repel each other with a force of $12N$. If a charge of $-2C$ is given to each other of these charges , the force will now be

A. zero

B. 8N (attractive)

C. 8N (repulsive)

D. None of these

Answer: A

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

A. $K\dfrac{e^2}{r^2}\hat{r}$

B. $-K\dfrac{e^2}{r^2}\hat{r}$

C. $k\dfrac{e^2}{r}r$

D. $-k\dfrac{e^2}{r}r$

Answer: B

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45. Three point charges +q, –2q and +q are placed at points (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. $\sqrt{2}qa$ 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

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46. A charge q is located at the centre of a cube.

The electric flux through any face is

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

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

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

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

Answer: D

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47. 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. $\dfrac{\phi_2 - \phi_1}{\varepsilon_0}$

B. $\dfrac{\phi_2 + \phi_1}{\varepsilon_0}$

C. $\dfrac{\phi_1 - \phi_2}{\varepsilon_0}$

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

Answer: D

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48. A conducting sphere of radius R is given a charge Q. The electric potential and the electric field at the centre of the sphere respectively are

A. Both are zero

B. Zero and $\frac{Q}{4\pi\varepsilon_0 R^2}$

C. $\frac{Q}{4\pi\varepsilon_0 R}$ and zero

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

Answer: C

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49. 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. $4\pi\varepsilon_0 Aa^3$

B. $\varepsilon_0 Aa^3$

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

D. $A\varepsilon_0 A^2$

Answer: A

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50. Two identical charged spheres suspended from a common point by two mass-less strings of length l are initially at a distance d ($d < < l$) apart because of their mutual repulsion . The charge begins to leak from both the spheres at a constant rate. As a result the charge approach each other with a velocity v. Then as a function of distance x between them .

A. $v \infty x^{-1/2}$

B. $v \infty x^{1/2}$

C. $v \propto x$

D. $v \propto x^{-1}$

Answer: A

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EXERCISE -4

1. An electron moving towards the east enters a magnetic field directed towards the north. The force on the electron will be directed

A. $\dfrac{2e^2}{4pe_0r^2SW}$

B. $\dfrac{e^2}{4pie_0r^2}NE$

C. $\dfrac{2e^2}{4pe_0r^2}Ne$

D. $\dfrac{e^2}{4\pi e_0r^2}SW$

Answer: A

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2. A conducting spehre has a radius 30 cm .If the dielectric strength of surrounding air is $3'10^6$

V/m, the maximum amount of charge the sphere can holdin micro coulombs is

A. 0.03

B. 0.3

C. 3

D. 30

Answer: D

Watch Video Solution

3. Three identical conducting spheres A, B and C are given charges +Q, +q and -2Q respectively. A and C are brought in to contact and separated. Next B and C are brought in to contact and separated. If A,B and C are arranged so that their centres form an equilateral triangle and they do not touch each wihich of the following statement is correct regarding the forces between the pairs

(A,B),(B,C), and (C,A)?

A. (A,B) atrract, (B,C) attract, (C,A) repel

B. (A,B) attract, (B,C) repel, (C,A) repel

C. (A,B) atrract, (B,C) repel, (C,A) attract

D. (A,B) repel, (B,c) attract, (C,A) repel

Answer: C

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4. A regular tetrhedron has four identical faces each an equilaterla triangle of side L. A charge +q is kept at one of the vertices. The magnitude of electric intensity due to this charge at thecentroid of the face opposite tio it is

$(k = 1/4pe_0)$

A. $\frac{2Kq}{3L^2}$

B. $\frac{3Kq}{2L^2}$

C. $\frac{3kq}{L^2}$

D. $\frac{4kq}{3L^2}$

Answer: B

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5. An electric dipole produces electric field in its surroundings.The angle between the directions of electric field at any point on the axial line and the electric field at any point on the equatorial line is

