PHYSICS

BOOKS - AAKASH SERIES

ELECTRIC CHARGES AND FIELDS

Problem

1. If 10^9 electrons move out of a body to another body every second, then the time required to get a total charge of 1 C on the other body is

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2. How much positive and negative charge is there in a cup of water?

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3. A Solid contains 5×10^{21} number of atoms. If an electron is removed from each of 0.01% of number of atoms, find the charge gained by this solid?

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4. Two uniform spheres A (Hollow) and B (solid) of same radius R (

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5. Two charges $2\mu C$ and $1\mu C$ are placed at a distance of 10cm. Where should a third charge be placed between them so that it does not experience any force.

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6. Three charges +q, -q and +q are kept at the corners of an equilateral triangle of side d. Find the resultant electric force on a charge +q placed at the centroid O of the triangle.

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7. A charge Q is divided into two charge q and Q-4 The value of q such that the force between them is maximum is

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8. Calculate the ratio of electric and gravitational force between two protons. Charge of each proton is $1.6 \times 10^{-19} C$, mass is $1.672 \times 10^{-27} kg$ and $G = 6.67 \times 10^{-11} Nm^2 kg^{-2}$.

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9. Four charges of +q, +q +q and +q are placed at the corners A, B, C and D of s square. The resultant force on the charge at D

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10. A ring of radius R carries a uniformly distributed charge +Q. A point charge $-q$ is placed on the axis of the ring at a distance 2R from the centre of the ring and released from rest. The particle executes a simple harmonic motion along the axis of the ring. State True or False.

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11. A shower of protons from outer space deposits equal charges +q on the earth and the moon, and the electrostatic repulsion exactly counter balances the gravitational attraction, How large is q ?

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12. Two point charges placed at a distance of 0.20m in air repel each other with a certain force. When a dielectric slab of thickness 0.08m is introduced in between the charges, the force of interaction is half of its previous value. Find the dielectric constant.

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13. Three point charges q are placed on vertices of an equilateral triangle of side length a. The charge Q

that should be kept at centroid of triangle such that the system is in equilibrium is equal to

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14. Four identical charges each .q. are placed at four corners of a square of side .a.. Find the charge to be placed at the centre of the square so that the system of charges is in equilibrium

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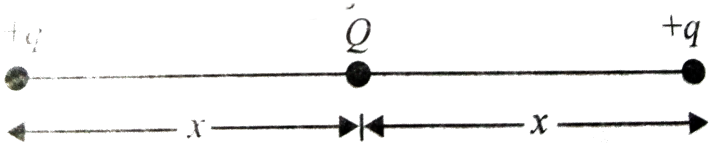
15. A charge Q is placed at the centre of the line joining two point charges +q and +q as shown in figure. The ratio of charges Q and q is



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16. A ray of light falls normally on a rectangular glass slab.

Draw a ray diagram showing the path of the ray till it emerges out of the slab.

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17. In a liquid medium of dielectric constant K and of specific gravity 2, two identically charged spheres are suspended from a fixed point by threads of equal lengths. The angle between them is 90°. In another medium of unknown dielectric constant K^1, and specific gravity 4, the angle between them becomes 120°. If density of material of spheres is 8gm/cc then find K^1.

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

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19. The speed of light in a transparent medium is 0.6 times that of its speed in vacuum. What is the refractive index of the medium?

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20. List four properties of the image formed by a plane mirror

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21. 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

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22. Find the force experienced by a chloride ion having 4 electrons removed, when placed in an electric field of intensity $2NC^{-1}$.

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23. An infinite 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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24. Three mass points each of mass m are placed at the vertices of an equilateral triangle of side l. What is the gravitational field and potential at the centroid of the triangle due to the three masses?

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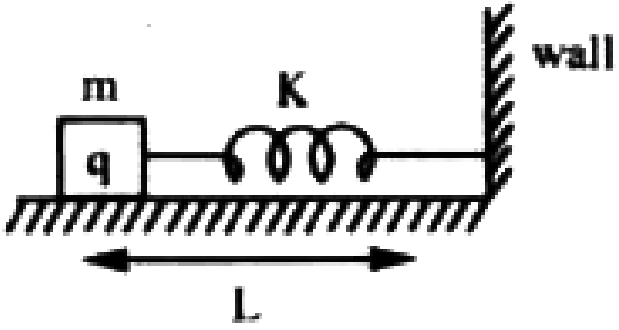
25. A point mass m and charge q is connected with a spring of negligible mass with natural length L. Initially spring is in its natural length. Now a horizontal uniform electric fiedl E is switched on as shown. Find

(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 enery stored in the spring at the equilibrium position of the point mass



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26. A point charge Q is placed at origin. Let $\vec{E}_A, \vec{E}_B,$ and $\vec{E}_C$ be the electirc field at three

points A (1,2,3), B (1,1,1), and C(2,2,2) due to charge Q.

Then

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27. A block having charge q mass m is resting on a smooth horizontal surface at a distance d from the wall as shown. Discuss the motion of the block when a uniform electic field E is applied horizontally towards the wall assuming that collision of the block with the wall is completely elastic

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28. A particle of charge q and mass m moves rectilinearly under the action of an electric field $E = \alpha - \beta x$. Here, α and β are positive constants and x is the distance from the point where the particle was initially at rest. Then:

(1) the motion of the particle is oscillatory with amplitude $\frac{\alpha}{\beta}$

(2) the mean position of the particles is at $x = \frac{\alpha}{\beta}$

(3) the maximum acceleration of the particle is $\frac{q\alpha}{m}$

(4) All 1, 2 and 3

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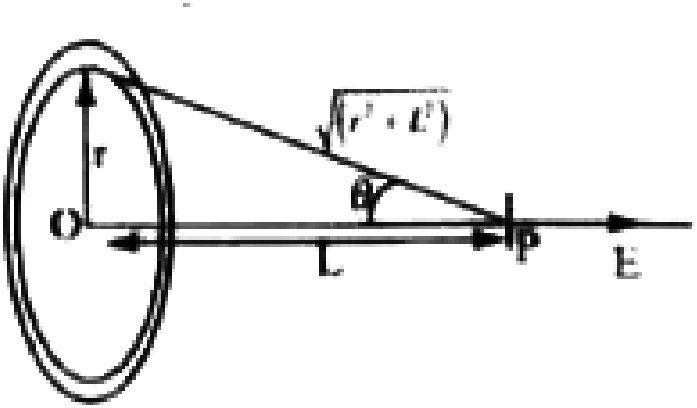
29. A thin wire of radius ..r.. carries a charge q. Find the magnitude of the electric field strength on the axis of the ring as a function of distance L from the centre. Find the same for $L > > r$ Find maximum field strength and the corresponding distance L.



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30. The surface charge density of a thin charged disc of radius R is σ. The value of the electric field at the centre of the disc $\frac{\sigma}{2 \in_0}$. With respect to the field at the centre, the electric field along the axis at a distance R from the centre of the disc is

A. A. reduced by 70.7%

B. B. reduced by 29.3%

C. C. reduced by 9.7 %

D. D. reduced by 14.6%

Answer:

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31. A particle that carries a charge . $-q.$ is placed at rest in uniform electric field 10N/C. It experiences a force and moves. In a certain time .t., it is observed to acquire a velocity $10\hat{i} - 10\hat{j}$ m/s. The given electric field intersects a surface of area $1m^2$ in the x-z plane. Find the Electric flux through the surface.

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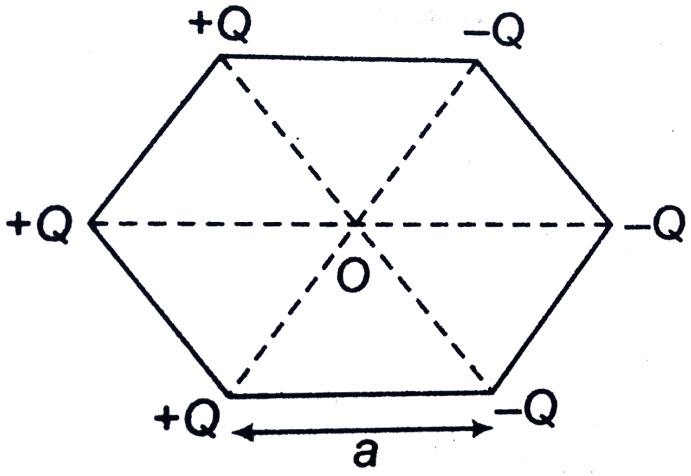
32. Six charges are placed at the vertices of a rectangular hexagon as shown in the figure. The electric field on the line passing through point O and

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



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33. The electric field in a region is given by $\vec{E} = E_0 \frac{x}{L} \hat{i}$. Find the charge contained inside a cubical volume bounded by the surface x=0, x= a, y= 0, y= a, z= 0 and z=a.

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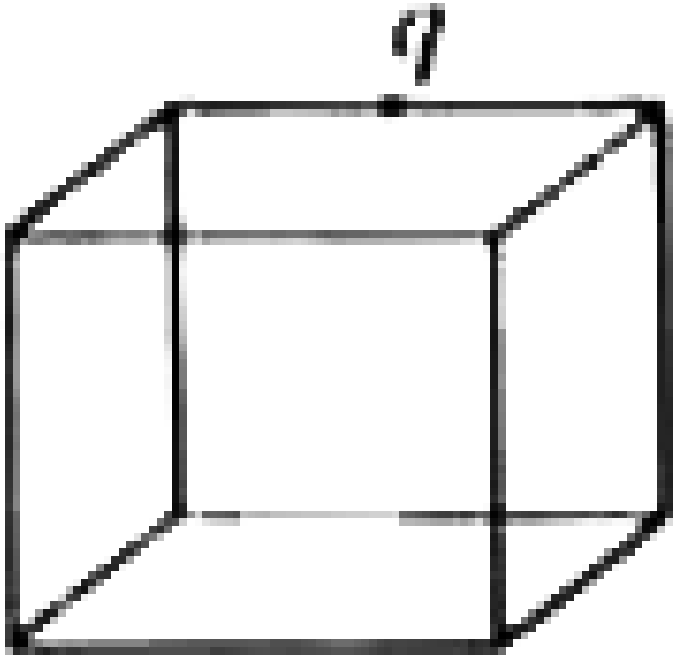
34. A point charge q is placed at the centre of the edge of a cubical box. Find the total flux associated with that box.



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

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36. Two charges $+q_1$ and $-q_2$ are placed at A and B respectively. A line of force emanates from q_1 at an angle α with the line AB. At what angle will it terminate at $-q_2$?

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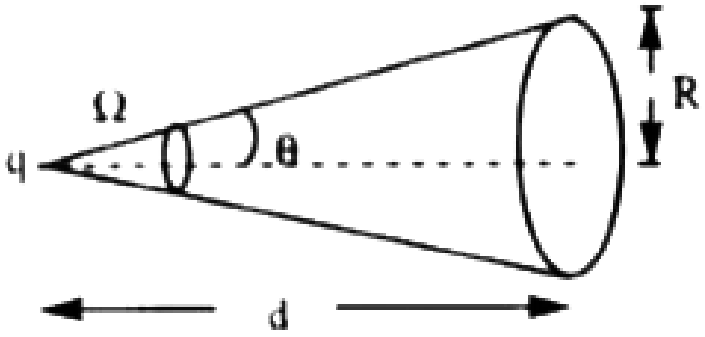
37. A point charge q is placed at a distance d from the centre of a circular disc of radius R. Find electric flux flowing through the disc due to that charge



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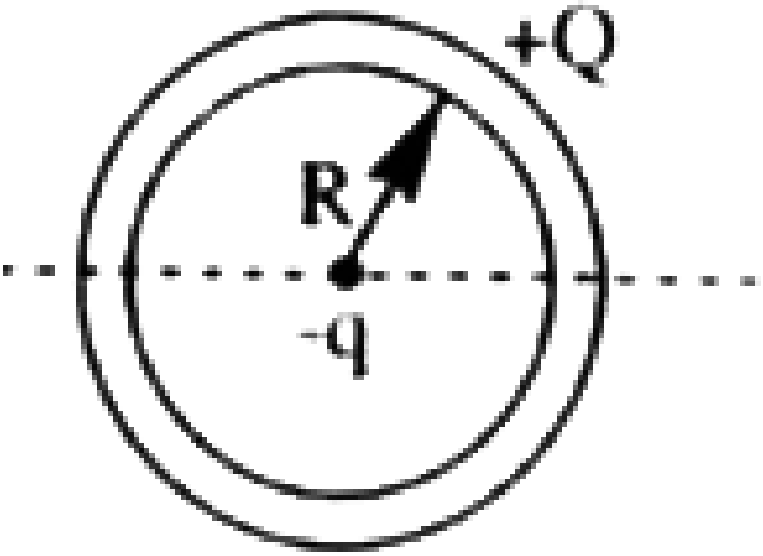
38. A thin spherical shell radius of R has a charge Q uniformly distributed on it. At the centre of the shell, a negative point charge -q is placed. If the shell is cut into two identical hemispheres, still equilibrium is maintained. Then find the relation between Q and q?



