doubtnut
India's Number 1 Education App

PHYSICS

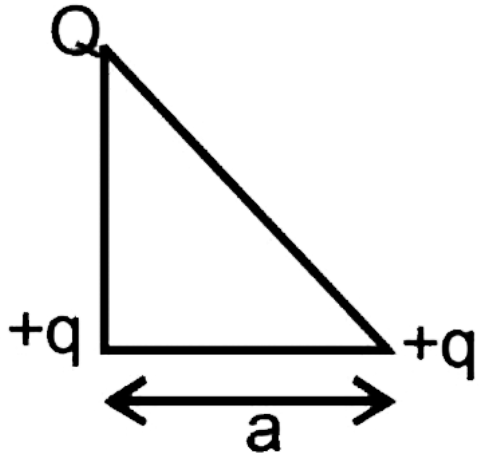
BOOKS - DISHA PHYSICS (HINGLISH)

ELECTROSTATICS

Physics

1. Three charges Q, $+q$ and $+q$ are placed at the vertices of a right-angled isosceles triangle as shown. The net electrostatic energy of the

configuration is zero if Q is equal to



A. $\frac{-q}{1+\sqrt{2}}$

B. $\frac{-2q}{2+\sqrt{2}}$

C. $-2q$

D. $+q$

Answer:

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2. If 3 charges are placed at the vertices of equilateral triangle of charge 'q' each. What is the net potential energy, if the side of equilateral Δ is lcm ?

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

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

C. $\frac{1}{4\pi \in_0}\frac{3q^2}{l}$

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

Answer:

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3. If identical charges $(-q)$ are placed at each corner of a cube of side b, then electric potential energy of charge $(+q)$ which is palced at centre of the cube will be

A. $\frac{8\sqrt{2}q^2}{4\pi \in_0 b}$

B. $\frac{-8\sqrt{2}q^2}{4\pi \in_0 b}$

C. $\frac{-4\sqrt{2}q^2}{\pi \in_0 b}$

D. $\frac{-4\sqrt{2}q^2}{\pi \in_0 b}$

Answer:

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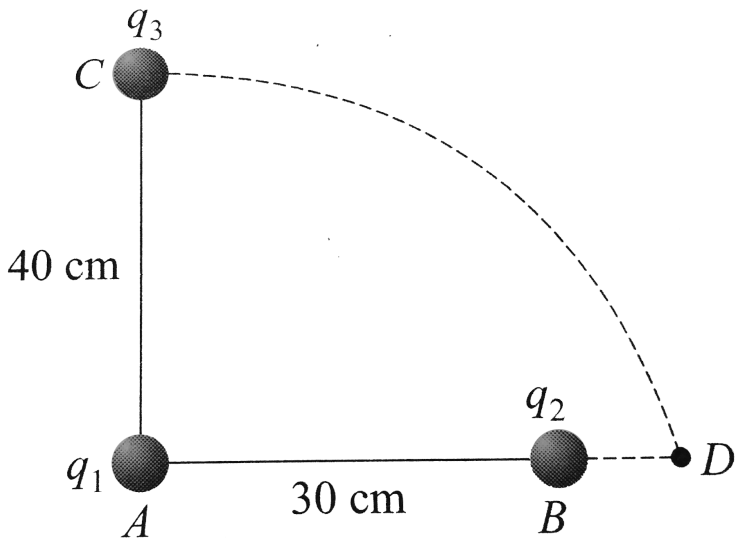
4. Two charges q_1 and q_2 are placed $30cm$ apart, as shown in the figure. A third charge q_3 is moved along the arc of a circle of radius $40cm$ from C to D. The change in the potential energy o fthe system is $\frac{q_3}{4\pi\varepsilon_0}k.$,

where k is



A. $8q_2$

B. $8q_1$

C. $6q_2$

D. $6q_1$

Answer:

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5. Three particles, each having a charge of $10\mu C$ are placed at the coners of an equilateral triangle of side $10cm$. The electrostatic potential energy of the system is (Given $\frac{1}{4\pi\varepsilon_0} = 9 \times 10^9 N - m^2 / C^2$)

A. Zero

B. Infinite

C. 27 J

D. 100 J

Answer:

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6. Two equal charges q are placed at a distance of $2a$ and a third charge $-2a$ is placed at the midpoint. The potential energy of the system is

A. $\frac{q^2}{8\pi \in_0 a}$

B. $\frac{6q^2}{8\pi \in_0 a}$

C. $-\frac{7q^2}{8\pi \in_0 a}$

D. $-\frac{9q^2}{8\pi \in_0 a}$

Answer:

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7. An electric dipole has the magnitude of its charge as q and its dipole moment is p. It is placed in a uniform electric field E. If its dipole

moment is along the direction of the field, the force on it and its potential energy are respectively

A. 2. qEand minimum

B. .qe and .pE

C. Zero and minimum

D. .qEand maximum

Answer:

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8. When one electron is taken towards the other electron, then the electric potential energy of the system

A. decreases

B. increases

C. remains unchanged

D. becomes zero

Answer:

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9. Two identical charges are placed at the two corners of an equilateral triangle. The potential energy of the system is U. The work done in bringing an identical charge from infinity to the third vertex is

A. U

B. 2U

C. 3U

D. zero

Answer:

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10. Potential energy of two equal negative point charges 2mC held 1 m apart in air is

A. 2 J

B. 2eV

C. 4 J

D. 0.036 J

Answer:

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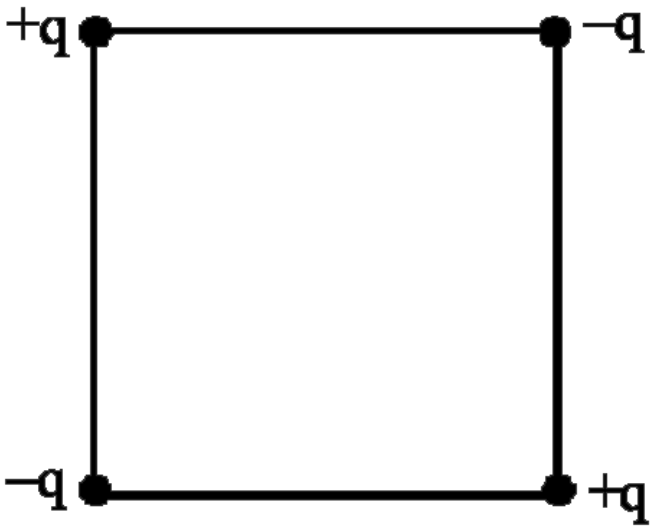
11. Four charges + q, –q, + q and –q are put together on four corners of a square as shown in figure. The work done by external agent in slowly assembling this configuration is



A. zero

B. $-2.59kq^2/a$

C. $-2.59kq^2/a$

D. none of these

Answer:

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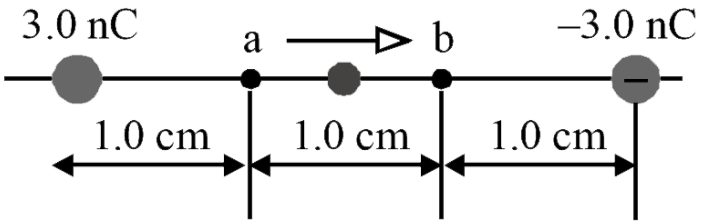
12. As shown in figure a dust particle with mass m = 5.0 × 10–9 kg and charge q0 = 2.0 nC starts from rest at point a and moves in a straight line to point b . What is its speed v at

point b?



A. $26ms^{-1}$

B. $34ms^{-1}$

C. $46ms^{-1}$

D. $14ms^{-1}$

Answer:

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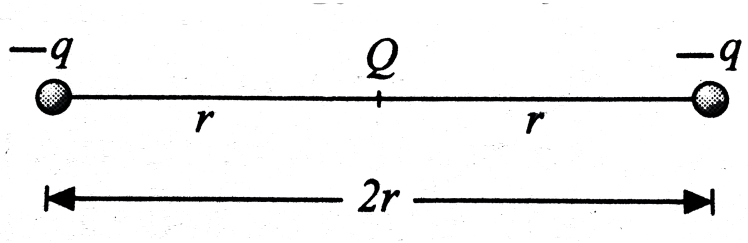
13. Charges $-q, Q,$ and $-q$ are placed at an equal distance on a straight liner. If the total potential energy of the system of three charges is zero, then find the ratio Q/q.