A. 0°

B. 90°

C. 180°

D. 60°

Answer: C

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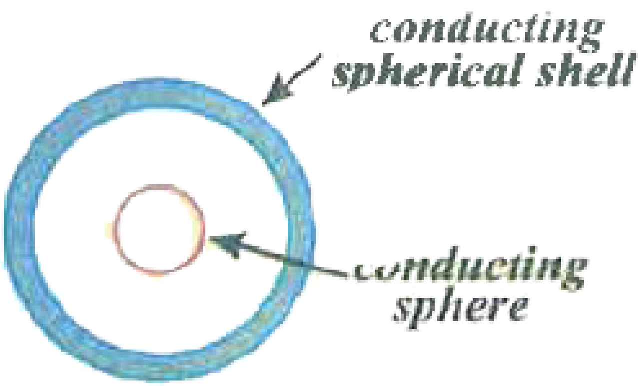
6. A conducting sphere that carries a total charge of -3q is placed at the centre of a conducting spherical shell that carries a total charged of +5q. The conductors are in electrostatic equilibrium. The charges on the inner and outer surfaces of the shell are respectively.



A. $+3q, \ +2q$

B. $+q, \ +q$

C. $+2q, \ +3q$

D. $+2q, \ +7q$

Answer: B

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7. A small bob is suspended from the roof with a string and hangs vertically. The bob is given a charge +q and a uniform horizontal electric field is set up o the neighbourhood of the bob. Now the bob hangs intjhe field such that the string makes an angle of 30° with the vertical. If the charge on te bob is made +3q, and the bob once again comes to equilibrium, then the angle made by the string with the vertical will be

A. 30°

B. 45°

C. 60°

D. 90°

Answer: A

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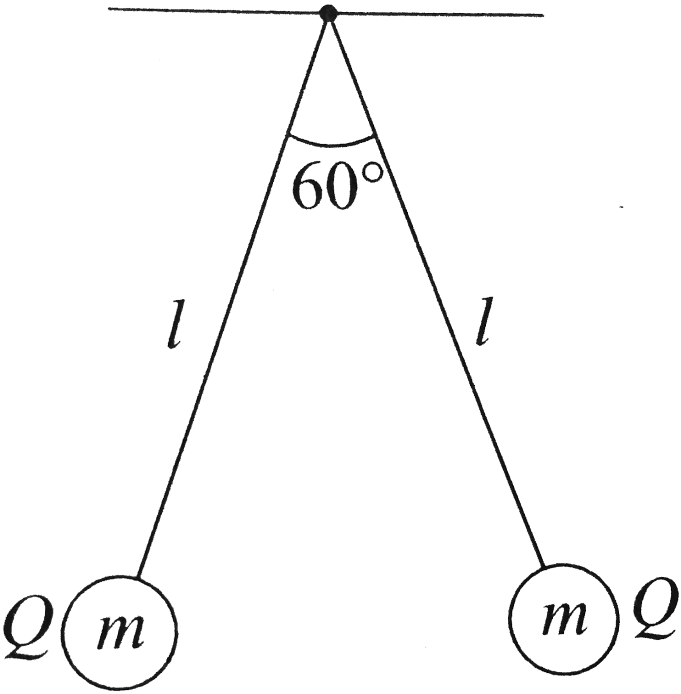
8. Two small balls, each having equal positive charge Q are suspended by two insulationg strings of equal length l from a hook fixed to a stand. It mass of each ball $= m$ and total angle between the two strings is 60° m, then find the charge on each ball.



A. $L\sqrt{\dfrac{\sqrt{3}mg}{k}}$

B. $L\sqrt{\dfrac{mg}{\sqrt{3}k}}$

C. $L\sqrt{\dfrac{mg}{k}}$

D. $\frac{L}{3}\sqrt{\frac{mg}{k}}$

Answer: C

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9. Two infinitely long straight conductors each having a charge density lamda are arranged parallel to each other. The spearation between them is d. What happens to the force per unit length on each conductor, when the separation between them is doubled?

A. remains same

B. doubled

C. halved

D. becomes 1/4 th

Answer: B

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10. Two point charges are fixed on the Xaxis , $q_1 = 12.0mC$ is located at the origin and $q_2 = -3.0mC$ is located at point A, with

$x_2 = 8.0cm$. Where should a third charge q_3, be placed on the X-axis so that the total, electrostatic force acting on it is zero?