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39. A soap bubble of diameter a is produced using the soap solution of surface tension T. Find the energy required to double the radius of the bubble without change of temperature.

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Assess Your Self

1. Usually it is the negative charge that is transferred when two bodies are rubbed together. Can you explain why?

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2. Name two basic properties of electric charge.

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3. Draw magnetic field lines around a bar magnet

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4. At the out set it appears as though the principle of superposition is similar to the additive property. But, it is not so. Can you guess the important difference?

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5. The concept of electric field is due to Faraday and now it is one of the central concepts in Physics. Can you see the electric fields? How can you detect the electric fields?

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6. Consider two charges +q and -q placed at B and C of an equilateral triangle ABC. For this system, the total charge is zero. But the electric field (intensity)

at A which is equidistant from B and C is not zero. Why?

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7. A Gaussian surface does not enclose a charge. Does it mean that E=0 on its surface?

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8. If electric force between point charged varies inversely as the cube of the distance, will Gauss's law be valid?

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9. Calculate the amount of energy consumed in carrying a charge of 1 coulomb through a battery of 3 V.

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10. The charge possessed by an electron is 1.6 X 10^-19 coulombs. Find the number of electrons that will flow per second to constitute a current of 1 ampere.

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11. An electric iron has a rating of 750 W, 220 V. Calculate the current flowing through it .

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12. A positive point charge (+q) is kept in the vicinity of an uncharged conducting plate. Sketch electric field lines originating from the point on to the surface of the plate.

Derive the expression for the electric field at the surface of a charged conductor.

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13. What are good conductors? Give examples.

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Exercise I

1. Due to the motion of a charge, its magnitude

A. changes

B. does not change

C. increases (or) decreases depends on its speed

D. can not be predicted

Answer: B

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2. Induction precedes attraction'. Explain the statement.

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

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

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

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

Answer: C

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3. When charge is given to a body

A. more charge accumulates at regions of small curvature

B. more charge accumulates at regions of large curvature

C. charge is distributed uniformly irrespective of curvature

D. none of the above is true

Answer: B

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4. A soap bubble is given a negative 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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5. The coulomb electrostatic force is defined for

A. two spherical charges at rest

B. two spherical charges in motion

C. two point charges in motion

D. two point charges at rest

Answer: D

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6. The law, governing the force between electric charges is known as

A. Ampere.s law

B. Ohm.s law

C. Faraday.s law

D. Coulomb.s law

Answer: D

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7. Other unit for the quantity having the units $\frac{C^2}{Nm^2}$ is

A. farad

B. $\frac{\text{farad}}{m^2}$

C. $\frac{\text{farad}}{m}$

D. $\frac{m}{\text{farad}}$

Answer: C

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8. One metallic sphere A is given positive charge wherease another identical metallic sphere B of exactly same mass as of A is given equal amount of negative charge. 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 $A >$ Mass of B

Answer: B

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9. A: Charge cannot exist without mass but mass can exist without charge.

B: Charge is invariant but mass is variant with velocity

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

A. A, B, C are true

B. A, B, C are not true

C. A, B are only true

D. A, B are false, C is true

Answer: A

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10. The electrostatic force between two charges Q_1 and Q_2 at separation r is given by $F = \frac{K.\,Q_1Q_2}{r^2}$ The constant K

A. depends on the system of units only

B. depends on the medium between the charges only

C. depends on both the medium between the charges and the system of units

D. is independent of both the system of units and the medium between the charges

Answer: C

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11. The electrostatic force between protons is how many times stronger than gravitational force.

A. 10^{34}

B. 10^{35}

C. 10^{36}

D. 10^{37}

Answer: C

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12. Identify the wrong statement in the following Coulomb.s law correctly describes the electric force that

A. Binds the electrons of an atom to its nucleus

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

C. Binds atoms together to form molecules

D. Binds atoms and molecules together to form solids

Answer: B

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13. When a brass plate is introduced between two charges, the force between the charges

A. Decreases

B. Increases

C. remains same

D. becomes zero

Answer: D

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14. A charge q_1 exerts some force on a second charge q_2 If a third charge q_3 is brought near q_2, then the force exerted by q_1 on q_2

A. Decreases

B. Increases

C. remain unchanged

D. Increases if q_3 is of the same sign as q_1 and decreases if q_3 is of opposite sign

Answer: C

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15. The angle between the dipole moment and electric field at any point on the equatorial plane is

A. will be parallel

B. will be in opposite direction

C. will be perpendicular

D. Are not related

Answer: B

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16. The Electric field is given by $\vec{E} = \frac{\vec{F}}{q_0}$, here the test charge . q_0. should be

(a) Infinitesimally small and positive

(b) Infinitesimally small and negative

A. only a

B. only .b.

C. a (or)b

D. neither .a. or .b.

Answer: A

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17. The pair of particles which have same acceleration in a uniform electric field is

A. Proton and Deuteron

B. Proton and alpha particle

C. Electron and Position

D. Deuteron and alpha particle

Answer: D

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18. A simple pendulum has time period T. The bob is given negative charge and surface below it is given positive charge. The new time period will be

A. Remains equal to T

B. Less than T

C. Greater than T

D. Infinite

Answer: B

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19. A spring-block system undergoes vertical oscillations above a large horizontal metal sheet with uniform positive charge. The time period of the oscillations is T. If the block is given a charge Q, its time period of oscillation will be

A. T

B. $> T$

C. $< T$

D. $> T$ if Q is positive and $< T$ if Q is negative

Answer: A

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20. A negatively charged particle is situated on a straight line joining two other stationary particles each having charge +q. The direction of the motion of the negatively charged particle will depend on

A. the magnitude of charge

B. the position at which it is situated

C. both magnitude of charge and its position

D. the magnitude of +q

Answer: B

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21. Two identical pendulums A and B are suspended from the same point. Both are given 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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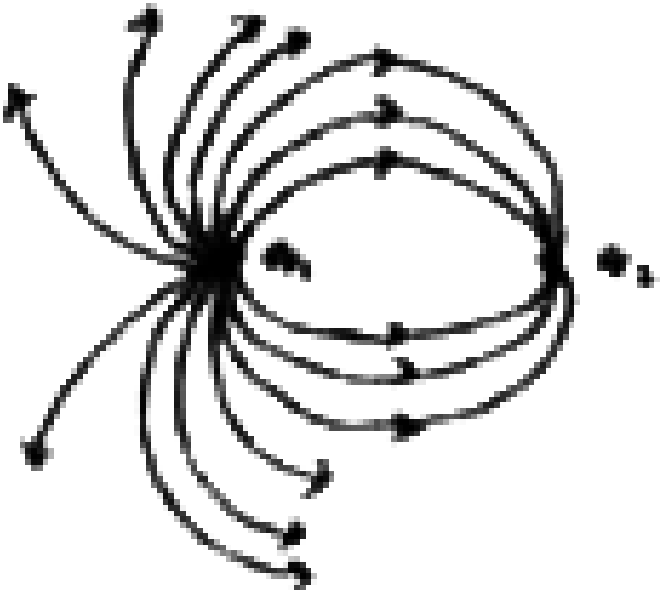
22. Figure shows lines of force for a system of two point charges. The possible choice for the charges is



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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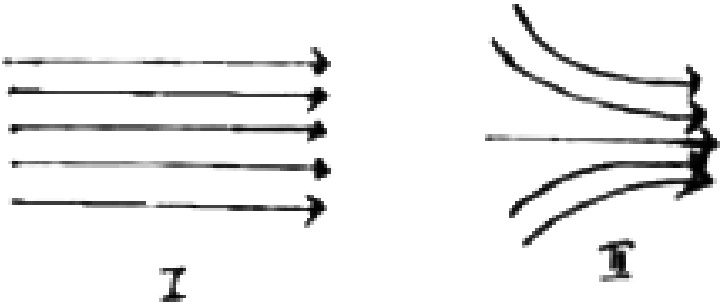
23. Drawings I and II show two samples of electric field lines



A. The electric field in both I and II 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 from left to right

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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24. The acceleration of a charged particle in 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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25. An electron enters an electric field with its velocity in the direction of the electric lines of force. Then

A. the path of the electron will be a circle

B. the path of the electron will be a parabola

C. the velocity of the electron will decrease

D. the velocity of the electron will increase

Answer: C

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26. 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 of 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 switched off and moves upwards when the field is switched on

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

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

Answer: D

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27. A positive charge and a negative charge are initially at rest. If same electric field is applied on them.

A. both have acclerated motions in the direction of the field

B. both have retarded motions in the direction of the field

C. positive charge has accelerated motion in the direction of the field and negative charge has also accelerated motion but in a direction opposite to that of the field

D. Positive charge has accelerated motion in a direction opposite to that of the field and

negative charge has also accelerated motion but in the direction of the field.

Answer: C

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

A. Vertical velocity changes but horizontal velocity remains constant

B. Horizontal velocity changes but vertical velocity remains constant

C. Both vertical and horizontal velocities change

D. Neither vertical nor horizontal velocity changes

Answer: A

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29. If E is the electric field intensity of an electrostatic field, then the electrostatic energy density is proportional to

A. E

B. E^2

C. $1/E^2$

D. E^3

Answer: B

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30. The path of a charged particle projected into a uniform transverse electric field is

A. circle

B. hyperbola

C. parabola

D. ellipse

Answer: C

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31. Two point charges +Q and -Q are separated by a certain distance. The resultant electric field is parallel to the line joining the charges at the points

A. on the line joining the charges

B. on the perpendicular bisector of the line joining the charges

C. both of the above

D. none of the above

Answer: C

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32. Two point charges +Q and -Q are separated by a certain distance. The resultant electric field is parallel to the line joining the charges at the points

A. zero at the mid point of the line joining the charges

B. parallel to the perpendicular bisector of the line joining the charges at any point on the bisector

C. zero at any point on the bisector in a direction parallel to the line joining the charges

D. All the above are true

Answer: D

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33. The wrong statement about electric lines of force is

A. These originate from positive charge and end on negative charge

B. They do not intersect each other at a point

C. They have the same form for a point charge and a sphere

D. They have physical existence

Answer: D

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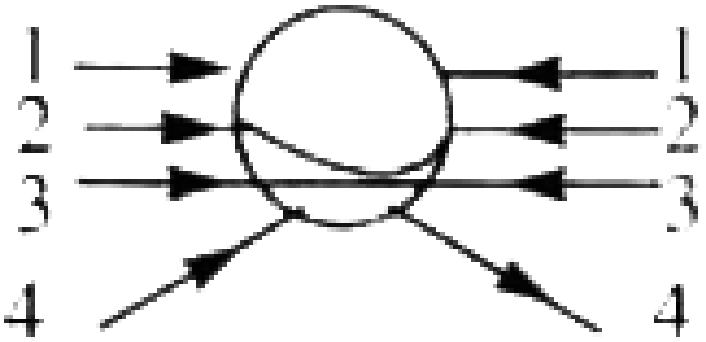
34. A metallic sphere is placed in a uniform electric field. The lines of force follow the path shown in the figures as