A. 1/2

B. 1/4

C. 2/3

D. 3/4

Answer:

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14. When the separation between two charges is increased, the electric potential energy of the charges

A. increases

B. decreases

C. remains the same

D. may increase or decrease

Answer: D

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15. If a positive charge is shifted from a low - potential region to a high- potential region, the electric potential energy

A. increases

B. decreases

C. will remain the same

D. nothing definite can be predicted

Answer:

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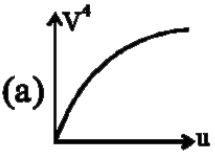
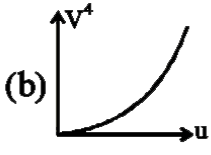
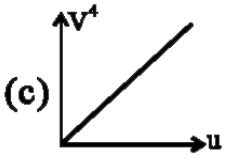
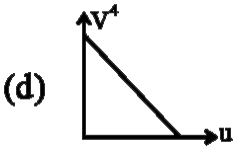
16. If V and u are electric potential and energy density, respectively, at a distance r from a positive point charge, then which of the following graph is correct ?

A. 

B. 

C. 

D. 

Answer:

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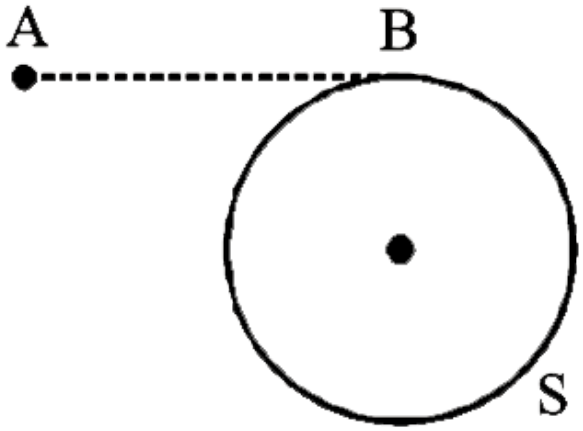
17. 7S is a solid neutral conducting sphere. A point charge q of 1 × 10–6 C is placed at point A. C is the centre of sphere and AB is a tangent. BC = 3m and AB = 4m.

(1) The electric potential of the conductor is 1.8 kV

(2) The electric potential of the conductor is 2.25 kV

(3) The electric potential at B due to induced charges on the sphere is – 0.45 kV

(4) The electric potential at B due to induced charges on the sphere is 0.45 kV



A. 1, 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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18. A proton moves a distance d in a uniform electric field E ®as shown in the figure. Then which of the following statements are correct

?

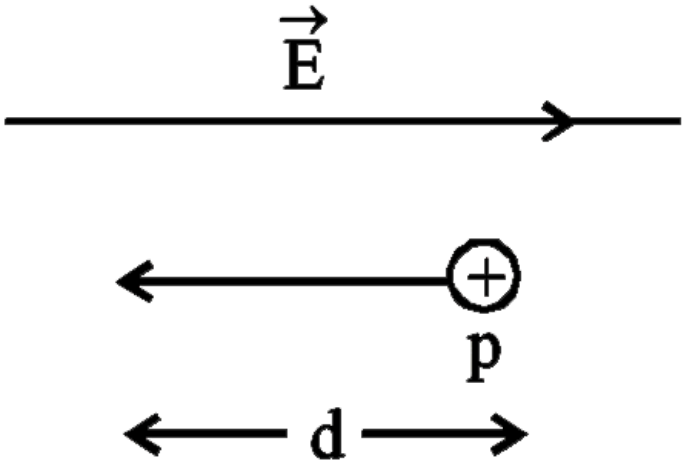
(1) Electric field do a negative work on the proton

(2) Electric potential energy of the proton increases

(3) Electric field do a positive work on the proton

(4) Electric potential energy of the proton

decreases



A. 1, 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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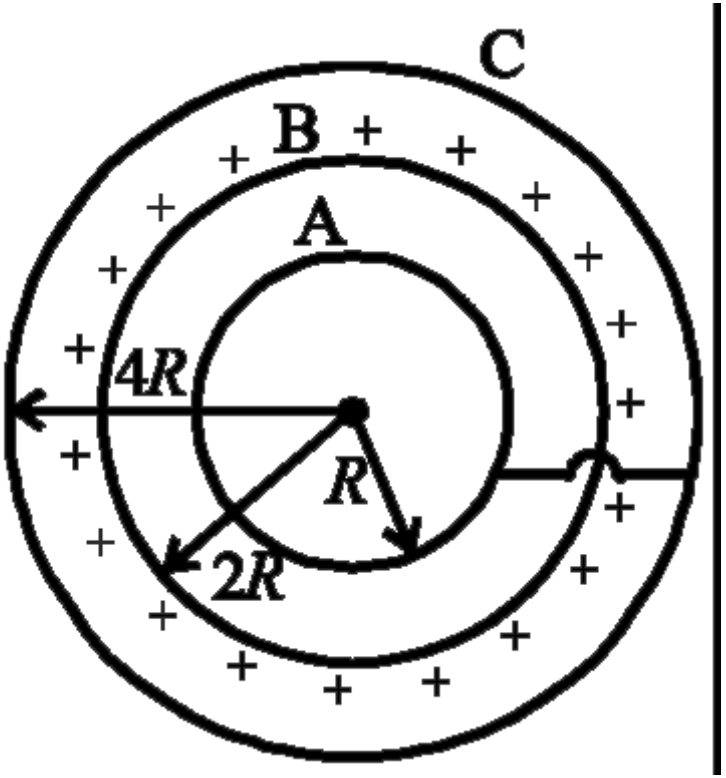
19. Three concentric spherical conductors A, B and C of radii R, 2R and 4R respectively. A and C is shorted and B is uniformly charged

Charge on conductor A is



A. Q/3

B. – Q/3

C. 2 Q /3

D. None of these

Answer:

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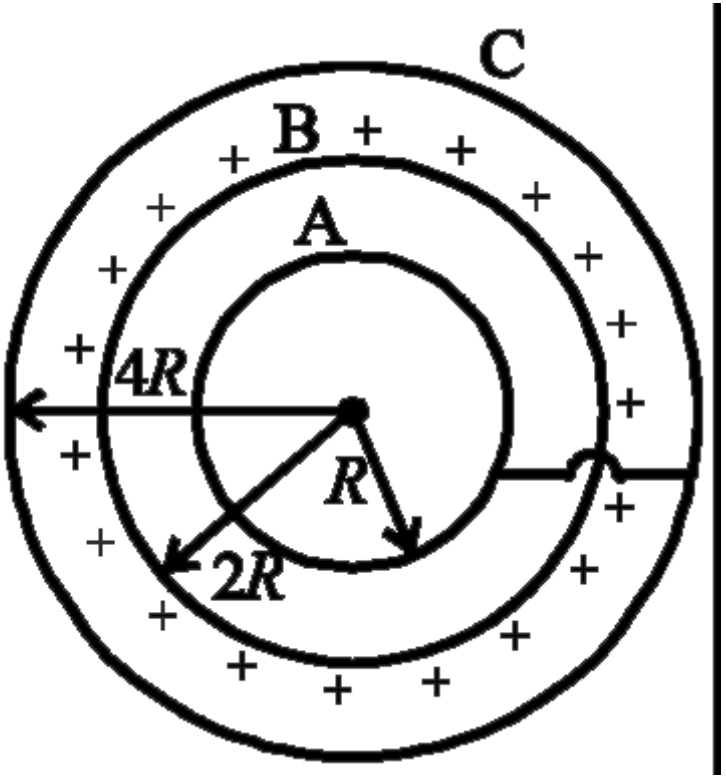
20. Three concentric spherical conductors A, B and C of radii R, 2R and 4R respectively. A and C is shorted and B is uniformly charged

Potential at A is



A. $\frac{Q}{4\pi \in_0 R}$

B. $\frac{Q}{16\pi \in_0 R}$

C. $\frac{Q}{20\pi \in_0 R}$

D. none of these

Answer:

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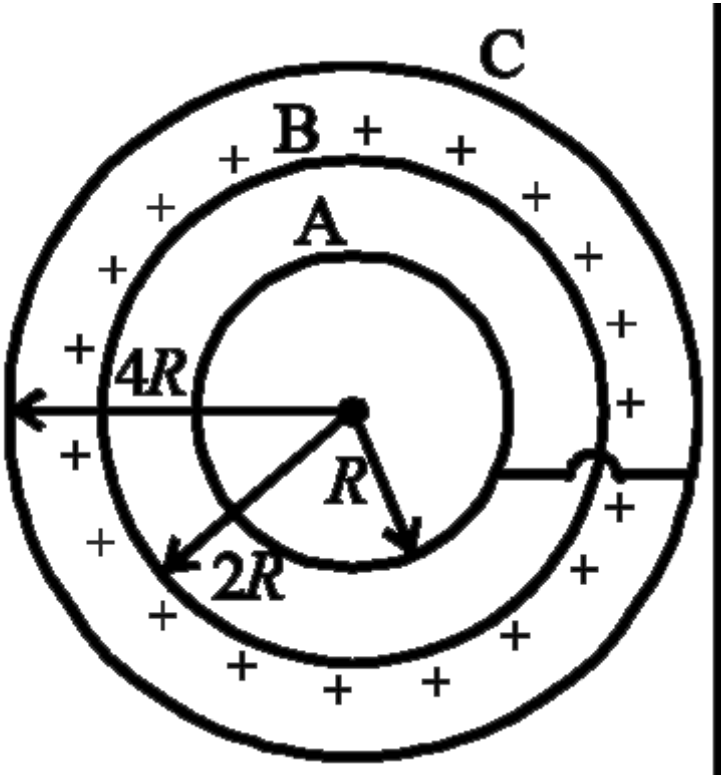
21. Three concentric spherical conductors A, B and C of radii R, 2R and 4R respectively. A and C is shorted and B is uniformly charged .