A. at $x_3 = 16cm$

B. at $x_3 = 12cm$

C. at $x_3 = 24cm$

D. at $x_3 = 6cm$

Answer: C

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11. An equilateral triangle ABC has a side a. Two infinitely long thin straight wires having uniform linear charge densities ' lamda ' and '-lamda' are arranged at A and B perpendicular to the plante of the triangle. The magnitude of electric intensity at the third vertex c will be

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

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

C. zero

D. $\frac{\sqrt{3}\lambda}{2\pi\varepsilon_0 a}$

Answer: A

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12. Consider the the following statemetns and select the correct opiton /s from those given below the statements.

a. An electron released for rest in a uniform field always increases its kinetic energy.

b. An electron fired in the direction of a uniform electrc field always speeds up.

c. An electron fired perpendicular to a uniform electric field traverses a parabolic path.

A. a,b and c are true

B. a and c are true

C. b and c are true

D. c only is true

Answer: b

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13. A uniform electrif field of intensit E is in the Y-negative direction. An electron of mass m and charge e is fired through the origin with initial velocity u in the X-positive direction. The displacement undergone of the electron during a time interval t is

A. ut

B. $2Et^2 / 2m$

C. $\sqrt{ut + \left(eEt^2 / 2m\right)^2}$

D. $\sqrt{ut - \left(eEt^2 / 2m\right)^2}$

Answer: B

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14. A point charge +Q is surrounded by two uncharged concentric conducting shells as shown. The region of space inside the inner shell is A, the region of space between the two shells is B and the regionof space outside of the outer shell is C. Regarding the electric field whihc of the following is correct?

A. it exists in A only

B. it exists in B and C only

C. it exists in C only

D. it exists in A,B and C

Answer: C

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15. Two isolated metal spheres are identical. They are electrically neutral and are touching. An electrically charged rod is then brought near the spheres without touching them, as the drawing shows. After a while, with the rod held in place, the spheres are separated, and teh rod is then removed. The following statements refere to the mases m_A and m_B of the spheres after they are separated and the rod is removed.

Which of the follownig statements is true?

A. $m_A = m_B$

B. $m_A > m_B$ if the rod is positive

C. $m_A > m_B$ if the rod is negative

D. $m_A > m_B$ irrespective of the charge (+ve or -ve) on the rod

Answer: D

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16. A positive charge kept at one of the vertices of a regular hexagon produces electric intensity E at the centre of the hexagon. If the charge is moved to an adjacent vertex, the magnitude of change in the electric intensity will be

A. zero

B. $\sqrt{3}E$

C. E

D. $E/\sqrt{3}$

Answer: c

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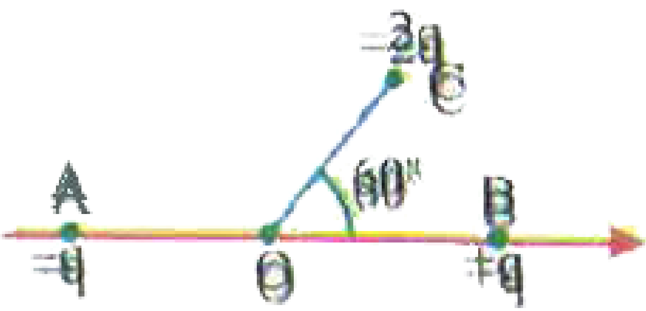
17. Figure shows three charges $-q, +q,$ and $-2q$ kept at points A,B and C respectivley. OA =OB=OC=r. The electric field inteinsity at O has a magnitude of



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

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

C. $\frac{1}{4p\varepsilon_0}\frac{2q}{r^2}$

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

Answer: C

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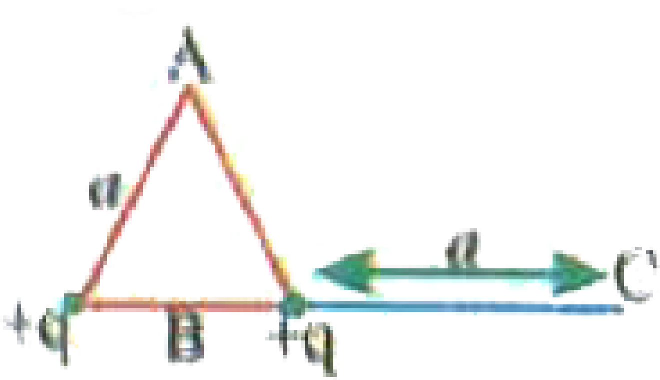
18. Two charges each +q are at the vertices of the equilateral triangle of side a as shown. A is a vertex, B is midpoint of the side and C is a point at a distance as from the right vertex as shown in the figure. THE magnitudes of electric intensities at A, B and C are respectively. The correct ascending order of these intensities is