A. 1

B. 2

C. 3

D. 4

Answer: D

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35. Two vertical metallic plates carrying equal and opposite charges are kept parallel to each other like a parallel plate capacitor. A small spherical metal ball is suspended by a long insulated thread such that it hangs freely in the centre of the two metallic plates. The ball which is uncharged is taken slowly towards the positively charged plate and is made to touch that plate. Then the ball will

A. stick to the positively charged plate

B. come back to its original position and will remain there

C. oscillate between the two plates touching each plate in turn

D. oscillate between the two plates without touching them

Answer: C

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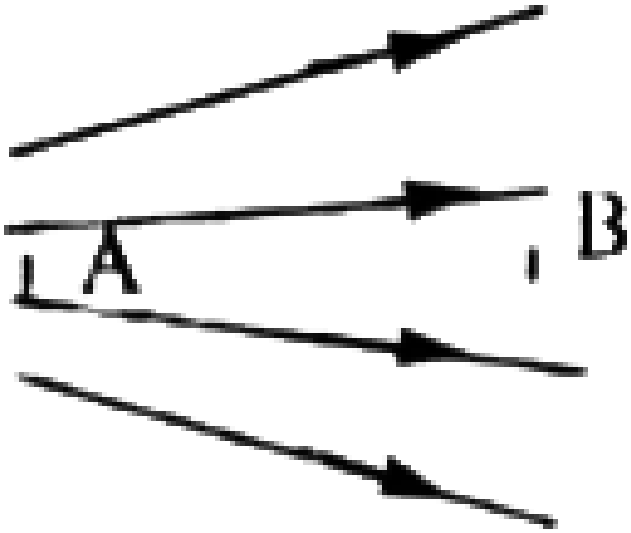
36. If the electric lines of force are as shown in the figure and electric intensity at A and B are

E_A and E_B respectively then



A. $E_A < E_B$

B. $E_A > E_B$

C. $E_A = E_B$

D. $E_A = E_B = 0$

Answer: B

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

A. Electric field out side the sphere is zero

B. Electric field inside the sphere is zero

C. Net induced charge on the sphere is zero

D. Electric potential inside the sphere is zero.

Answer: C

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38. Electric lines of force always leave an equipotential surface

A. at any angle to the surface

B. parallel to the surface

C. perpendicular to the surface

D. Parallel or perpendicular to the surface

Answer: C

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39. Three positive 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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40. The property of the electric line of force

(a) The tangent to the line of force at any point is parallel to the direction of .E. at that point

(b) No two lines of force intersect each other

A. both .a & b.

B. only .a.

C. only .b.

D. a. (or) .b.

Answer: A

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41. A force between the two stationary charges separated by certain distance

(a) obeys Newton.s third law

(b) is a central force (c) is non conservative force (d) is a scalar

A. a is correct

B. a & b are correct

C. a & c are correct

D. c & d are correct

Answer: B

42. 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, then field is

strong

(d) Electric lines of force are closed loops

A. both a & c

B. both b & d

C. only .a.

D. all

Answer: A

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43. For a given surface, the Gauss's law stated as $\int E.\, dS = 0$. From this, we can conclude that

A. E is necessarily zero on the surface

B. E is perpendicular to the surface at every point

C. the total flux through the surface is zero

D. the flux is only going out of the surface

Answer: C

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44. It is not convenient to use a spherical Gaussian surface to find the electric field due to an electric dipole using Gauss's theorem because:

A. Gauss's law fails in this case

B. This problem does not have spherical symmetry

C. Coulomb's law is more fundamental than Gauss.s law

D. Spherical Gaussian surface will alter the dipole moment

Answer: B

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45. An ellipsoidal cavity is carved with in 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

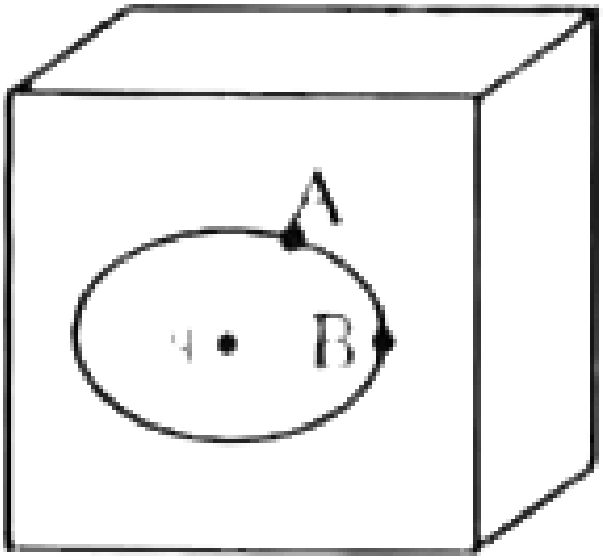
(a) Electric field near A in the cavity = Electric field near B in the cavity

(b) Charge density at A= Charge density at B

(c) Potential at A= Potential at B

(d) Total electric flux through the surface of the

cavity is q/ε_0.



A. a,b,c,d are correct

B. a,b,c are correct

C. only a and b are correct

D. only c and d are correct

Answer: D

Watch Video Solution

46. If a charge is enclosed by the surface of the sphere then total flux emitted from the surface will be:

A. (the charge enclosed by surface)/ε_0

B. (charge enclosed by surface) ε_0

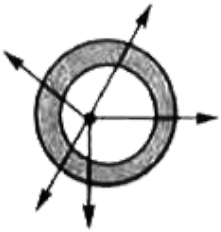
C. (charge enclosed by surface)/$4\pi\varepsilon_0$

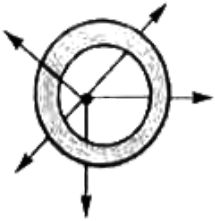
D. 0

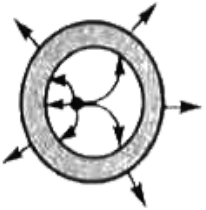
Answer: A

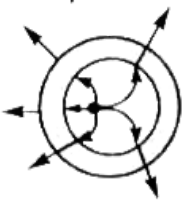
Watch Video Solution

47. A metallic shell has a point charge q kept inside its cayity. Which of the following diagrame correctly represents the electric lines of forces?

A. 

B. 

C. 

D. 

Answer: C

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48. A charge of Q coulomb is placed on a solid piece of metal of irregular sphase. The charge will distribute itself

A. Uniformly in the metal object

B. Uniformly on the surface of the object

C. Such that the potential energy of the system is minimized

D. Such that the total heat loss is minimized

Answer: C

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49. Gauss.s law is true only if force due to a charge varies as:

A. r^{-1}

B. r^{-2}

C. r^{-3}

D. r^{-4}

Answer: B

Watch Video Solution

50. An electric diple is put in north-south direction in a sphere filled with water. Which statement is correct:

A. electric flux is coming towards sphere

B. electric flux is coming out of sphere

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

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

Answer: C

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51. Two small spheres each carrying a charge q are placed. Distance r apart. If one of the spheres is taken around the other in a circular path, the work done will be equal to

A. Force between them $\times r$

B. Force between them $\times 2\pi r$

C. Force between them $/2\pi r$

D. zero

Answer: D

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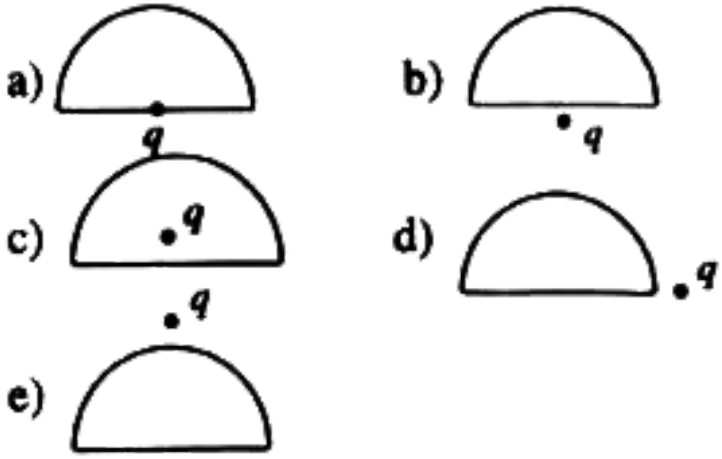
52. Find the total flux due to charge q associated with the given hemispherical surface



A. (a) $\frac{q}{2\in_0}$, (b) 0, (c) $\frac{q}{\in_0}$, (d) 0 (e)0

B. (a) 0, (b) $\frac{q}{2\in_0}$, (c) 0, (d) $\frac{q}{\in_0}$, (e)0

C. (a) $\frac{q}{2\in_0}$, (b) $\frac{q}{\in_0}$, (c) 0, (d) $\frac{q}{\in_0}$, (e) 0

D. (a) 0, (b) $\frac{q}{2\in_0}$, (c) 0, (d) $\frac{q}{\in_0}$, (e) $\frac{q}{\in_0}$

Answer: A

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53. A: A metallic shield in the form of a hollow shell may be built to block an electric field.

R: In a hollow spherical shield, the electric field inside it is 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 tru 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

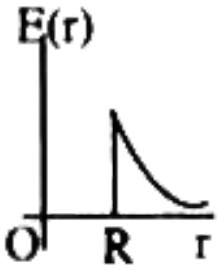
Answer: A

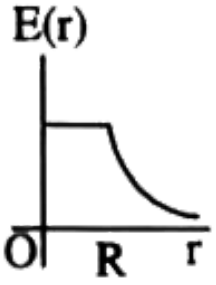
Watch Video Solution

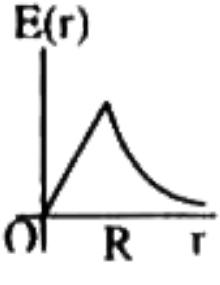
54. A thin conducting spherical shell of radius R has charge Q spread uniformly over its surface. Using Gauss's law, derive an expression for an electric field at a point outside the shell.

Draw a graph of electric $E(r)$ with distance r from the centre of the shell for

A.



B. 

C. 

D. 

Answer: A

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55. An electric dipole placed in a uniform electric field experiences, in general

A. a force and a torque

B. a force but not a torque

C. a torque but not a force

D. neither a force nor a torque

Answer: C

 Watch Video Solution

56. The value of electric potential at any point due to any electric dipole is :

A. $k.\dfrac{\vec{p} \times \vec{r}}{r^2}$

B. $k.\dfrac{\vec{p} \times \vec{r}}{r^3}$

C. $k.\dfrac{\vec{p} \cdot \vec{r}}{r^2}$

D. $k.\dfrac{\vec{p} \cdot \vec{r}}{r^3}$

Answer: D

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57. An electric dipole is plced at an angle of 30° to a nonuniform electric field. The dipole will experience

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

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

C. a torque as well as a translational force

D. a torque only

Answer: C

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

A. 0°

B. 90°

C. 180°

D. None of these

Answer: C

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59. An electric dipole is kept in non-uniform electric field. It experiences

A. a force and a torque

B. a force but not a torque

C. a torque but not a force

D. neither a force nor a torque

Answer: A

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60. Match List-I with List-II

List-I	List-II
a) proton and electron	e) gains same velocity in an elctric field for same time
b) proton and positron	f) gains same KE in an electric field for same time.
c) Deuteron and α - particle	g) experience same force in electric field
d) electron and positron	h) gains same KE when accelerated by same potential difference.

A. $a-h, b-g, c-e, d-f$

B. $a-h, b-g, c-f, d-e$

C. $a-g, b-h, c-e, d-f$

D. $a-e, b-f, c-g, d-h$

Answer: A

Watch Video Solution

61. (A): Coulomb force between charges is central force

(R): Coulomb force depends an medium between charges

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

B. Both .A. and .R. are tru 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: B

Watch Video Solution

62. (A): Two particles of same charge projected with different velocity normal to electric field experience same force

(R): A charged particle experiences force, independent of velocity in electric field

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

B. Both .A. and .R. are tru 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

Watch Video Solution

63. Assertion The coulomb force is the dominating force in the universe.

Reason The coulomb force is weaker than the gravitational force.