Potential at B is



A. $\frac{Q}{4\pi \in_0 R}$

B. $\frac{Q}{16\pi \in_0 R}$

C. $\frac{5Q}{48\pi \in_0 R}$

D. none of these

Answer:

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22. Statement-1 : No work is done in taking a small positive charge from one point to other inside a positively charged metallic sphere while outside the sphere work is done in taking the charge towards the sphere. Neglect induction due to small charge.

Statement-2 : Inside the sphere electric potential is same at each point, but outside it is different for different points.

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

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

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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23. Statement-1 : Electric potential of earth is taken to be zero as a reference.

Statement-2 : The electric field produced by earth in surrounding space is zero.

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

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

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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24. 4Statement - 1 : The electric potential and the electric field intensity at the centre of a square having four fixed point charges at their vertices as shown in figure are zero.

Statement - 2 : If electric potential at a point is

zero then the magnitude of electric field at that point must be zero.

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

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

C.

D. Statement -1 is True, Statement-2 is False.

Answer:

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25. A parallel plate capacitor is charged to a potential difference of 50V. It is discharged through a resistance. After 1 second, the potential difference between plates becomes 40V. Then

A. Fraction of stored energy after 1 second is 16/25

B. Potential difference between the plates after 2 seconds will be 30V

C. Potential difference between the plates after 2 seconds will be 20V

D. Fraction of stored energy after 1 second is 4/5

Answer: A

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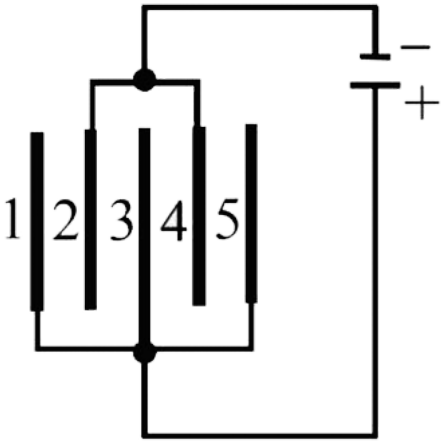
26. Five identical capacitor paltes, each of area A, are arranged such that adjacent plates are at a distance d apart, the plates are connected

to a source of emf V as shown in the figure



The charge on plate 1 is .....and on plate 4 is.....

A. $\frac{\varepsilon_0 AV}{2d}, \frac{2\varepsilon_0 AV}{2d}$

B. $\frac{\varepsilon_0 AV}{2d}, \frac{2\varepsilon_0 AV}{2d}$

C. $\frac{\varepsilon_0 AV}{2d}, \frac{-2\varepsilon_0 AV}{2d}$

D. $\frac{-\varepsilon_0 AV}{2d}, \frac{-2\varepsilon_0 AV}{2d}$

Answer:

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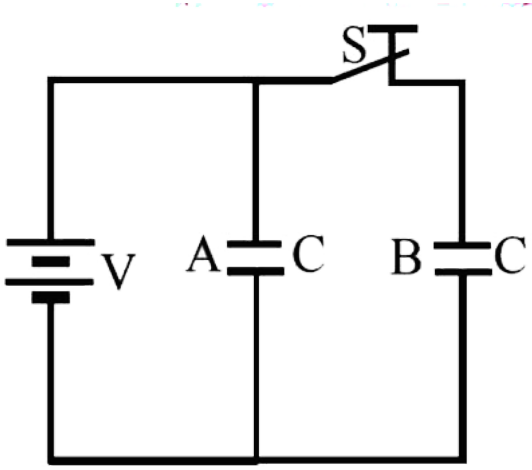
27. The figure shows two identical parallel plate capacitors connected to a battery with the switch S closed. The switch is now opened and the free space between the plates of the capacitors is filled with a dielectric of dielectric constant(or relative permittivity) 3. Find the ratio of the total electrostatic energy stored in both capacitors before and after the

introduction of the dielectric.



A. 3 : 1

B. 5 : 1

C. 3 : 5

D. 5 : 3

Answer:

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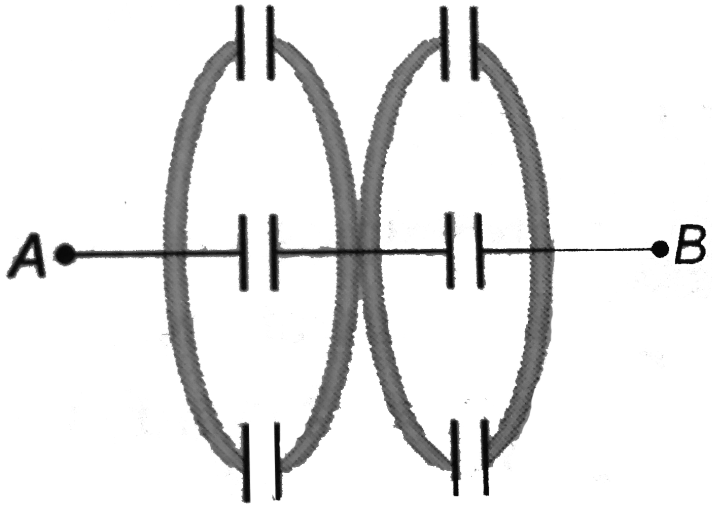
28. All six capacitors shown are identical. Each can withstand maximum 200 volts between its terminals. The maximum voltage that can be safely applied between A and B is



A. 1200 V

B. 400 V

C. 800 V

D. 200 V

Answer:

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29. A capacity of capacity C_1 is charged up to V volt and then connected to an uncharged

capacitor of capacity C_2. Then final potential difference across each will be

A. $\frac{C_2 V}{C_1 + C_2}$

B. $1 + \left(\frac{C_2}{C_1}\right) V$

C. $\frac{C_1 V}{C_1 + C_2}$

D. $1 - \left(\frac{C_2}{C_1}\right) V$

Answer:

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30. Two capacitors of capacitances $3\mu F$ and $6\mu F$ are charged to a potential of $12V$ each. They are now connected to each other, with the positive plate of each joined to the negative plate of the other. The potential difference across each will be

A. 6 volt

B. 4 volt

C. 3 volt

D. zero

Answer:

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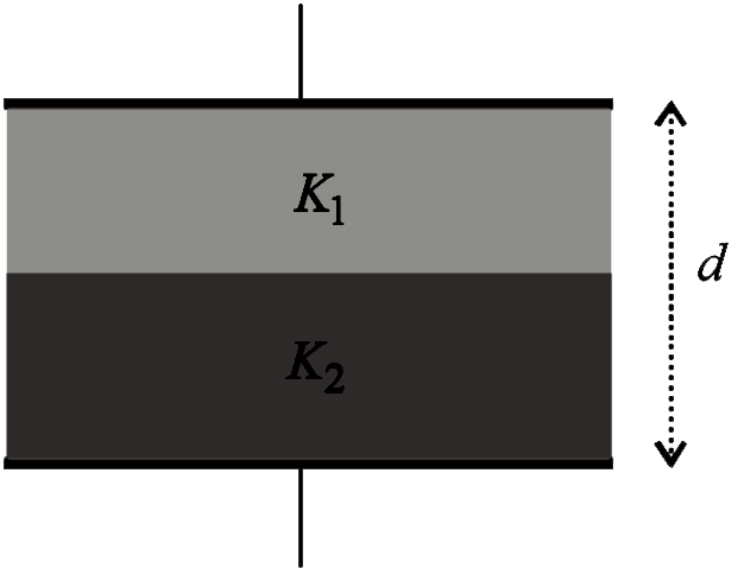
31. In the figure a capacitor is filled with dielectrics K_1,K_2 and K_3. The resultant

capacitance is



A. $\frac{2\varepsilon_0 A}{d}\left[\frac{1}{K_1}+\frac{1}{K_2}+\frac{1}{K_3}\right]$

B. $\frac{\varepsilon_0 A}{d}\left[\frac{1}{K_1}+\frac{1}{K_2}+\frac{1}{K_3}\right]$

C. $\frac{2\varepsilon_0 A}{d}[K_1+K_2+K_3]$

D. None of these

Answer:

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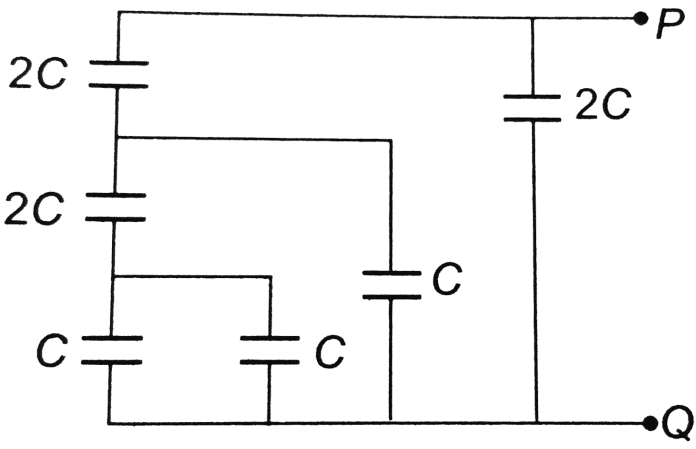
32. The resultant capacitance of given circuit is



A. 3C

B. 2C

C. C

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

Answer:

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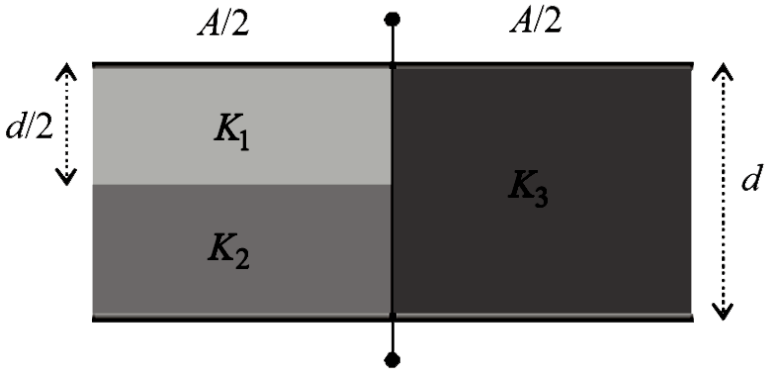
33. Two dielectric slabs of constant K1 and K2 have been filled in between the plates of a capacitor as shown below. What will be the

capacitance of the capacitor



A. $\frac{2\varepsilon_0 A}{d}(K_1 + K_2)$

B. $\frac{2\varepsilon_0 A}{d}\left(\frac{K_1 + K_2}{K_1 \times K_2}\right)$

C. $\frac{4\varepsilon_0 A}{d}\left(\frac{K_1 \times K_2}{K_1 + K_2}\right)$

D. $\frac{2\varepsilon_0 A}{d}\left(\frac{K_1 \times K_2}{K_1 + K_2}\right)$

Answer:

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34. Eight drops of mercury of equal radii possessing equal charges combine to from a big drop. Then the capacitance of bigger drop compared to each individual small drop is

A. 8 times

B. 4 times

C. 2 times

D. 32 times

Answer:

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35. Separation between the plates of a parallel plate capacitor is d and the area of each plates is A. When a slab of material of dielectric constant k and thickness $t(t < d)$ is introduced between the plates. Its capacitance becomes

A. $\frac{\varepsilon_0 A}{d + t\left(1 - \frac{1}{k}\right)}$

B. $\frac{\varepsilon_0 A}{d + t\left(1 + \frac{1}{k}\right)}$

C. $\frac{\varepsilon_0 A}{d - t\left(1 - \frac{1}{k}\right)}$

D. $\frac{\varepsilon_0 A}{d - t\left(1 + \frac{1}{k}\right)}$

Answer:

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36. There is an air filled 1pF parallel plate capacitor. When the plate separation is doubled and the space is filled with wax, the

capacitance increases to 2pF. The dielectric constant of wax is

A. 2

B. 4

C. 6

D. 8

Answer:

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37. Between the plates of a parallel plate condenser, a plate of thickness t_1 and dielectric constant k_1 is placed. In the rest of the space, there is another plate of thickness t_2 and dielectric constant k_2. The potential difference across the condenser will be

A. $\frac{Q}{A\varepsilon_0}\left(\frac{t_1}{K_2}+\frac{t_2}{K_2}\right)$

B. $\frac{\varepsilon_{0_Q}}{A}\left(\frac{t_1}{K_1}+\frac{t_2}{K_2}\right)$

C. $\frac{Q}{(A)\varepsilon_0}\left(\frac{K_1}{t_1}+\frac{K_2}{t_2}\right)$

D. $\frac{\varepsilon_{0_Q}}{A}(K_1t_1+K_2t_2)$

Answer:

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38. A parallel plate capacitor is charged and the charging battery is then disconnected. If the plates of the capacitor are moved farther apart by means of insulating handles:

A. The charge on the capacitor increases

B. The voltage across the plates decreases

C. The capacitance increases

D. The electrostatic energy stored in the capacitor increases

Answer:

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39. A parallel plate capacitor of plate area A and plates separation distance d is charged by applying a potential V_0 between the plates. The dielectric constant of the medium between the plates is K. What is the uniform

electric field E between the plates of the capacitor ?

A. $E = \in_0 \frac{CV_0}{KA}$

B. $E = \frac{V_0}{Kd}$

C. $E = \frac{V_0}{KA}$

D. $E = \frac{KV_0 d}{\in_0 A}$

Answer:

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40. A parallel plate air capacitor is connected to a battery. The quantities charge, voltage, electric field and energy associated with this capacitor are given by Q_0 , V_0, E_0 and U_0 respectively. A dielectric slab is now introduced to fill the space between the plates with battery still in connection. The corresponding quantities now given by Q, V, E and U are related to the previous one as

A. 1, 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

41. The false statement are, on increasing the distance between the plates of a parallel plate condenser,

(1) The electric field intensity between the plates will decrease

(2) The electric field intensity between the plates will increase

(3) The P. D. between the plates will decrease

(4)The electric field intensity between the plates will remain unchanged

A. 1, 2 and 3 are incorrect

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer: A

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42. The capacitance of a parallel plate condenser depends on

(1) Area of the plates

(2) Medium between the plates

(3) Distance between the plates

(4) Metal of the plates

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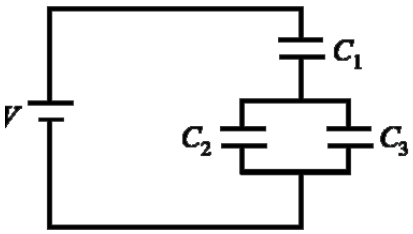
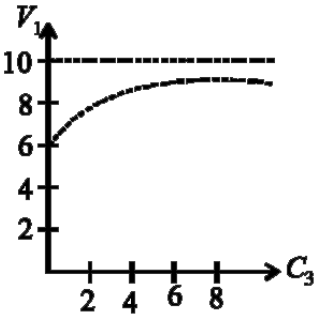
43. Capacitor C_3 in the circuit is variable capacitor (its capacitance can be varied). Graph is plotted between potential difference V_1 (across capacitor C_1) versus C_3.

Electric potential V_1 approaches on asymptote of 10 volts as $C_3 \to \infty$

The ratio of the capacitance $\frac{C_1}{C_2}$ will be





A. 2 / 3

B. 4 / 3

C. 3 / 4

D. 3 / 2

Answer:

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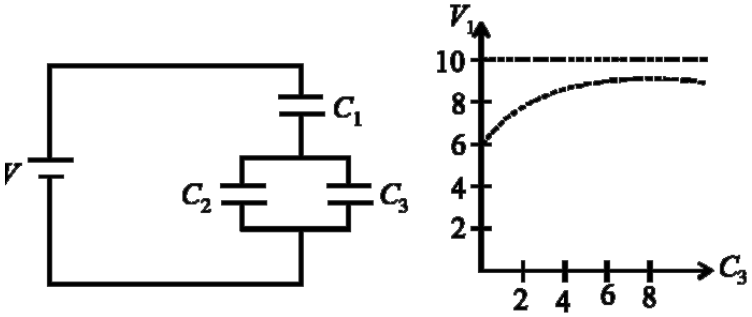
44. Capacitor C_3 in the circuit is variable capacitor (its capacitance can be varied). Graph is plotted between potential difference V_1 (across capacitor C_1) versus C_3.