A. $E_B < E_A < E_C$

B. $E_C < E_a < E_B$

C. $E_A < E_B < E_C$d

D. $E_B < E_C < E_A$

Answer: C

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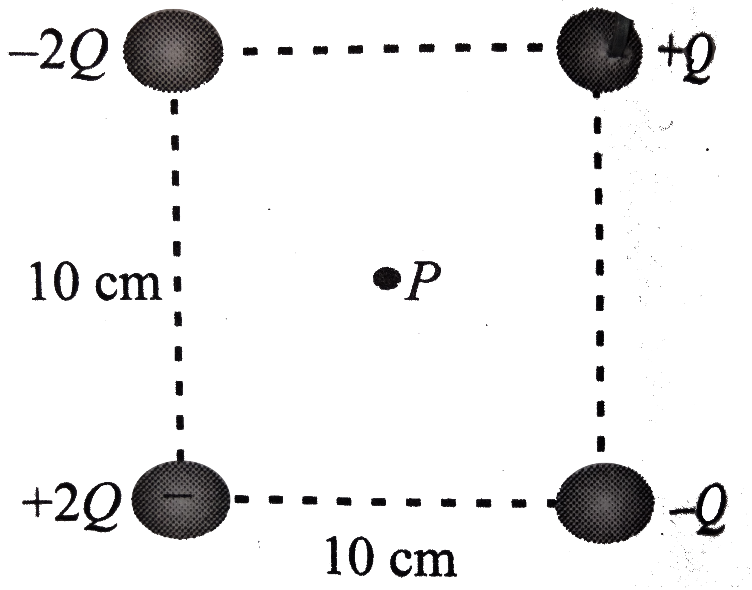
19. Four electrical charge are arranged on the corners of a 10cm square as shown.

What would be the direction of the resulting electric field at the center point P?



A. parallel to AD

B. parallel to CB

C. parallel to AB

D. parallel to CD

Answer: D

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20. Two small identical balls are suspened from a common point by two identical strings. When they are given identical charges, they move apar and the strings make with the vertical an angle of q. Now the system is immersed in a liquid and as a result the angle q does not change. If r is the density of the material of the balls and s is the density of the liquid, the dielectric constant of the liquid is

A. $\dfrac{p}{p-\sigma}$

B. $\dfrac{p-\sigma}{p}$

C. $\dfrac{\sigma}{p-\sigma}$

D. $\dfrac{p-\sigma}{\sigma}$

Answer: A

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21. Let there be a spherically symmetric charge distribution with charge density varying as $\rho(r) = \rho\left(\frac{5}{4} - \frac{r}{R}\right)$ upto $r = R$, and $\rho(r) = 0$ for $r > R$, where r is the distance from the origin. The electric field at a distance r(rltR) from the origin is given by

A. $\frac{4\pi\rho_0 r}{3\varepsilon_0}\left(\frac{5}{4} - \frac{r}{R}\right)$

B. $\frac{\rho_0 r}{4\varepsilon_0}\left(\frac{5}{3} - \frac{r}{R}\right)$

C. $\frac{4\rho_0 r}{3\varepsilon_0}\left(\frac{5}{4} - \frac{r}{R}\right)$

D. $\frac{\rho_0 r}{3\varepsilon_0}\left(\frac{5}{4} - \frac{r}{R}\right)$

Answer: B

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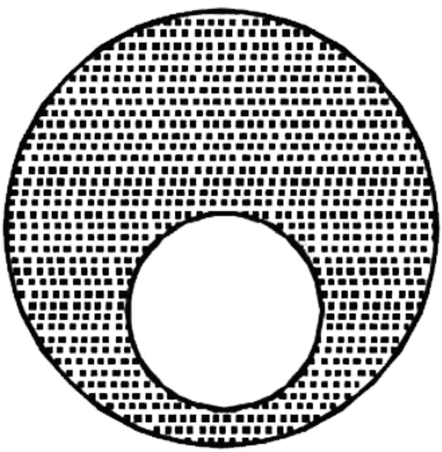
22. A spherical portion has been removed from a solid sphere having a charge distributed uniformly in its volume as shown in the figure. The electric field inisde the emptied space is