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

B. Both .A. and .R. are tru 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: D

Watch Video Solution

64. (A): Electric and gravitational fields are acting along same line. When proton and α-particle are

projected up vertically along that line, the time of flight is less for proton.

(R): In the given electric field acceleration of a charged particle is directly proportional to specific charge

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

Watch Video Solution

65. Assertion : If there exists coulomb attraction between two bodies, both of them may not be charged.

Reason : In coulomb attraction two bodies are oppositely charged.

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

B. Both .A. and .R. are tru 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: B

Watch Video Solution

66. (A) : No two electric lines of force can intersect each other

(R): Tangent at any point of electric line of force gives the direction of electric field.

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

Watch Video Solution

67. (A): Magnitude of electric force acting on a proton and an electron, moving in a uniform electric field is same, where as acceleration of electron is 1836

times that of a proton.

(R): Electron is lighter than proton.

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

B. Both .A. and .R. are tru 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: B

 Watch Video Solution

68. (A): Sharper is the curvature of spot on a charged body lesser will be the surface density of charge at that point.

(R): Electric field is zero inside a charged conductor.

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

B. Both .A. and .R. are tru 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: D

Watch Video Solution

69. (A): The surface densities of two spherical conductors of different radii are equal. Then the electric field intensities near their surface are also equal.

(R): Surface density is equal to charge per unit area.

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

B. Both .A. and .R. are tru 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: B

Watch Video Solution

70. (A): A charged particle free to move in an electric field always move along an electric line of force.

(R): The electric line of force diverge from a positive charge and converge at a negative charge.

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

B. Both .A. and .R. are tru 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: D

Watch Video Solution

71. (A): Mass of a body decreases slightly when it negatively charged.

(R): Charging is due to transfer of electrons.

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

B. Both .A. and .R. are tru 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: D

Watch Video Solution

72. (A): Coulomb force is a long range force.

(R): Coulomb force acts along the line joining two

charged particles.

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

B. Both .A. and .R. are tru 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: B

Watch Video Solution

73. (A): A small metal ball is suspended in a uniform electric field with an insulated thread. If high energy X-ray beam falls on the ball, the ball will be deflected in the electric field.

(R): X-rays emits photoelectron and metal becomes negatively charged.

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

B. Both .A. and .R. are tru 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: C

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74. (A): A charge is lying at the centre of the line joining two similar charges each which are fixed. The system will be in equilibrium if that charge is one fourth of the similar charges.

(R): For charge to be in equilibrium, sum of the forces on charge due to rest of the two charges must be zero.

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

B. Both .A. and .R. are tru 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: D

Watch Video Solution

75. (A): If a conducting medium is placed between two charges, then electric force between them becomes zero.

(R): Reduction in a force due to introduced material is inversely proportional to its dielectric constant.

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

B. Both .A. and .R. are tru 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

Watch Video Solution

76. (A): A point charge is lying at the centre of a cube of each side. The electric flux emanating from each surface of the cube is $\frac{1^{th}}{6}$ total flux.

(R): According to Gauss theorem, total electric flux through a closed surface enclosing a charge is equal to $1/\varepsilon_0$ times the magnitude of the charge enclosed.

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

B. Both .A. and .R. are tru 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: B

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77. Assertion : In a cavity within a conductor, the electric field is zero.

Reason : Charges in a conductor reside only at its surface.

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

B. Both .A. and .R. are tru 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

Watch Video Solution

78. (A): The typres of aircrafts are slightly conducting.

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

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

B. Both .A. and .R. are tru 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: C

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79. Assertion : A bird perches on a high power line and nothing happens to the bird.

Reason : The level of bird is very high from the ground.

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

B. Both .A. and .R. are tru 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: C

Watch Video Solution

80. A: A metallic shield in the form of a hollow shell may be built to block an electric field.

R: In a hollow spherical shield, the electric field inside it is 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 tru 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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Exercise Ii

1. How many electrons must be removed from a piece of metal to give it a positive charge of $1.0 \times 10^{-7} C$

A. 6.25×10^{11}

B. 62.5×10^{11}

C. 62.5×10^{-11}

D. 625×10^{11}

Answer: A

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2. A proton and an electron are placed 1.6cm apart in free space. Find the magnitude of electrostatic force between them. The nature of this force.

A. 9×10^{-25} repulsion

B. 90×10^{-25} repulsion

C. 9×10^{-25}N, attractive

D. 9×10^{25} attractive

Answer: C

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3. Two identical copper spheres are separated by 1m in vacuum. How many electrons would have to be removed from one sphere and added to the other so that they now attract each other with a force of 0.9N?

A. 6.25×10^{15}

B. 6.25×10^{15}

C. 6.25×10^{13}

D. 0.65×10^{13}

Answer: C

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4. The force between two electrons when placed in air is equal to 0.5 times the weight of an electron. Find the distance between two electrons (mass of electron $= 9.1 \times 10^{-31} kg$)

A. 7.2m

B. 72m

C. 72m.

D. 720m

Answer: A

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5. Two charged particles having charge $2.0 \times 10^{-8} C$. Each are joined by an isolating string of length 1m and the system is kept on a smooth horizontal task. The tension in the string.

A. $36 \times 10^{-6} N$

B. $3.6 \times 10^{-6} N$

C. $36 \times 10^{6} N$

D. $3.6 \times 10^{6} N$

Answer: B

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6. Two electrons separated by distance .r. experience a force F between them. The force between a proton and a singly ionized helium atom separated by distance 2r is

A. 4F

B. 2F

C. F/2

D. F/4

Answer: D

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7. Two charges of equal magnitudes and at a distance r exert a force F on each other. If the charges are halved and distance between them is doubled, then the new force acting on each charge is

A. F/8

B. F/4

C. 4F

D. F/16

Answer: D

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8. Four point charge of $+10^{-7}C, -10^{-7}C, -2\times10^{-7}C$ and $+2\times10^{-7}C$ are placed respectively at the corners A, B, C, D of a 0.05m square. Find the magnitude of the resultant force on the charge at D.

A. 0.2 dyne

B. 0.2 newton

C. 2 dyne

D. 0.02 newton

Answer: B

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9. Two positive charges separated by a distance 2m repel each other with a force of 0.36N. If the combined charge is $26\mu C$, the charges are

A. $20\mu C, 6\mu C$

B. $16\mu C, 10\mu C$

C. $18\mu C, 8\mu C$

D. $13\mu C, 13\mu C$

Answer: B

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10. A Copper atom has 29 electrons revolving around the nucleus. A copper ball contains 4×10^{23} atoms. What fraction of the electrons be removed to give the ball a charge of $+9.6\mu C$?

A. ~1.8×10^{-13}

B. ~1.3×10^{-12}

C. 6×10^{-10}

D. ~5.2×10^{-12}

Answer: D

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11. A pith ball of mass 9×10^{-5} kg carries a charge of $5\mu C$. What must be charge in another pith ball placed directly 2 cm above the given pith ball such that they held in equilibrium?

A. $3.2 \times 10^{-11} C$

B. $7.84 \times 10^{-12} C$

C. $1.2 \times 10^{-13} C$

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

Answer: B

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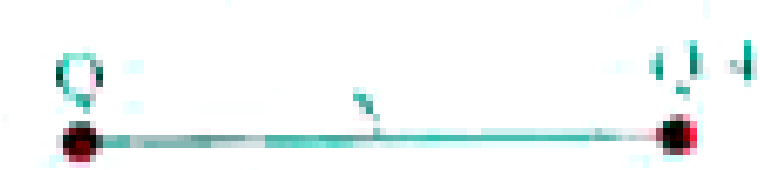
12. Two point charges Q and -Q/4 are separated by a distance x.



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

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

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

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

Answer: C

Watch Video Solution

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

A. Kr

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

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

D. $r\sqrt{K}$

Answer: C

Watch Video Solution

14. Two point charge $+2C$ and $+6C$ repel each other with a force of $12N$. If a charge of $-4C$ is given to each other of these charges , the force will now be

A. $4 \times 10^3 N$ repulsion

B. $4 \times 10^2 N$ repulsion

C. $6 \times 10^3 N$ attraction

D. $4 \times 10^3 N$ attraction

Answer: D

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15. Two small balls having equal positive charge Q C on each are suspended by two insulating strings of equal length L metre, from a hook fixed to a stand. The whole setup is taken into space where there is no gravity (state of weightlessness). Then the angle θ between the two strings is

A. 0°

B. 90°

C. 180°

D. $0^\circ < \theta < 180^\circ$

Answer: C

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16. The force between two similar charges of magnitude 2C each separated by a distance 2km

A. 9N

B. $9 \times 10^3 N$

C. 300N

D. 50N

Answer: B

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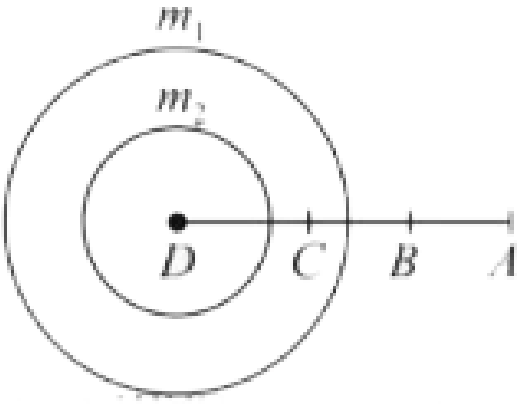
17. Figure shows two shells of masses m_1 and m_2 . The shells are concentric. At which point, a particle of mass m shall experience zero force?



A. 7cm

B. 2cm

C. 5.858cm

D. 8cm

Answer: C

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18. Deuteron and α-particle are put $1A^{\circ}$ apart in Air. Magnitude of intensity of electric field due to deuteron at α-particle is (N/C).

A. Zero

B. 2.88×10^{11}

C. 1.44×10^{11}

D. 5.76×10^{11}

Answer: C

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19. Two point charges Q and -3Q are placed at some distance apart. If the electric field at the location of Q is $\vec{E}$, the field at the location of - 3Q is

A. $\vec{E}$

B. $-\vec{E}$

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

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

Answer: C

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20. The electric field at (30, 30) cm due to a charge of $-8nC$ at the origin in NC^{-1} is

A. $-400(\bar{i}+\bar{j})$

B. $400(\bar{I}+\bar{j})$

C. $-200\sqrt{2}(\bar{i}+\bar{j})$

D. $200\sqrt{2}(\bar{i}+\bar{j})$

Answer: C

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21. Two charges $4 \times 10^{-9} C$ and $-16 \times 10^{-9} C$ are separated by a distance 20cm in air. The position of the neutral point from the small charge is

A. 40/3 cm

B. 20/3 cm

C. 40cm

D. 10/3 cm

Answer: C

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

A. 2.7×10^5

B. 2.6×10^5

C. 2.5×10^5

D. 2.4×10^5

Answer: C

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23. The magnitude of electric field intensity at a distance x due to charge q is E. An identical charge in placed at a distance 2x form it. Then the magnitude of force it experiences is -

A. Eq

B. 2Eq

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

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

Answer: D

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24. Three equal charges, each $+q$ are placed on the corners of an equilateral triangle . The electric field intensity at the centroid of the triangle is

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

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

C. $\frac{1}{v^2}\frac{Q}{r^2}$

D. zero

Answer: D

Watch Video Solution

25. The electric field in a region is radially outward with magnitude $E = \alpha r$. Calculate the charge contained in a sphere of radius R centered at the origin. Calculate the value of the charge if $\alpha = 100 V m^{-2}$ and $R = 0.30 m$.