Electric potential V_1 approaches on asymptote of 10 volts as $C_3 \to \infty$

0The value of C3 for which potential difference across C_1 will become 8V, is



A. $1.5C_1$

B. $2.5C_1$

C. $3.5C_1$

D. $4.5C_1$

Answer:

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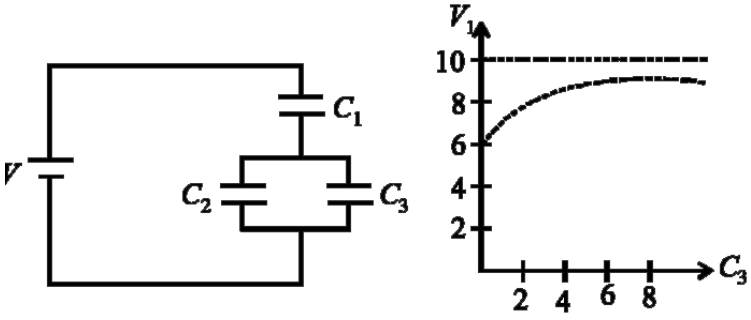
45. Capacitor C_3 in the circuit is variable capacitor (its capacitance can be varied). Graph is plotted between potential difference V_1 (across capacitor C_1) versus C_3.

Electric potential V_1 approaches on asymptote of 10 volts as $C_3 \to \infty$

The ratio of energy stored in capacitorC_1 to

that of total energy when $C_3 \to \infty$ is



A. zero

B. 1/3

C. 1

D. Data insufficient

Answer:

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46. Assertion: The force with which one plate of a parallel plate capacitor is attracted towards the other plate is equal to square of surface density per ε per unit area.

Reason: The electric field due to one charged plate of the capacitor at the location of the other is equal to surface density per ε.

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

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

C. Statement-1 is False, Statement-2 is True.

D. Statement-1 is True, Statement-2 is False.

Answer:

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47. Assertion: Circuit containing capacitors should be handled cautiously even when there is no current.

Reason: The capacitors are very delicate and so quickly break down.

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

B. Statement-1 is True, Statement-2 is True, Statement-2 is NOT a correct explanation

for Statement-1.

C. Statement-1 is False, Statement-2 is True.

D. Statement-1 is True, Statement-2 is False.

Answer:

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48. Assertion: If the distance between parallel plates of a capacitor is halved and dielectric constant is made three times, then the capacitor becomes 6 times.

Reason: Capacity of the capacitor does not depend upon the nature of the meterial.

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

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

C. Statement-1 is False, Statement-2 is True.

D. Statement-1 is True, Statement-2 is False.

Answer:

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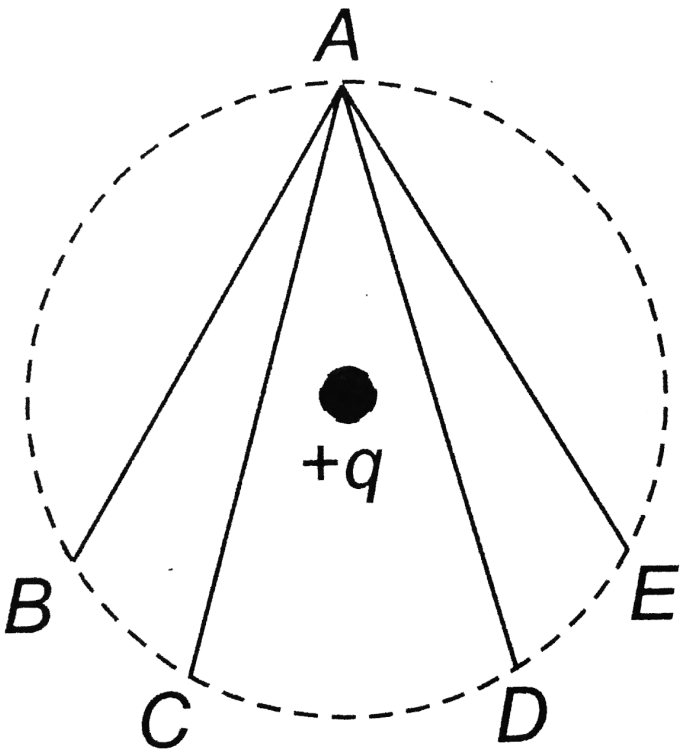
49. In the electric field of a point chargde q, a cetrain charge is carried from point A to

B, C, D and E. Then the ork done



A. least along the path AB

B. least along the path AD

C. zero along all the paths AB,AC,AD and AE

D. least along AE

Answer:

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50. Four equal charges Q are placed at the four corners of a square of each side is 'a'. Work done in removing a charge $-Q$ from its centre to infinity is

A. 0

B. $\frac{\sqrt{2}Q^2}{4\pi \in_0 a}$

C. $\frac{\sqrt{2}Q^2}{\pi \in_0 a}$

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

Answer:

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51. A particle A has chrage $+q$ and a particle B has charge $+4q$ with each of them having the same mass m. When allowed to fall from rest through the same electric potential

difference, the ratio of their speed $\frac{v_A}{v_B}$ will become

A. $2:1$

B. $1:2$

C. $1:4$

D. $4:1$

Answer:

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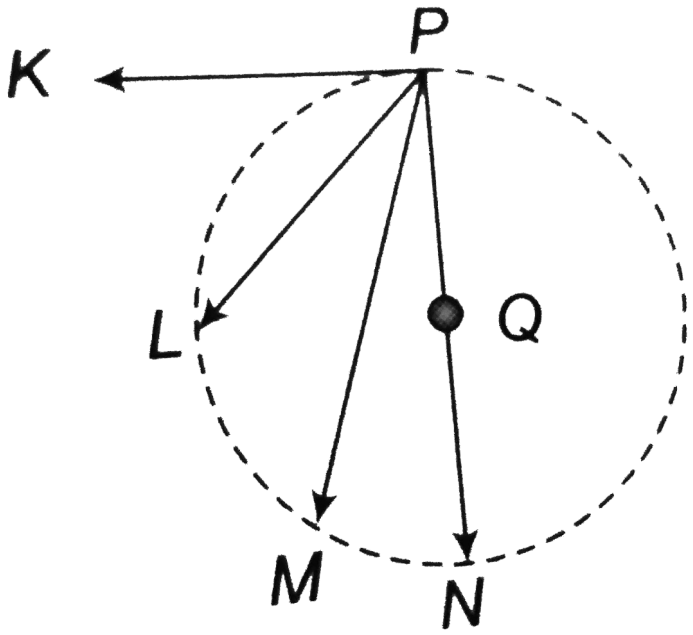
52. In the firgure the charge Q is at the centre of the circle. Work done is maximum when another charge is taken from point P to



A. K

B. L

C. M

D. N

Answer:

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53. How much kinetic energy will be gained by an $\alpha -$ particle in going from a point at $70V$ to another point at $50V$

A. 40 eV

B. 40 KeV

C. 40 MeV

D. 0 eV

Answer:

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54. Ten electrons are qually spaced and fixed around a circle of radius R. Relative to $V = 0$ at infinity, the electrostatic potential V and the electric field E at the centre C are

A. $V \neq 0$ and $\vec{E} \neq 0$

B. $V \neq 0$ and $\vec{E} = 0$

C. $V = 0$ and $\vec{E} = 0$

D. $V = 0$ and $\vec{E} \neq 0$

Answer:

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55. The displacement of a charge Q in the electric field $\vec{E} = e_1\hat{i} + e_2\hat{j} + e_3\hat{k}$ is $\vec{r} = a\hat{i} + b\hat{j}$. 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. $Q\left(\sqrt{e_1^2 + e_2^2}\right)(a + b)$

Answer:

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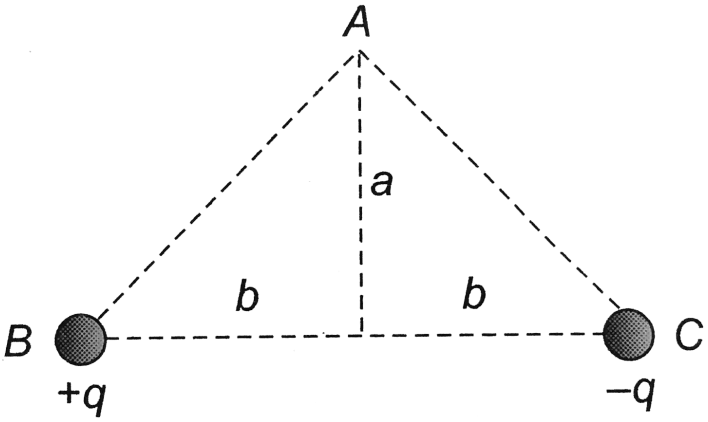
56. As shown in the figure, charges $+q$ and $-q$ are placed at the vertices B and C of an isoscles triangle. The potential at the

vertex A is



A. $\frac{1}{4\pi\varepsilon_0} \cdot \frac{2q}{\sqrt{a^2+b^2}}$

B. Zero

C. $\frac{1}{4\pi\varepsilon_0} \cdot \frac{q}{\sqrt{a^2+b^2}}$

D. $\frac{1}{4\pi\varepsilon_0} \cdot \frac{(-q)}{\sqrt{a^2+b^2}}$

Answer:

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57. Two electric charges $12\mu C$ and $-6\mu C$ are placed $20cm$ apart in air. There will be a point P on the line joining these charges and outside the region between them, at which the electric potential is zero. The distance of P from $6\mu C$ chrage is

A. 0.10 m

B. 0.15 m

C. 0.20 m

D. 0.25 m

Answer:

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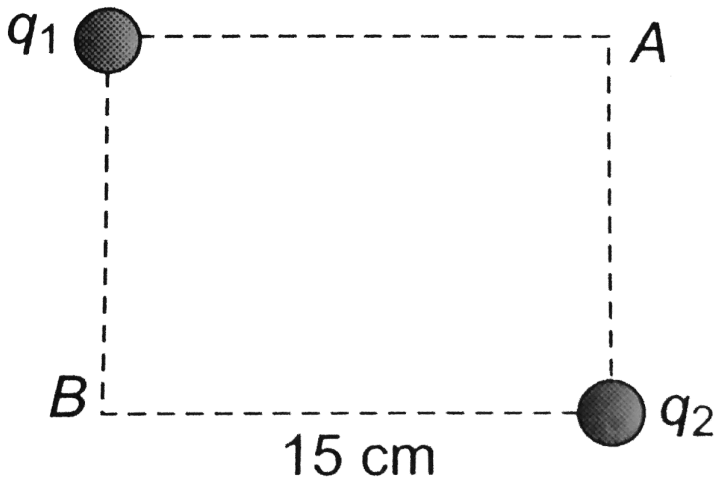
58. In the rectangle, shown below, the two corners have charges $q_1 = -5\mu C$ and $q_2 = +2.0\mu C$. The work done in moving a charge $+3.0\mu C$ from $B \to A$ is (take

$1/44\pi\varepsilon_0 = 10^{10} N - m^2/C^2)$



A. 2.8 J

B. 3.5 J

C. 4.5 J

D. 5.5 J

Answer:

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

A. ql

B. $2ql$

C. $\sqrt{3}ql$

D. $4ql$

Answer:

Watch Video Solution

60. A charge $(-q)$ and another charge (Q) are kept at two points A and B respectively. Keeping the charge $(+Q)$ fixed at B, the charge $(-q)$ at A is moved to another point C such that ABC forms an equilateral triangle of side l. The net work done in moving teh charge $(-q)$ is

A. $\frac{1}{4\pi \in_0} \frac{Qq}{l}$

B. $\frac{1}{4\pi \in_0} \frac{Qq}{l^2}$

C. $\frac{1}{4\pi \in_0} Qql$

D. zero

Answer:

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61. In an hydrogen atom, the electron revolves around the nucles in an orbit of radius $0.53 \times 10^{-10} m$. Then the electrical potential

produced by the nucleus at the position of the electron is

A. $-13.6V$

B. $-27.2V$

C. $27.2V$

D. $13.6V$

Answer:

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62. Point charge $q_1 = 2\mu C$ and $q_2 = -1\mu C$ are kept at points $x = 0$ and $x = 6$ respectively. Electrical potential will be zero at points

A. $x = 2$ and $x = 9$

B. $x = 1$ and $x = 5$

C. $x = 4$ and $x = 12$

D. $x = -12$ and $x = 2$

Answer:

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63. The distance between H^+ and CI^- ions in HCI molecule is 1.28Å. What will be the potential due to this dipole at a distance of 12Å on the axis of dipole ?

A. 0.13 V

B. 1.3 V

C. 13 V

D. 130 V

Answer:

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64. Two identical thin ring, each of radius R meters, are coaxially placed a distance R metres apart. If Q_1 coulomb, and Q_2 coulomb, are repectively the charges uniformly spread on the two rings, the work done in moving a charge q from the centre of one ring to that of the other is

A. Zero

B. $\frac{q(Q_2 - Q_1)\left(\sqrt{2} - 1\right)}{\sqrt{2}.4\pi \in_0 R}$

C. $\frac{q\sqrt{2}(Q_1 + Q_2)}{4\pi \in_0 R}$

D. $\frac{q(Q_1 + Q_2)\left(\sqrt{2} + 1\right)}{4\pi \in_0 R}$

Answer:

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65. A charge $+q$ is fixed at each of the points

$x = x_0, \quad x = 3x_0, \quad x = 5x_0, \ldots\ldots\ldots\ldots x = \infty$ on

the x axis, and a charge $-q$ is fixed at each of the points $x = 2x_0$, $x = 4x_0$, $x = 6x_0$, ... $x = \infty$. Here x_0 is a positive constant. Take the electric potential at a point due to a charge Q at a distance r from it to be $Q/(4\pi\varepsilon_0 r)$.Then, the potential at the origin due to the above system of

A. 0

B. $\frac{q}{8\pi \in_0 x_0 \ln 2}$

C. ∞

D. $\frac{q \ln 2}{4\pi \in_0 x_0}$

Answer:

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66. A uniform electric field pointing in positive x-direction exists in a region. Let A be the origin, B be the point on the x-axis at $x = +1cm$ and C be the point on the y-axis at $y = +1$cm. then the potetial at the points A,B and C satisfy

a. $V_A < V_B$, b. $V_A > V_B$ c. $V_A < V_C$ d. $V_A > V_C$

A. $V_A < V_B$

B. $V_A > V_B$

C. $V_A < V_C$

D. $V_A > V_C$

Answer:

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67. A point Q lies on the perpendicular bisector of an electrical dipole of dipole moment p, If the distance of Q from the dipole

is r (much larger than the size of the dipole), then electric field at Q is proportional to

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

B. P and r^{-2}

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

D. p and r^{-3}

Answer:

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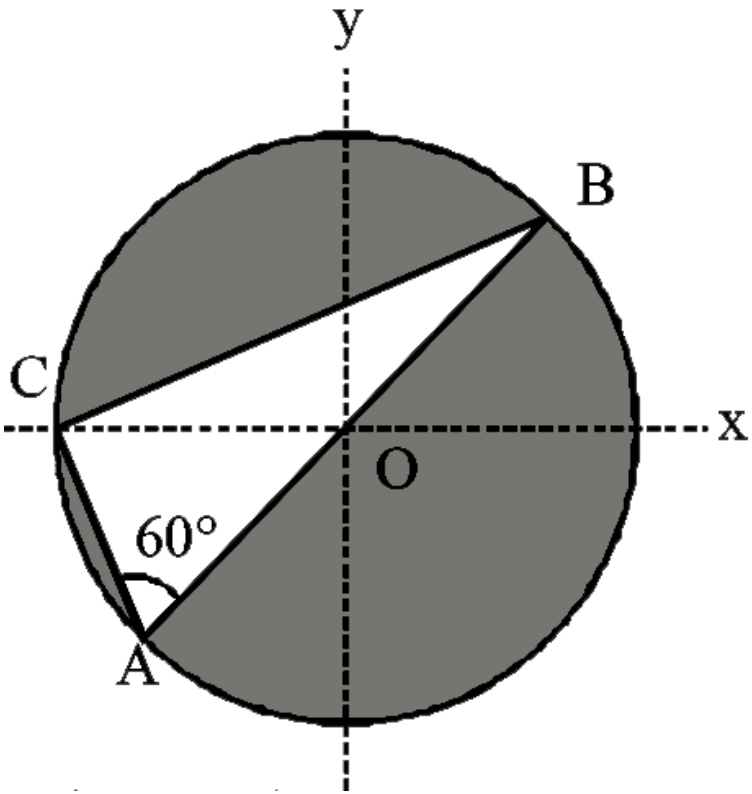
68. Consider a system of three charges $\frac{q}{3}, \frac{q}{3}$ and $-\frac{2q}{3}$ placed ar point A,B and C respectively, as shown in the figure. Take O to be the centre of the circle of radius R and angle $CAB = 60^\circ$. Choose the incorrect options



(1) The electric field at point O is $\frac{q}{8\pi\varepsilon_0 R^2}$ directed along the negative x-axis

(2) The potential energy of the system is zero

(3) The potential at point O is $\frac{q}{12\pi\varepsilon_0 R}$

(4) The magnitude of the force between the charges at C and B is $\frac{q^2}{54\pi\varepsilon_0 R^2}$