A. zero everywherey

B. non-zero and uniform

C. non-uniform

D. zero only at its centre

Answer: B

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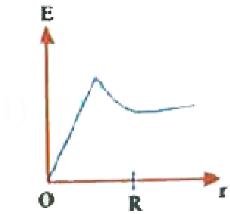
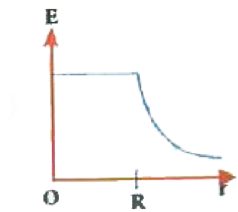
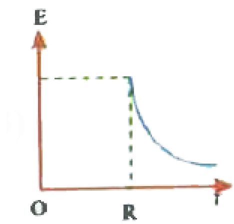
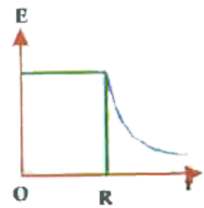
23. An isolated solid metal sphere of radius R is given an electric charge. The variation of the intensity of the electric field with the distance r

from the centre of the sphere is best shown by

A. 

B. 

C. 

D. 

Answer: C

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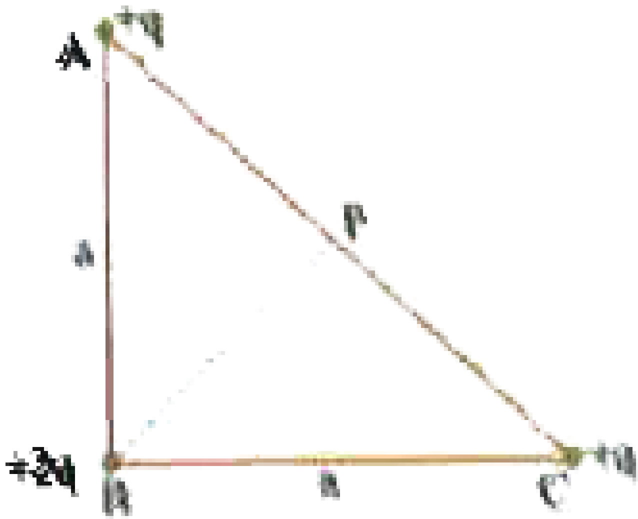
24. Three charges +q, +q, +2q are arranged as shown in figure. What is the field at point P (center of side AC)



A. $E = \dfrac{q}{\pi \varepsilon_0 a^2}$

B. $E = \dfrac{q}{2\pi \varepsilon_0 a^2}$

C. $E = \dfrac{q}{3\pi \varepsilon_0 a^2}$

D. $E = \dfrac{q}{4\pi \varepsilon_0 a^2}$

Answer: A

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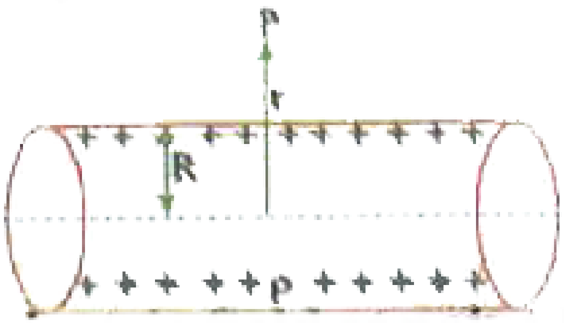
25. Point P is at a distance of $r(> R)$ from the axis of the cylinder. The volume charge densilty and radius of this cylinder are n and r respectively



What is the electric field at point P?

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

B. $\frac{\rho R^2}{2\varepsilon_0}$

C. $\frac{\rho R^2}{\varepsilon_0 r}$

D. $\frac{\rho R^2}{\varepsilon_0}$

Answer: A

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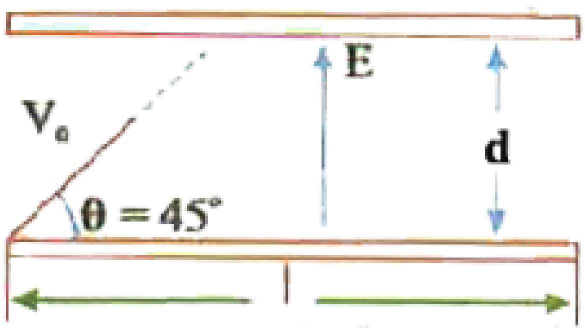
26. An electron is projected as in fig. at a speed of $6x10^6 ms^{-1}$ at an angle of $45^\circ E = 2000 Vm^{-1}$ directed upward $d = 3cm$ and 1=10cm. Will the electron strike either of the plates?