A. $8.89 \times 10^{-11} C$

B. $9 \times 10^{-11} C$

C. $8.89 \times 10^{11} C$

D. $88.9 \times 10^{11} C$

Answer: A

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26. A sphere of mass 50gm is suspended by a string in an electric field of intensity $5NC^{-1}$ acting vertically upward. If the tension in the string is 520 milli newton, the charge on the sphere is $(g = 10ms^{-2})$

A. $4 \times 10^{-3}C$

B. $-4 \times 10^{-3}C$

C. $8 \times 10^{-3}C$

D. $-8 \times 10^{3}C$

Answer: B

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27. A and B are two points separately by a distance 5cm. Two charges $10\mu C \text{ and } 20\mu C$ are placed at A and B. The resultant electric intensity at a point P outside the charges at a distance 5cm from $10\mu C$ is

A. $54 \times 10^6 N/C$ away from $10\mu C$

B. $56 \times 10^6 N/C$ towards $10\mu C$

C. $9 \times 10^6 N/C$ away from $10\mu C$

D. zero

Answer: A

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28. At the corners A, B, C of a square ABCD, charges $10mC, -20mC$ and $10mC$ are placed. The electric intensity at the centre of the square to become zero, the charge to be placed at the corner D is

A. $-20mC$

B. $+20mC$

C. $30mC$

D. $-30mC$

Answer: A

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29. A charged oil drop is suspended in uniform field 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 $= 9.9 \times 10^{-15} kg \& g = 10 m/s^2$)

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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30. A particle of mass .m. and charge q is placed at rest in a uniform electric field E and then released. The K.E. attained by the particle after moving a distance y is

A. qEy^2

B. qE^2y

C. qEy

D. q^2Ey

Answer: C

Watch Video Solution

31. A proton and an α-particle start from rest in a uniform electric field, then the ratio of times of flight to travel same distance in the field is

A. $\sqrt{5}:\sqrt{2}$

B. $\sqrt{3}:1$

C. $2:1$

D. $1:\sqrt{2}$

Answer: D

Watch Video Solution

32. In a regular hexagon each corner is at a distance .r. from the centre. Identical charges of magnitude .Q. are placed at 5 corners. The field at the centre is $\left(K = \frac{1}{4\pi \in_0}\right)$

A. KQ/r^2

B. $\frac{6KQ}{r^2}$

C. $\frac{5KQ}{r^2}$

D. zero

Answer: A

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33. The force experienced by a charge of $2\mu C$ in an electric field is $3 \times 10^{-3} N$. The intensity of the electric field.

A. $1.5 \times 10^{3} N/C$

B. $150 N/C$

C. $15 N/C$

D. $10 N/C$

Answer: A

Watch Video Solution

34. Four charges of +q, +q +q and +q are placed at the corners A, B, C and D of s square. The resultant force on the charge at D

A. $\frac{q^2}{8\pi \in_0 a^2}\left(1+2\sqrt{2}\right)$

B. $\frac{2q^2}{\pi \in_0 a^2}$

C. $\frac{q^2}{8\pi \in_0 a^2} x 2\sqrt{2}$

D. zero

Answer: A

Watch Video Solution

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

A. $E_e = 2E_a$

B. $E_a = 2E_e$

C. $E_a = E_e$

D. None of the above

Answer: B

Watch Video Solution

36. Electric charges q,q and -2q are placed at the corners of an equilateral triangle of side l. The magnitude of electric dipole moment of the system is

A. q1

B. 2q1

C. $\sqrt{3}q1$

D. 4 q1

Answer: C

Watch Video Solution

37. An electric dipole is placed at the origin along x-axis.The electric field at any point , whose position vector , makes an angle θ with the x-axis ,makes an angle,

A. α

B. θ

C. $\theta + \alpha$

D. $\theta + 2\alpha$

Answer: C

Watch Video Solution

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

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

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

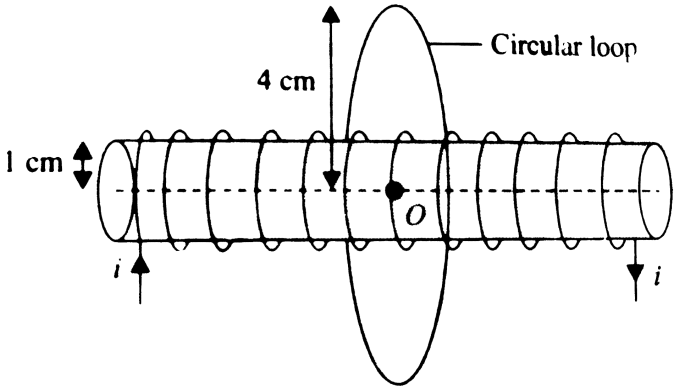
C. $7.68 \times 10^{-29} \text{coulomb} \times m$

D. $7.68 \times 10^{-19} \text{coulomb} \times m$

Answer: C

Watch Video Solution

39. A long solenoid having n = 200 turns per metre has a circular cross-section of radius $a_1 = 1cm$. A circular conducting loop of radius $a_2 = 4cm$ and resistance $R = 5(\Omega)$ encircles the solenoid such that the centre of circular loop coincides with the midpoint of the axial line of the solenoid and they have the same axis as shown in Fig.



A current 't' in the solenoid results in magnetic field along its axis with magnitude $B = (\mu)ni$ at points

well inside the solenoid on its axis. We can neglect the insignificant field outside the solenoid. This results in a magnetic flux $(\phi)_B$ through the circular loop. If the current in the winding of solenoid is changed, it will also change the magnetic field $B = (\mu)_0 ni$ and hence also the magnetic flux through the circular loop. Obvisouly, it will result in an induced emf or induced electric field in the circular loop and an induced current will appear in the loop. Let current in the winding of solenoid be reduced at a rate of $75A/\sec.$

When the current in the solenoid becomes zero so that external magnetic field for the loop stops changing, current in the loop will follow a

differenctial equation given by [You may use an approximation that field at all points in the area of loop is the same as at the centre

A. E

B. E/4

C. E/2

D. 2E

Answer: C

Watch Video Solution

40. An electric dipole is along a uniform electric field. If it is deflected by 60°, work done by agent is $2 \times 10^{-19} J$. Then the work done by an agent if it is deflected by 30° further is

A. $2.5 \times 10^{-19} J$

B. $2 \times 10^{-19} J$

C. $4 \times 10^{-19} J$

D. $2 \times 10^{-16} J$

Answer: B

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41. An electric dipole made up of a positive and negative charge, each of $1\mu C$ separated by a distance of 2cm is placed in an electric field of $10^5 N/C$, then the work done in rotating the dipole from the position of stable equilibrium through an angle of 180° is

A. 2×10^{-3} Joule

B. 2×10^{-8} Joule

C. 4×10^{-3} Joule

D. zero

Answer: C

Watch Video Solution

42. show an electric dipole formed by two

. particles fixed at the ends of a light rod of length l. The

. mass of each particle is m and the charges are -q and

. +q . The system is placed in such a way that the dipole

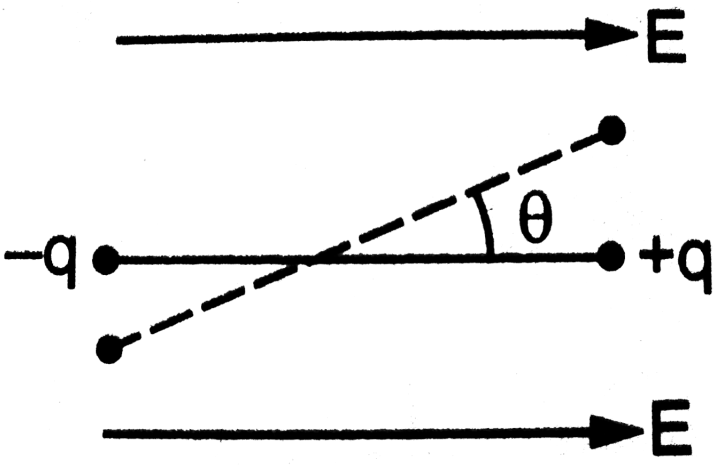
. axis is parallel to a uniform electric field E that exist

. in the region. The dipole is slightly rotated abut its

. centre and released. Show that for small angular

. displacement, the motion is anguler simple harmonic

. and find its time period.



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

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

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

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

Answer: C

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43. An electric dipole consists of two opposite charges each of magnitude $1\mu C$separated by a distance of 2cm. The dipole is placed in an external of $10^5 N/C$. The maximum torque 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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44. A small electric dipole is placed at origin with its dipole moment directed along positive x-axis. The direction of electric field at point $\left(2, 2\sqrt{2}, 0\right)$ is

A. Along positive x-axis

B. Along positive y-axis

C. along negative y-axis

D. along negative x-axis

Answer: B

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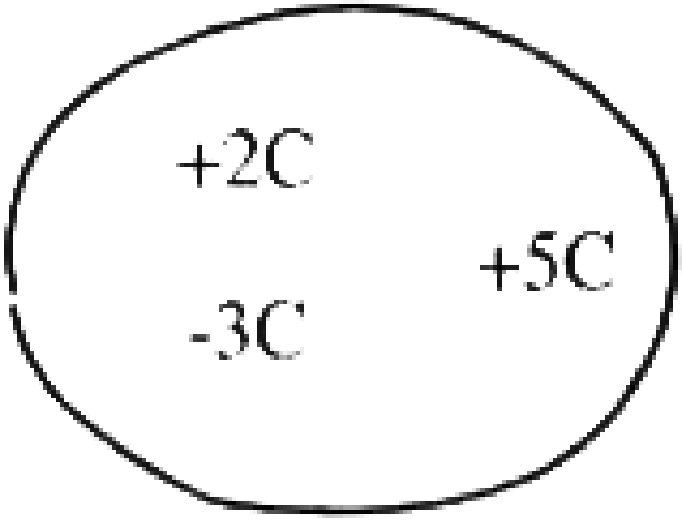
45. Calculate the net flux emerging from given enclosed surface $-Nm^2C^{-1}$



A. 4.5×10^{11}

B. 45×10^{12}

C. zero

D. 1.12×10^{12}

Answer: A

Watch Video Solution

46. The gravitational field in a region is given by $\overrightarrow{g} = \left(2\hat{i} + 3\hat{j}\right)$ N/kg. The work done in moving a particle of mass 1 kg from (1, 1) to $\left(2, \frac{1}{3}\right)$ along the line 3y + 2x = 5 is

A. 10

B. 20

C. $10\sqrt{2}$

D. $2\sqrt{29}$

Answer: A

Watch Video Solution

47. A charge Q is situated at the centre of a cube. The electric flux through one of the faces of the cube 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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48. When mercuric iodide is added to an aqueous solution of Kl the

A. E/2

B. E

C. 2E

D. 4E

Answer: C

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49. The magnitude of the electric field on the surface of a sphere of radius r having a uniform surface charge density σ is

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

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

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

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

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

Answer: A

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51. a hemispherical hollow body is placed in a uniform electric field E. the total flux linked with the curved surface is 

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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52. The electric flux through a Gaussian surface that encloses three charges given by $q_1 = -14nC, q_2 = 78.85nC, q_3 = -56nC$

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

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

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

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

Answer: A

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53. An infinitely long thin straight wire has uniform linear charge density of 1/4 coul m^{-1}. Then the magnitude of the electric intensity at a point 18 cm away is

A. $0.33 \times 10^{11} NC^{-1}$

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

C. $0.25 \times 10^{11} NC^{-1}$

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

Answer: A

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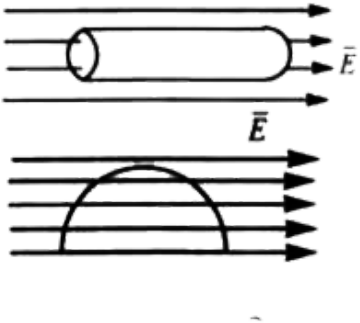
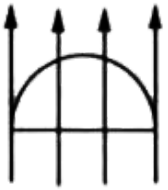
54. In a uniform electric field find the total flux associated with the given surfaces





A. A) $a-0, b-0, c-0$

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

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

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

Answer: A

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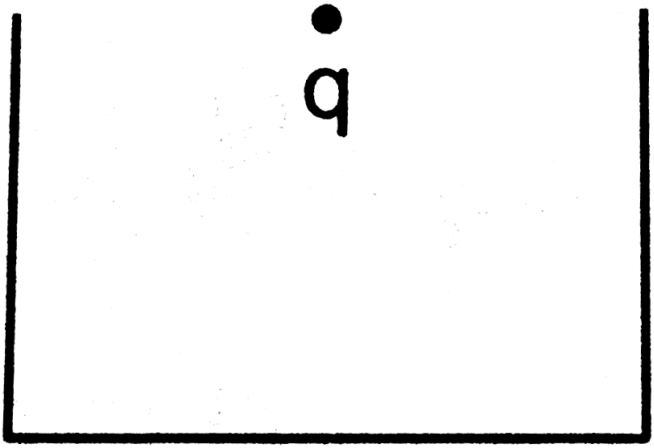
55. A charge q is placed at the centre of the open end of a cylindrical vessel . The flux of the electric field through the surface of the vessel is



A. $\frac{q}{2\,\epsilon_0}$

B. $\frac{q}{\epsilon_0}$

C. $\frac{q}{3\,\epsilon_0}$

D. zero

Answer: A

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56. The electric field in a region of space is given by, $\vec{E} = E_0\hat{i} + 2E_0\hat{j}$ where $E_0 = 100N/C$. The flux of this field through a circular surface of radius 0.02m parallel to the Y-Z plane is nearly.