A. Upper plate

B. Lower plate

C. Upper plate at the edge

D. No where

Answer: B

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27. Two large conducting plates are placed parallel to each other with a separation of d between them. An electron starting from rest near one of the plates reaches the other plate in time t. If e is the charge on the electron and m is its mass, then the surface charge density on the inner surface is

A. $\dfrac{dme}{4\pi\varepsilon_0 t^2}$

B. $\dfrac{dm\varepsilon_0}{4\pi e t^2}$

C. $\dfrac{2dm\varepsilon_0}{et^2}$

D. None of the above

Answer: C

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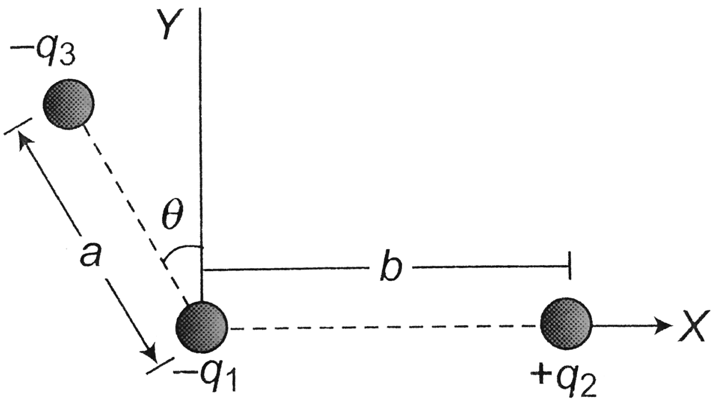
28. Three charges $-q_1, +q_2$ and $-q_3$ are placed as shown in the figure. The x-component of the force on $-q_1$ is proportional to



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. $\frac{q_2}{b^2} + \frac{q_3}{a^2}\cos\theta$

Answer: C

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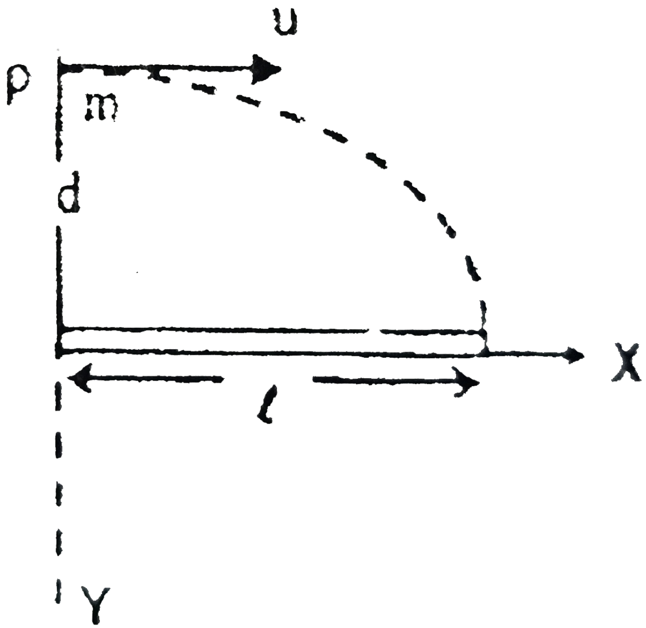
29. An electron is projected from a distance d and with initial velocity u parallel to a uniformly charged flat conducting plate as shown. It strikes the plate after travelling a distance l along the direction of projection. The surface charge density of the conducting plate is equal to



A. $\frac{2d\varepsilon_0 mu^2}{el^2}$

B. $\frac{2d\varepsilon_0 mu}{el}$

C. $\frac{d\varepsilon_0 mu^2}{el}$

D. $\frac{d\varepsilon_0 mu}{el}$

Answer: A

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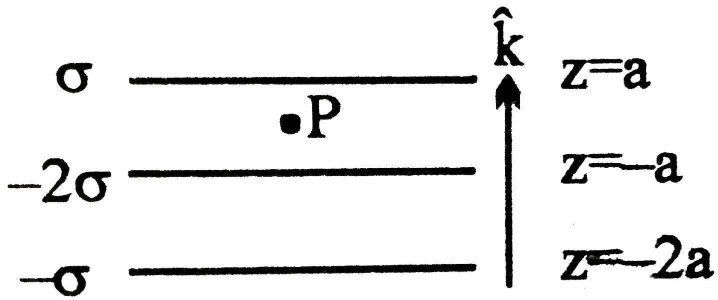
30. Three large parallel plates have uniform surface charge densities as shown in the figure. What is the electric field at P



A. $\frac{-2\sigma}{\varepsilon_0}$

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: A

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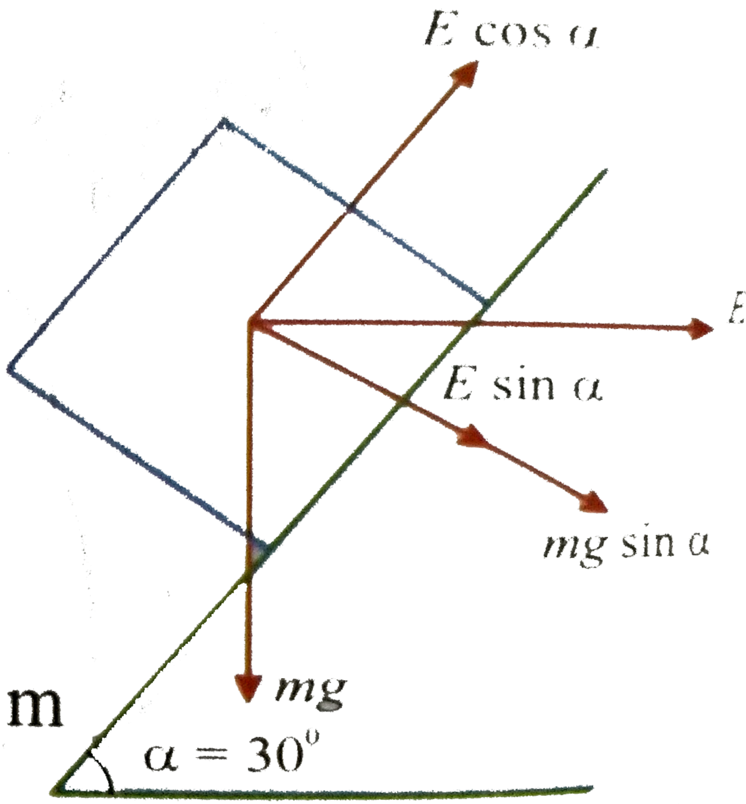
31. A particles of mass $1kg$ and carrying positive charge $0.01C$ is sliding down an inclined plane of angle 30° with the horizontal .An electric field E is applied to stop the particles.If the coefficient of friction between the particles and the surface of the plane is $\frac{1}{2\sqrt{3}}$. E must be



A. 1260 V/m

B. 245 V/m

C. $140\sqrt{3}$V/m

D. $\frac{490}{\sqrt{3}}$ V/m

Answer: C

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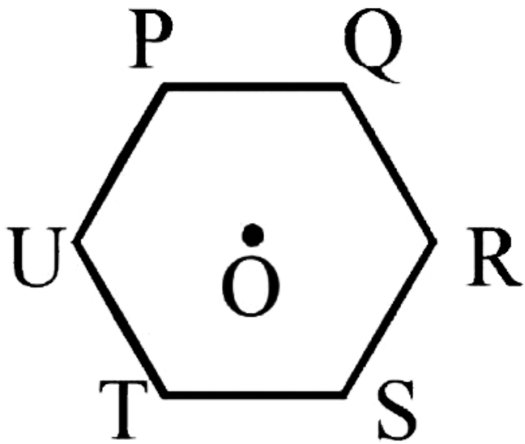
32. six charges of equal magnitude, 3 poistive and 3 negative are to be placed on PQRSTU corners of a regular hexagon, such that field at the centre is double that of what it would have been if only one +ve charge is placed at R. Which of the following arrangement of charge is posisble for P, Q, R, S, T and U respectively.