A. $3.14Nm^2/C$

B. $0.02Nm^2/C$

C. $0.005Nm^2/C$

D. $0.125 Nm^2 / C$

Answer: D

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Practice Exercise

1. When charge is given to a body

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

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

C. $16 \times 10^{-13} C$

D. $20 \times 10^{-13} C$

Answer: A

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2. Calculate force between two charges of 1C each separated by 1m in vacuum.

A. $9 \times 10^{9} N$

B. $0.9 \times 10^{-9} N$

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

D. 9×10^{9} dyne

Answer: A

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3. Two equal and opposite charges are placed at a certain distance apart and force of attraction between them is F. If 75% charge of one is transferred to another, then the force between the charges becomes

A. $\frac{7F}{16}$ (attraction)

B. $\frac{F}{16}$ (attraction)

C. $\frac{7F}{16}$ (repulsion)

D. $\frac{F}{16}$ (repulsion)

Answer: B

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4. Two positively charged small particles, each of mass $1.7 \times 10^{-27} kg$ and carrying a charge of $1.6 \times 10^{-19} C$ are placed apart at a separation r. If each one experiences a repulsive force equal to its weight find their separation.

A. 117m

B. 117cm

C. 11.cm

D. 1.17m

Answer: C

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5. The minimum electrostatic force between two charged particles placed at a distance of 1m is

A. $25 \times 10^{-24} N$

B. $23 \times 10^{-24} N$

C. 2.3×10^{-24} dyne

D. $2.3 \times 10^{-24} N$

Answer: D

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6. The force between two α-particles separated by a distance .r. is F. In order to have same force F, the distance between singly ionized chlorine atoms separated by a distance of

A. 2r

B. 4r

C. r/2

D. r/4

Answer: C

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7. The force between two charges 0.06m apart is 5N. If each charge is moved towards the other by 0.01 m, then the force between them will become

A. 170N

B. 11.25N

C. 45N

D. 22.50N

Answer: B

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8. Four point charges qA = 2 μC, qB = –5 μC, qC = 2 μC, and qD = –5 μ C are located at the corners of a square ABCD of side 10 cm. What is the force on a charge of 1 μC placed at the centre of the square?

A. zero

B. $2.545 \times 10^9 N$

C. $15.91 \times 10^9 N$

D. $12.72 \times 10^9 N$

Answer: A

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9. The force between two charges separated by a distance 1m is 1.8N. The charges are in the ratio $1:2$ then the charges are

A. $5\mu C, 5\mu C$

B. $5\mu C, 10\mu C$

C. $1\mu C, 10\mu C$

D. $10\mu C, 20\mu C$

Answer: D

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10. In 1 gram of solid, there are 5×10^{21} atoms. If one electron is removed from every one of 0.1% of atoms of the solid, the charge gained by the solid is

A. $+0.018C$

B. $+0.8C$

C. $+8\mu C$

D. $-0.08C$

Answer: B

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11. Two positively charged particles each of mass is $9 \times 10^{-30} kg$ and carrying a charge of $1.6 \times 10^{-19} C$ are placed at a distance .r. apart. If each experiences a force equal to its weight, the value of r is $\left(g = 10 ms^{-2}\right)$

A. 1.6m

B. 0.16m

C. 0.116m

D. 0.8m

Answer: A

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12. A charge Q is divided into two charge q and Q-q. The value of q such that the force between them is maximum is

A. Q/3

B. Q/2

C. Q/4

D. 3Q/4

Answer: B

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13. The ratio of the forces between two charges placed at a certain distance apart in air at half of the distance apart in medium of dielectric .k. is

A. A) $1:4k$

B. B) $k:4$

C. C) $4k:1$

D. D) $4:k$

Answer: B

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14. Two point charges +2C and +6C repel each other with a force of 12N. If a charge q is given the each of the these charges then they attract with 4N. Then value q is

A. A) $+4C$

B. B) $-2C$

C. C) $-4C$

D. D) $+2C$

Answer: C

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

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

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

C. $\frac{1}{4\pi\varepsilon_0}\frac{\sqrt{2}q^2}{L^2}$

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

Answer: A

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16. The force between two charges 4C and -2C which are separated by a distance of 3km is

A. $9 \times 10^3 N$

B. $24 \times 10^3 N$

C. $8 \times 10^3 N$

D. $4 \times 10^3 N$

Answer: C

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17. Two charges $9\mu C$ and $1\mu C$ are placed at a distance of 30cm. The position of third charge from $9\mu C$ between them so that it does not experience any force.

A. 7.5cm

B. 22.5cm

C. 5.858cm

D. 10cm

Answer: B

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18. Three point charges Q_1, Q_2 and Q_3 in that order are placed equally spaced along a striaght line. Q_2 and Q_3 are equal in magnitude but opposite is sign. If the net force on Q_3 is zero, the value of Q_1 is

A. $Q_1 = |Q_3|$

B. $Q_1 = \sqrt{2}|Q_3|$

C. $Q_1 = 2|Q_3|$

D. $Q_1 = 4|Q_3|$

Answer: D

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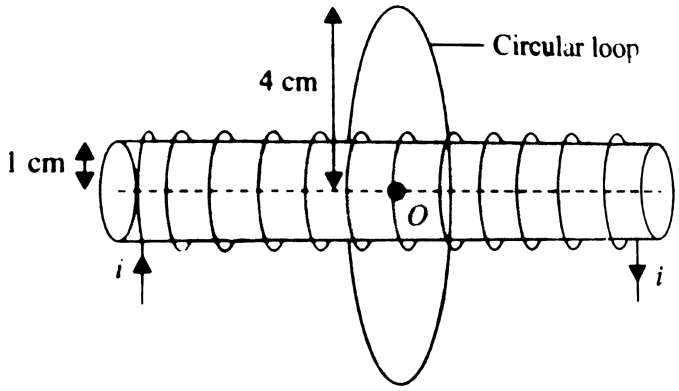
19. A long solenoid having n = 200 turns per metre has a circular cross-section of radius $a_1 = 1cm$. A circular conducting loop of radius $a_2 = 4cm$ and resistance $R = 5(\Omega)$ encircles the solenoid such that the centre of circular loop coincides with the

midpoint of the axial line of the solenoid and they have the same axis as shown in Fig.



A current 't' in the solenoid results in magnetic field along its axis with magnitude $B = (\mu)ni$ at points well inside the solenoid on its axis. We can neglect the insignificant field outside the solenoid. This results in a magnetic flux $(\phi)_B$ through the circular loop. If the current in the winding of solenoid is changed, it will also change the magnetic field $B = (\mu)_0 ni$ and hence also the magnetic flux

through the circular loop. Obvisouly, it will result in an induced emf or induced electric field in the circular loop and an induced current will appear in the loop. Let current in the winding of solenoid be reduced at a rate of $75A/\sec$.

When the current in the solenoid becomes zero so that external magnetic field for the loop stops changing, current in the loop will follow a differenctial equation given by [You may use an approximation that field at all points in the area of loop is the same as at the centre

A. 3.6×10^{10}

B. 36×10^{-10}

C. 4×10^{-2}

D. 7.2×10^{-10}

Answer: A

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20. 10C and 20C are separated by a distance d. If the electric field at the location of a charge 10C is $\vec{E}$, the field at the location of 20C is

A. $\vec{E}/2$

B. $-\vec{E}/2$

C. $-\overrightarrow{E}$

D. $\overrightarrow{E}$

Answer: B

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21. A charge of mass .m. charge .2e. is released from rest in a uniform electric field of strength .E.. The time taken by it to travel a distance .d. in the field is

A. $t = \sqrt{\frac{dm}{Ee}}$

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

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

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

Answer: A

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22. A charge $q = -2.0\mu C$ is placed at origin. Find the electric field at $(3m, 4m, 0)$.

A. $\bar{i} + \bar{j}$

B. $\frac{0.45}{\sqrt{2}}(\bar{i} + \bar{j})$

C. $20\bar{j}$

D. $4.5\sqrt{2}(\bar{i}+\bar{j})$

Answer: B

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

A. 2L

B. L/4

C. 8L

D. 4L

Answer: A

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24. A hollow spherical conductor of radius 1m has a charge of $250\mu C$ then electric intensity at a point distance of 0.5m from the centre of the spherical conductor is

A. zero

B. $2.25 \times 10^6 N/C$

C. $4.5 \times 10^4 N/C$

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

Answer: A

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25. Two point charges $q_A = 3\mu C$ and $q_B = -3\mu C$ are located 20cm apart in vacuum. What is the electric field at the mid point of the line joining the two charges.

A. $54 \times 10^6 N/C$ along OA

B. $5.4 \times 10^6 N/C$ along OB

C. $5.4 \times 10^{-6} N/C$ along OB

D. $54 \times 10^{-6} N/C$ along OB

Answer: B

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26. The displacement $\bar{r}$ of a charge Q in an electric field $E = e_1\hat{i} + e_2\hat{j} + e_3\hat{k}$ is $\bar{r} = a\hat{i} + b\hat{j}$. The work done is

A. $Q(ae_1 + be_2)$

B. $Q\sqrt{(ae_1)^2 + (be_2)^2}$

C. $Q(e_1 + e_2)\sqrt{a^2 + b^2}$

D. $\left(e_1^2 + e_2^2\right)(a + b)$

Answer: A

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27. A solid sphere of radius $2.45m$ is rotating with an angular speed of $10rad/s$. When this rotating sphere is placed on a rough horizontal surface then after sometime it starts pure rolling. Find the linear speed of the sphere after it starts pure rolling.