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

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

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

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

Answer: C

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33. Three concentric metallic spherical shells of radii R, 2R, 3R are given charges $Q_1 Q_2 Q_3$, respectively. It is found that the surface charge densities on the outer surface of the shells are equal. Then, the ratio of the charges given to the shells $Q_1 : Q_2 : Q_3$ is

A. $1 : 2 : 3$

B. $1 : 3 : 5$

C. $1 : 4 : 9$

D. $1:8:18$

Answer: B

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34. 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. $E_a = 4E_q$

B. $E_q = 2E_a$

C. $E_a = 2E_q$

D. $E_q = 3E_a$

Answer: C

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35. A positive charge Q is uniformly distributed along a circular ring of radius. A small test charge q is placed at the centre of the ring. Then A. If $q > 0$ and is displaced away from the centre in the plane of the ring., it will be pushed bactowards the centre.

B. If $q < 0$ and is displplced away from the centre in the plane of the ring, it will never return no the centre and will continue moving til it hits the ring.

C. If $q < 0$, it will performe SHM for small displacement along the axis.

D. Q at the centre of the ring is in an unstable equilibrium within the plane of the ring for $q > 0$

A. A,C are true

B. All are true

C. A,D are true

D. B,C are true

Answer: B

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36. A hemispherical shell is uniformly charge positively .the electric field at point on a diameter away from the centre is directed

A. perpendicular to the diameter

B. parallel to the diameter

C. at an angle titled towards the diameter.

D. at an angle tilted away from thke diameter.

Answer: A

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37. 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 the plane is

A. directed perpendicular to the plane and 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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38. An insulator (non-conductor) can be charged by

a. conduction (b) induction (c) friction

A. a,c

B. b,c

C. c only

D. b only

Answer: C

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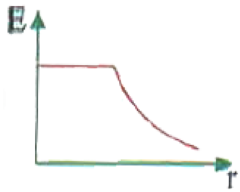
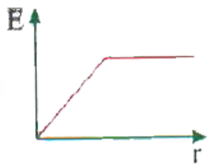
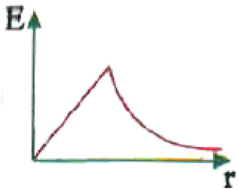
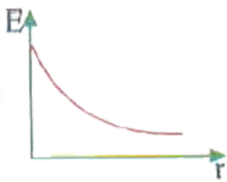
39. Which one of the following graphs represents the variation of electric field with distance r from the centre of a charged spherical conductor of radius R?

A. 

B. 

C. 

D. 

Answer: C

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40. In a liquid medium of dielectric constant K and specific gravity 2 two identically charged spheres are suspended from a fixed point by threads of equal length .The angle between them is 90° .In another medium of unknown dielectric constant K^{1} and specific gravity 4 the angle between them become 120° if density of material of spheres is $8gm/cc$ thenK^{1} is

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

B. $\frac{\sqrt{3}}{K}$

C. $\frac{\sqrt{3}}{2}K$

D. $\frac{K}{\sqrt{3}}$

Answer: D

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41. A particle of mass $1kg$ and carrying $0.01C$ is at rest on an inclined plane of angle 30° with horizontal when an electric field of $\frac{490}{\sqrt{3}}NC^{-1}$

applied parallel to horizontal .The coefficient of friction is

A. 0.5

B. $\frac{1}{\sqrt{3}}$

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

D. $\frac{\sqrt{3}}{7}$

Answer: D

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42. v33.2

A. 0.34 mmn

B. 0.57 mm

C. 7.5 mm

D. 0.75 mm

Answer: D

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43. A bob of a simple pendulum of mass $40gm$ with a positive charge $4 \times 10^{-6}C$ is oscillating with a time period T_1.An electric field of intensity $3.6 \times 10^4 N/C$ is applied vertically upwards.Now the time period is T_2 the value of $\frac{T_2}{T_1}$ is $(g = 10/s^2)$

A. 0.16

B. 0.64

C. 1.25

D. 0.8

Answer: C

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