A. $36 \times 10^6 N/C$

B. $1.8 \times 10^6 N/C$

C. zero

D. $0.9 \times 10^6 N/C$

Answer: C

 Watch Video Solution

28. A 0.50 gm ball carries a charge of magnitude $10\mu C$. It is suspended by a string in a downward electric field of intensity 300N/C. If the charge on the

ball is positive, then the tension in the string is $(g = 10ms^{-2})$

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

B. $8 \times 10^{-3}N$

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

D. zero

Answer: B

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29. Two equal and opposite charges of magnitude $0.2\mu C$ are 15 cm apart, the magnitude and direction

of the resultant electric intensity at a point midway between the charges is

A. $6.4 \times 10^5 N/C$ towards -ve charge

B. $6.4 \times 10^5 N/C$ towards +ve charge

C. zero

D. infinity

Answer: A

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30. Three charges each of $+4\mu C$ are the corners B, C, D of a square ABCD of side 1m. The electric field at

the centre .O. of the square is

A. $7.2 \times 10^4 N/C$ towards A

B. $7.2 \times 10^4 N/C$ towards C

C. $3.6 \times 10^4 N/C$ towards A

D. $3.6 \times 10^4 N/C$ towards C

Answer: A

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31. There are n electrons of charge on a drop of oil of density ρ. It is in equilibrium in an electric field E. Then radius of drop is

A. $\left[\frac{2neE}{4\pi\rho g}\right]^{1/3}$

B. $\left[\frac{neE}{\rho g}\right]$

C. $\left[\frac{3neE}{4\pi\rho g}\right]^{1/3}$

D. $\left[\frac{2neE}{\pi\rho g}\right]$

Answer: C

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32. The electrons in a particle beam each have a kinetic energy of $1.6 \times 10^{-17} J$. What are the magnitude and direction of the electric field that stops these electrons in a distance of 10.0cm

A. 10^3 v/m in the direction of velocity of electrons

B. 10^3 v/m positive direction of velocity of electrons

C. $10^3 v/m$ perpendicular to velocity of electrons

D. $10^6 v/m$ perpendicular to velocity of electrons

Answer: A

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33. Two charged particles having masses in the ratio $2:3$ and charges in the ratio $1:2$ are released from

rest in a uniform electric field. After a time 1 minute their K.E. will be in the ratio of

A. $3:8$

B. $3:4$

C. $1:3$

D. $2:5$

Answer: A

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34. ABC is an equilateral triangle. Charges +q are placed at each corner. The electric field intensity at

the centroid of triangle will be

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

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

C. zero

D. $\frac{1}{4\pi \in_0} \frac{3q}{r^2}$

Answer: C

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35. An α particle is situated in an electric field of $10^6 N/C$. The force exerted or it is

A. $6.4 \times 10^{-3} N$

B. $3.2 \times 10^{-13} N$

C. $32 \times 10^{-13} N$

D. $64 \times 10^{-13} N$

Answer: B

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36. Four charges of +q, +q, +q and +q are placed at the corners A, B, C and D of a square of side a. Find the resultant force on the charge at D

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

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

C. $\frac{q^2}{8\pi\varepsilon_0 a^2}2\sqrt{2}$

D. zero

Answer: A

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37. The electric intensity due to a dipole of length 10 cm and having a charge of 1500 muC`, at a point on the axis at a distance 20 cm from one of the charges in air, is

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

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

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

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

Answer: A

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

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

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

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

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

Answer: B

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39. A molecule with a dipole moment p is placed in an electric field of strength E. Initially, the dipole is aligned parallel to the field. If the dipole is to be

rotated to be a anti-parallel to the field, then the work required to be done by an external agency is

A. $-2pE$

B. $-pE$

C. pE

D. 2pE

Answer: D

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40. An electric dipole of dipole moment p is placed in the position of stable equilibrium in uniform electric

field of intensity E. this is rotated through an angle θ from the initial position . The potential energy of the electric dipole in the final position is

A. $pE\cos\theta$

B. $pE\sin\theta$

C. $pE(1-\cos\theta)$

D. $-pE\cos\theta$

Answer: D

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41. For dipole $q = 2 \times 10^{-6} C$ and $d = 0.01m$, calculate the maximum torque for this dipole if $E = 5 \times 10^5 N/C$

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

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

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

D. $1 \times 10^2 Nm$

Answer: B

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42. An electric dipole of moment p is placed normal to the lines of force of electric intensity E, then the work done in deflecting it through an angle of 80° is

A. pE

B. $+2pE$

C. $-2pE$

D. zero

Answer: D

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43. A dipole consisting of $+10nC$ and $-10nC$ separated by a distance of 2cm oscillates in an electric field of strength 60,000 Vm^{-1}. The frequency of its oscillation is (M.I. about the axis of oscillations is $3 \times 10^{-10} kgm^2$)

A. 20.2 Hz

B. 25.4 Hz

C. 31.38 Hz

D. 37.1 Hz

Answer: C

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44. The number of electric lines of force originating from a charge of 1C is

A. 1.129×10^{11}

B. zero

C. 1.129×10^{-11}

D. 1.129×10^{10}

Answer: A

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45. A cube of side 1 is placed in a uniform field E, where $E = E\hat{i}$. The net electric flux through the cube is

A. zero

B. 1^2E

C. 41^2E

D. 61^2E

Answer: A

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46. A point charge +q is placed at the centre of a cube of side l. The electric flux emerging from the 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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47. A long thin flat sheet has a uniform surface charge density σ. The magnitude of the electric field at a distance .r. from it is given by

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

A. $10^{12}V/m$

B. $10^{-12}V/m$

C. $10^{8}V/m$

D. $10^{10}V/m$

Answer: A

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49. The inward and outward electric flux for a closed surface in units of $N - m^2C^{-1}$ are respectively, 8×10^3 and 4×10^3. Then, the total charge inside the surface is [where, ε_0 = permittivity constant]

A. 4×10^3

B. -4×10^3

C. $\frac{(-4 \times 10^3)}{\in_0}$

D. $-4 \times 10^3 \in_0$

Answer: D

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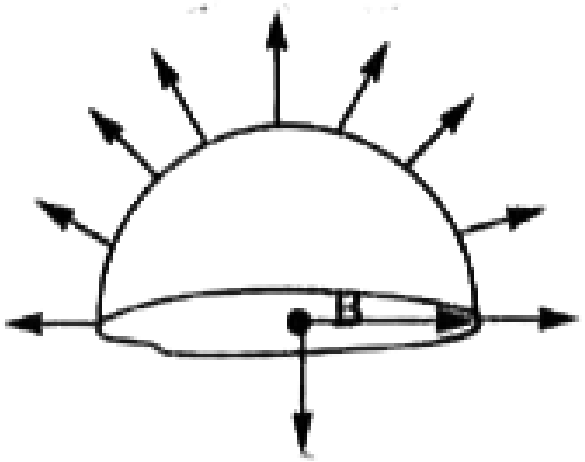
50. If a charge q is placed at the centre of a hemispherical body as shown below then the flux linked with the curved surface is



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

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

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

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

Answer: B

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51. Total electric flux coming out of a unit positive 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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52. Two square plates are at potential difference of 100V separated by 2cm. Calculate electric intensity between them

A. 5×10^{-3}

B. 5000

C. 200

D. 98

Answer: B

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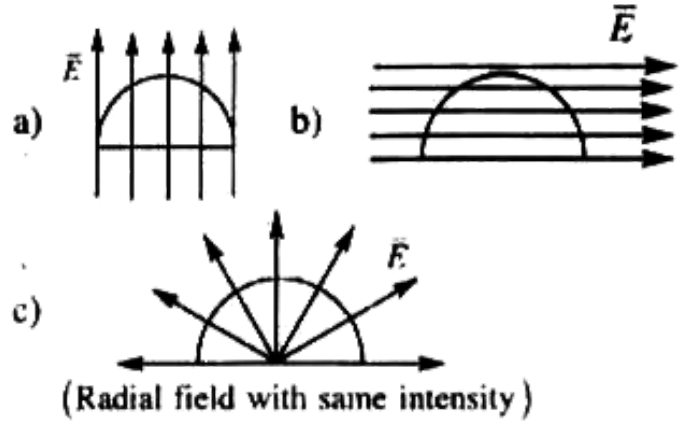
53. Find the flux due to the electric field through the curved surface (R is radius of curvature)



A. $a-0, b-0, c-2\pi R^2 E$

B. $a-\pi R^2 E, b-0, c-2\pi R^2 E$

C. $a-0, b-0, c-0$

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

Answer: B

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54. The length of each side of a cubical closed surface is L metre. If charge 48C is situated at one of the corners of the cube, Find the flux passing through the cube. (In Volt-metre)

A. $\frac{6}{\in_0}$

B. $\frac{3}{\in_0}$

C. $\frac{48}{\in_0}$

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

Answer: A

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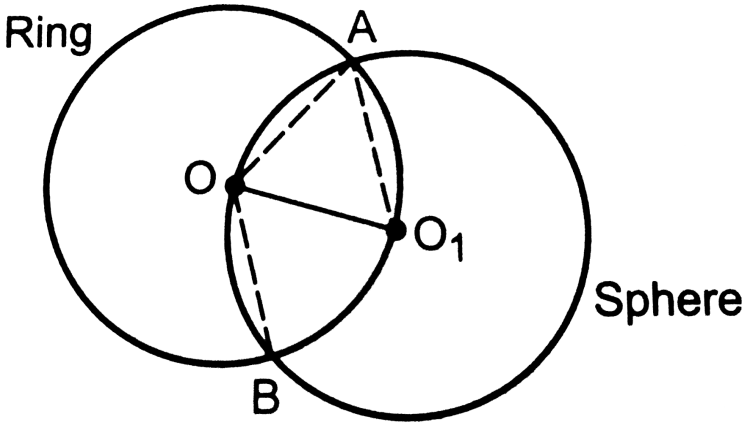
55. A Charge Q is distributed uniformly on a ring of radius r. A sphere of equal r is constructed with its centre at the periphery of the ring (figure 30.12) Find the flux of the electric field through the surface of the sphere.



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

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

C. $\frac{q}{3 \in_0}$

D. zero

Answer: C

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56. A cube is arranged such that its length, breadth and height are along X, Y and Z directions, One of its corners is situated a 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. Find the flux coming out of the cube at one end.

A. 25

B. $\frac{25}{\sqrt{2}}$

C. $25\sqrt{2}$

D. zero

Answer: C

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57. A metallic ring is connected to a rod oscillates freely like a pendulum. If now a magnetic field is

applied in horizontal direction so that the pendulum now swings through the field, the pendulum will

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

B. $\pi a^2 E$

C. $\pi a^2 E/\left(2\sqrt{2}\right)$

D. $\pi a^2 E/\sqrt{2}$

Answer: D

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Problems

1. If 10^9 electrons move out of a body to another body every second, how much time is required to get a total charge of 1 C on the other body?

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2. How much positive and negative charge is there in a cup of water?

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3. A Solid contains 5×10^{21} number of atoms. If an electron is removed from each of 0.01% of number of

atoms, find the charge gained by this solid ?

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4. A and B are two identical point sized metal spheres each holding the same charge q. These two are separated by certain distance and the mutual electrostatic force between them is F. if a third identical uncharged sphere 'C' is touched with A and kept exactly at the midpoint of line joining A and B, what is the resulting force on C and its direction ?

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5. Two charges $2\mu c$ and $1\mu c$ are placed at a distance of 10 cm. Where should a third charge be placed between them so that it does not experience any force.

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6. Three chargers +q, -q and + q are kept at the corners of an equilateral triangle of side d. Find the resultant electric force on a charge to placed at the centroid O of the triangle.

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7. A charge is to be divided into two small parts. What should be the value of the charges on the parts so that the force between the parts will be maximum?

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8. Calculate the ratio of electric and gravitational force between two protons. Charge of each proton is $1.6 \times 10^{-19} C$, mass is 1.672×10^{-27} kg and $G = 6.67 \times 10^{-11} Nm^{-2} kg^{-2}$?

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9. Four charges of +q, +q, +q and +q are placed at the corners A, B, C and D of a square of side a. Find the resultant force on the charge at D.

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

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11. A shower of protons from outer space deposits equal charges +q on the earth and the moon, and the electrostatic repulsion exactly counter balances the gravitational attraction, How large is q ?

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12. Two point charges placed at a distance of 0.20m in air repel each other with a certain force. When a dielectric slab of thickness 0.08m is introduced in between the charges, the force of interaction is half of its previous value. Find the dielectric constant.

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13. Three charges q each are at vertices of equilateral triangle of side r? How much charge should be placed at the centroid so that the system remains in equilibrium?

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14. Four identical charges each ‘q’ are placed at four corners of a square of side 'a'. Find the charge to be placed at the centre of the square so than the system of charges is in equilibrium.

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15. Two identical pith balls each of mass 'm' holding charge 'q' each are suspended by silk threads of equal length from same point. They move apart due to repulsion. If the separation between the two balls is 2x and each string makes small angle θ to the vertical.

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16. In a liquid medium of dielectric constant K and of specific gravity 2, two identically charged spheres are suspended from a fixed point by threads of equal

lengths. The angle between them is 90°. In another medium of unknown dielectric constant K^1, and specific gravity 4, the angle between them becomes 120°. If density of material of spheres is 8 gm/cc then find K^1

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17. A charge is placed at the centre of the line joining two charges q and q. For the system of three charges to be in equilibrium, what should be the value of Q?

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18. Two equal negative charges -q are fixed at points (o,a) and (o,-a). A positive charge is released from rest at the point $(2a, 0)$ on the x-axis. What type of oscillations does the charge Q execute ?

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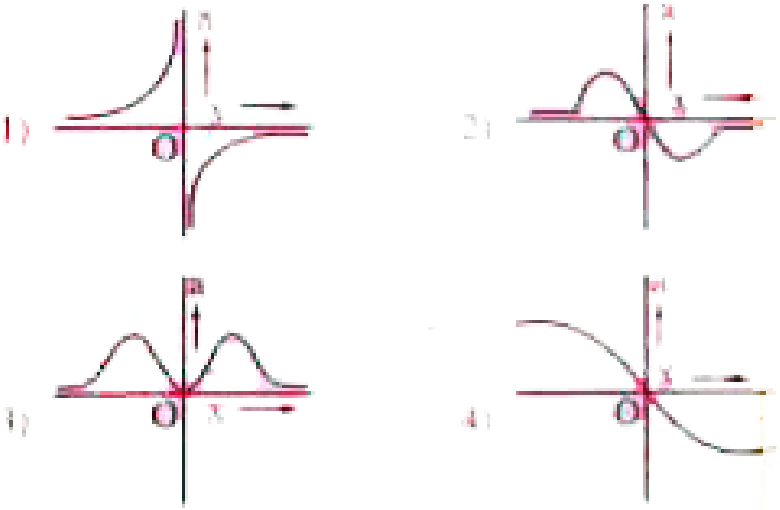
19. Two identical positive charges are fixed on the y-axis, at equal distances from the origin O. A particle with a negative charge starts on the negative x-axis at a large distance from O, moves along the x-axis, passed through O and moves far away from O. Ita acceleration a is taken as positive along its direction of motion. The particle's acceleration ais plotter

against its x-co-ordinate. Which of the following best represents the plot ?



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20. Two point charges 4 μC and 9 μC are separated by 30 cm. Find the point where the strength of the field is zero.

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21. Calculate the electric field intensity which would be just sufficient to balance the weight of an electron. If this electric field is produced by a second electron located below the first one what would be the distance between them? [Given: $1.6 \times 10^{-19} C, m = 9.1 \times 10^{-31}$ kg and $g = 9.8 m / s^2$].

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22. A point charge $50\mu C$ is located at a point $2\hat{i} + 3\hat{j}$. Find the electric field vector $\overrightarrow{E}$ at a point with position vector $8\hat{i} - 5\hat{j}$, when the position vectors are expressed in metre.

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23. Find the force experienced by a chloride ion having 4 electrons remover, when laced in an electric field of intensity $2NC^{-1}$

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

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25. A point charge 'q' is placed at orgin. $\overline{E_A}$, $\overline{E_B}$ and $\overline{E_C}$ be the electric field at three points A(1,2,3), B(1, 1, -1) and C(2,2,2) due to changed. Then give the possible relations between the above field strengths.

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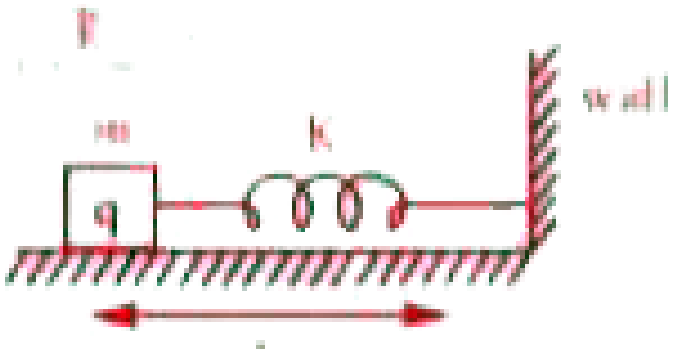
26. A point mass in and charge q is connected with a spring of negligible mass with natural length L. Initially spring is in its natural length. Now a horizontal uniform electric field E is switched on as shown. Find

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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27. 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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28. A particle of charge q and mass m moves rectilinearly under the action of an electric field $E = \alpha - \beta x$. Here, α and β are positive constants and x is the distance from the point where the particle was initially at rest. Then :

1) the motion of the particle is oscillatory withamplitude $\frac{\alpha}{\beta}$

2) the mean position of the particles is at $x = \frac{\alpha}{\beta}$.

3) the maximum acceleration of the particle is $\frac{q\alpha}{m}$

4) All 1, 2 and 3

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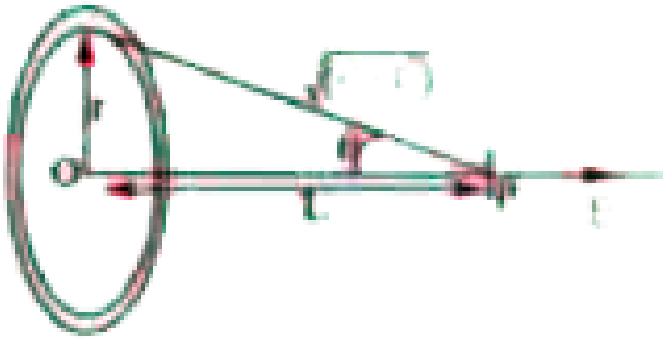
29. A thin wire ring of radius "r" carries a charge q. Find the magnitude of the electric field strength on the axis of the ring as a function of distance L from the centre. Find the same for $L >> r$. Find maximum field strength and the corresponding distance L.



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30. The surface charge density of a thin charged disc of radius R is σ. The value of the electric field at the centre of the disc $\frac{\sigma}{2\varepsilon_0}$. With respect to the field at the centre, the electric field along the axis at a distance R from the centre of the disc is

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31. A particle that carries a charge '-q' is placed at rest in uniform electric field 10 N/C. It experiences a force and moves. In a certain time 't', it is observed to acquire a velocity $10\hat{i} - 10\hat{j}$ m/s. The given electric

field intersects a surface of area $1m^2$ in the x-z plane. Find the Electric flux through the surface.

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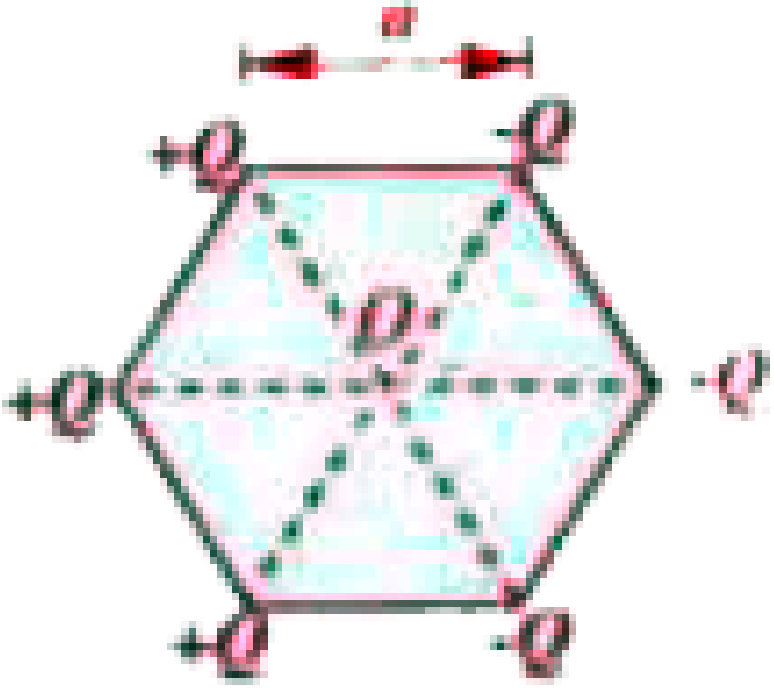
32. Six charges are placed at the vertices of a regular hexagon as shown in the figure. The electric field on the line passing through point O and perpendicular to the plane of the figure at a distance of x ($>>$

a) from O is

1) $\frac{Qa}{\pi\varepsilon_0 x^3}$ 2) $\frac{2Qa}{\pi\varepsilon_0 x^3}$

3) $\frac{\sqrt{3}Qa}{\pi\varepsilon_0 x^2}$ 4) zero.



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33. The electric field in a region is given by $\vec{E} = E_0 \frac{x}{L} \hat{i}$. Find the charge contained inside a

cubical volume bounded by the surface x = 0, x = L, y = 0 , y = L, z = 0 and z = L.

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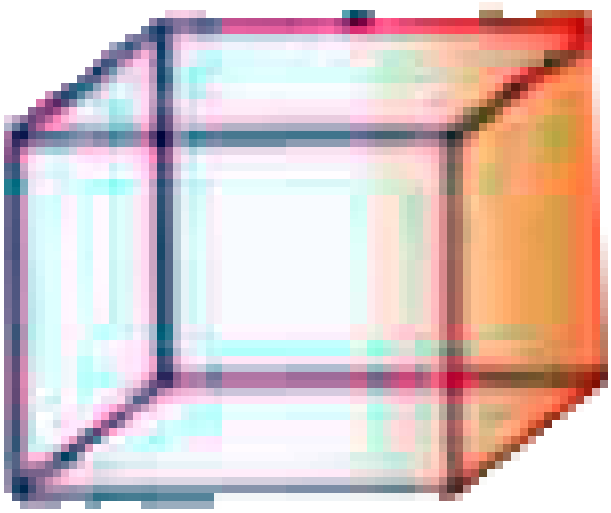
34. A point charge q is placed at the centre of the edge of a cubical box. Find the total flux associated with that box.



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

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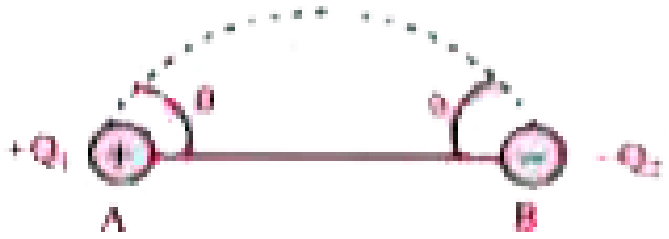
36. Two point charges $+Q_1$ and $-Q_2$, are placed at A and B respectively. A line of force emanates from Q_1 at an angle θ with the line joining A and B. At

what angle will it terminate at B ?



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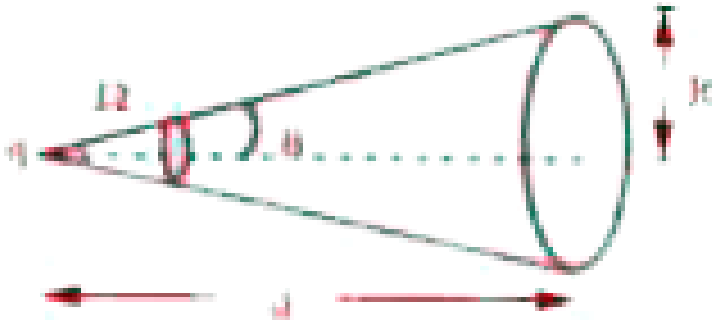
37. A point charge q is placed at a distance d from the centre of a circular disc of radius R. Find electric flux flowing through the disc due to that charge.



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38. A thin spherical shell radius of r has a charge 2 uniformly distributed on it. At the centre of the shell, a negative point charge -q is placed. If the shell is cut into two identical hemi spheres, still equilibrium is maintained. Then find the relation between Q and q?

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39. If r and T are radius and surface tension of a spherical soap bubble respectively then find the charge needed to double the radius of bubble

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