A. 1,2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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69. For spherical symmetrical charge distribution, variation of electric potential with distance from centre is given in diagram

Given that : $V = \frac{q}{4\pi\varepsilon_0 R_0}$ for $r \leq R_0$ and $V = \frac{q}{4\pi\varepsilon_0 r}$ for $r \geq R_0$

Then which option (s) are correct :

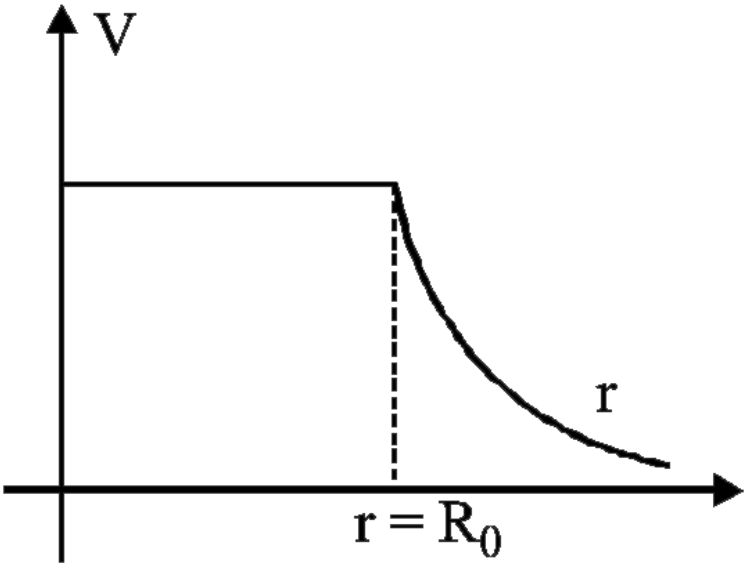
(1) Total charge within $2R_0$ is q

(2) Total electrosstatic energy for $r \leq R_0$ is non-zero

(3) At $r = R_0$ electric field is discontinuous

(4) There will be no charge anywhere except at

$r < R_0$



A. 1,2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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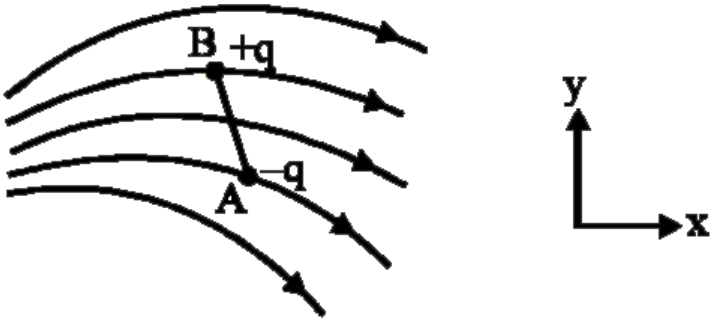
70. An electric dipole (AB) consisting of two particles of equal and opposite charge and same mass is released in an electric field. In the figure field lines are without considering effect of field of dipole.



The centre of mass of the dipole

A. Has no acceleration

B. Has acceleration with positive x and y components

C. Has acceleration with positive x component and negative y component

D. Has acceleration with negative x component and positive y component

Answer:

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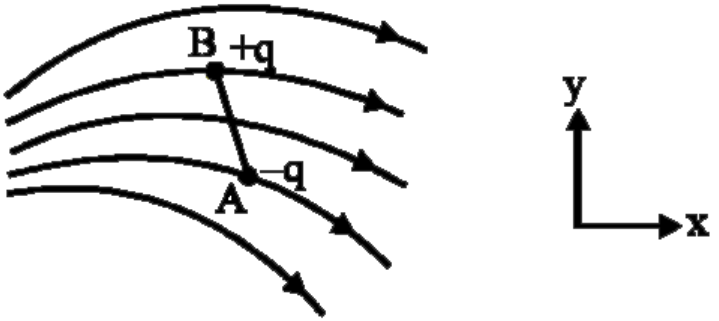
71. An electric dipole (AB) consisting of two particles of equal and opposite charge and same mass is released in an electric field. In the figure field lines are without considering effect of field of dipole.



Angular acceleration of the dipole, immediately after it is released

A. is zero

B. is clockwise

C. is anticlockwise

D. cannot be determined from the given information

Answer:

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72. Statement -1 : A bird perches on a high power line and nothing happens to the bird. Statement -2 : The level of bird is very high from the ground.

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

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

C. Statement-1 is False, Statement-2 is True

D. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-1

Answer:

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73. Statement -1 : Electrons move away from a low potential to high potential region. Statement- 2 : Because electrons have negative charge

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

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

C. Statement-1 is False, Statement-2 is True

D. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-2

Answer:

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74. Assertion: Surface of asymmetrical conductor can be treated as equipotential

surface.

Reason: Charges can easily flow in a conductor.

A. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-3

B. Statement-1 is True, Statement-2 is True , Statement-2 is NOT a correct explanation for Statement-3

C. Statement-1 is False, Statement-2 is True

D. Statement-1 is True, Statement-2 is True , Statement-2 is a correct explanation for Statement-3

Answer:

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75. A total charge Q is broken in two parts Q_1 and Q_2 and they are placed at a distance R from each other. The maximum force of repulsion between them will occur, when

A. $Q_2 = \frac{Q}{R}, Q_1 = Q - \frac{Q}{R}$

B. $Q_2 = \frac{Q}{4}, Q_1 = Q - \frac{2Q}{3}$

C. $Q_2 = \frac{Q}{4}, Q_1 = \frac{3Q}{4}$

D. $Q_1 = \frac{Q}{2}, Q_2 = \frac{Q}{2}$

Answer:

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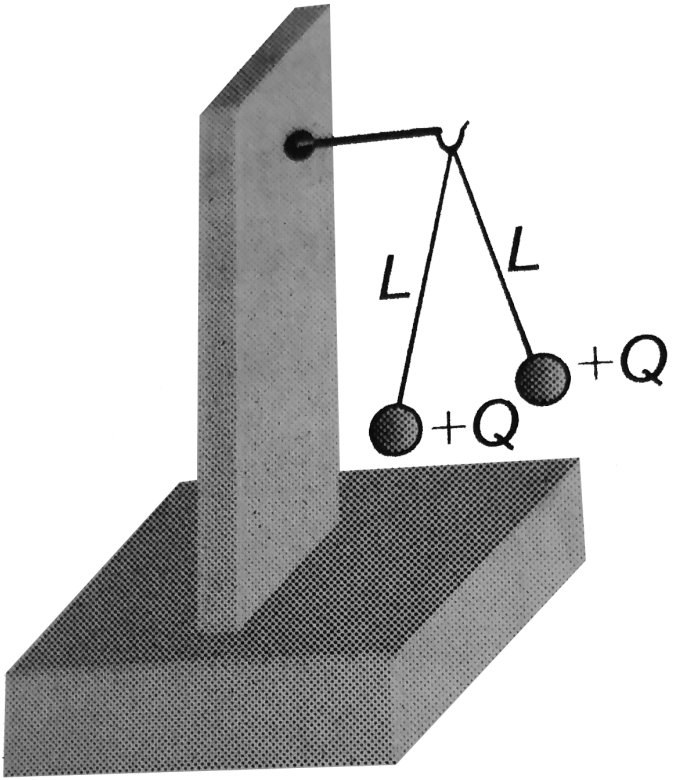
76. Two small balls having equal positive charge Q(coulomb) on each are suspended by two insulated string of equal length L meter,

from a hook fixed to a stand. The whole gravity (state of weightlessness). Then the angle between the string and tension in the string is



A. $180^\circ \frac{1}{4\pi \in_0}$

B. $90^\circ \frac{1}{4\pi \in_0} \frac{Q}{L^2}$

C. $180^\circ, \frac{1}{4\pi \in_0} \frac{Q^2}{2L^2}$

D. $180^\circ, \frac{1}{4\pi \in_0} \frac{Q^2}{L^2}$

Answer:

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77. Electric charges of $1\mu C, -1\mu C$ and $2\mu C$ are placed in air at the corners A, B and C respectively of an equilateral triangle ABC

having length of each side $10cm$. The resultant force on the charge at C is

A. 0.9 N

B. 1.8 N

C. 2.7 N

D. 3.6 N

Answer:

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

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

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

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

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

Answer:

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

A. $\frac{3q^2}{4\pi \in_0 a^2}$

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

C. $\left(\frac{1+2\sqrt{2}}{2}\right)\frac{q^2}{4\pi \in_0 a^2}$

D. $\left(2+\frac{1}{\sqrt{2}}\right)\frac{q^2}{4\pi \in_0 a^2}$

Answer:

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80. The charges on two spheres are $+7\mu C$ and $-5\mu C$ respectively. They experience a force F. If each of them is given an additional charge of $-2\mu C$, the new force of attraction will be

A. F

B. $F/2$

C. $F / \sqrt{3}$

D. $2F$

Answer:

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81. Electric lines of force about negative point charge are

A. Circular, anticlockwise

B. Circular, clockwise

C. Radial, inward

D. Radial, outward

Answer:

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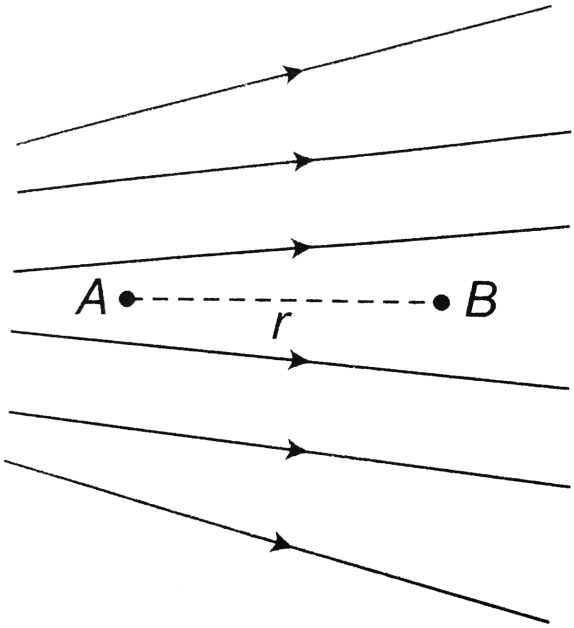
82. Figure shows the electric lines of force emerging from a charged body. If the electric field at A and B are E_A and E_B respectively and if the displacement between A and B is r

then



A. $E_A > E_B$

B. $E_A < E_B$

C. $E_A = \dfrac{E_B}{r}$

D. $E_A = \dfrac{E_B}{r^3}$

Answer:

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83. The magnitude of electric field intensity E is such that, an electron placed in it would experience an electrical force equal to its weight is given by

A. mge

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

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

D. $\frac{e^2}{m^2}g$

Answer:

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

A. Always along a line of force

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

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

D. None of the above

Answer:

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85. Two point charges Q and $-3Q$ are placed at some distance apart. If the electric field at

the location of Q is E then at the locality of $-3Q$, it is

A. $-E$

B. $E/3$

C. $-3E$

D. $-E/3$

Answer:

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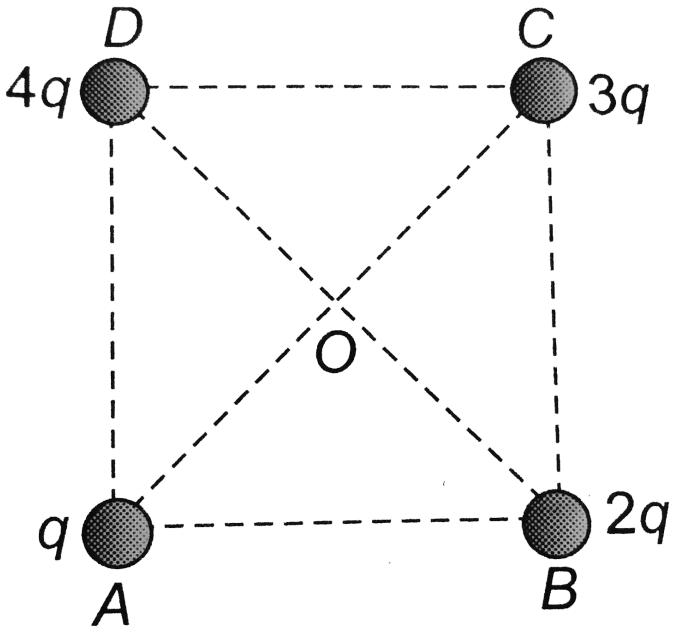
86. Charges q, $2q$, $3q$ and $4q$ are placed at the corners A, B, C and D of a square as shown in the following figure. The directon of electric field at the centre of the square is along



A. AB

B. CB

C. BD

D. AC

Answer:

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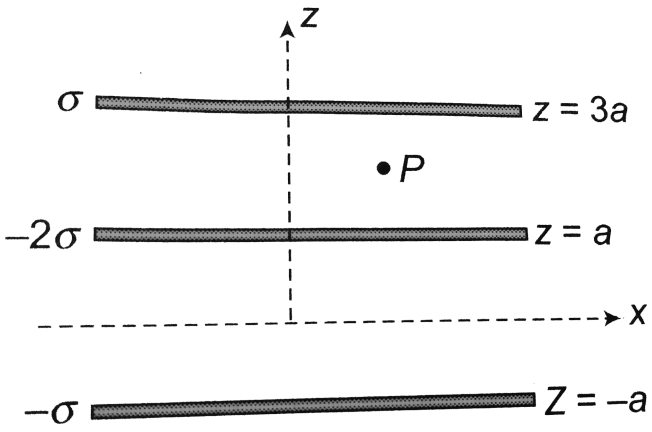
87. Three infinitely long charge sheets are placed as shown in figure. The electric field at

point P is



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

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

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

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

Answer:

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88. 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:

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89. The electric intensity due to a uniformly charged infinite cylinder of radius R , at a distance $r(>R)$, from its axis is proportional to

A. Directly proprotional to r^2

B. Directly proprotional to r^3

C. Inversely proprotional to r

D. Inversely proprotional to r^2

Answer:

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90. A sphere of radius R has a uniform distribution of electric charge in its volume. At a distance x from its centre, for $x < R$, the electric field is directly proportional to

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

B. $\frac{1}{x}$

C. x

D. x^2

Answer:

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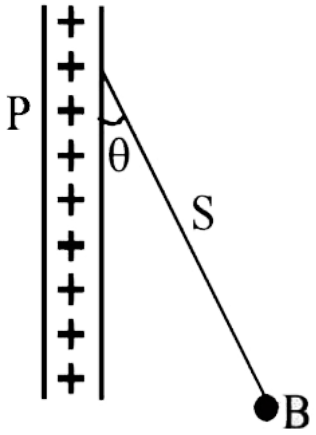
91. A charged ball B hangs from a silk thread S, which makes an angle θ with a large charged conducting sheet P, as shown in figure. The surface charge density σ of the sheet is

proportional to



A. $\sin\theta$

B. $\tan\theta$

C. $\cos\theta$

D. $\cot\theta$

Answer:

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92. A charge q is placed at the centre of a cube of side l what is the electric flux passing through two opposite faces of the cube ?

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

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

C. $\frac{q}{4 \in_0}$

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

Answer:

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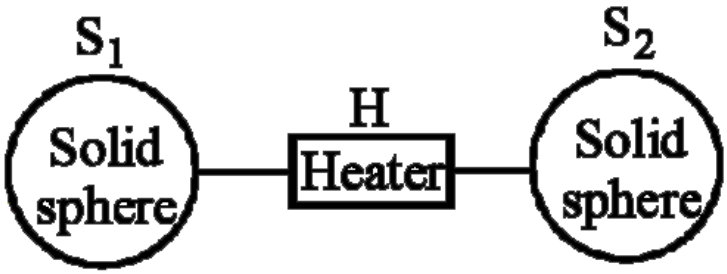
93. A solid sphere S_1 is connected to a charge reservoir through a heater H as shown in figure.



Flux through a closed spherical surface around S_1 is given by $\phi = \alpha t^2$ where α is a constant and t is time in seconds. If resistance of heater is R then select correct statements

(1) Power consumed by heater will be $4\alpha^2 e_0^2 R t^2$.

(2) Electric flux through a closed spherical surface around S_2 will be $-\alpha t_2$.

(3) Rate of change of electric flux through a closed spherical surface around S_2 will be $-2\alpha t$

(4) All of the above are correct

A. 1, 2 and 3 are correct

B. 1 and 2 are correct

C. 2 and 4 are correct

D. 1 and 3 are correct

Answer:

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94. A simple pendulum has a time period T. The bob is now given some positive charge –

(1) If some positive charge is placed at the point of suspension, T will increases

(2) If some positive charge is placed at the point of suspension, T will not change

(3) If a uniform downward electric field is switched on, T will increase

(4) If a uniform downward electric field is switched on, T will decrease

A. 1, 2 and 3 are correct

B. 2 and 2 are correct

C. 3 and 4 are correct

D. 2 and 3 are correct

Answer:

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95. A sphere of radius R contains charge density $\rho(r) = A(R - r)$, for $0 < r < R$. The total electric charge inside the sphere is Q.

The value of A in terms of Q and R is

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

B. $\frac{3Q}{\pi R^4}$

C. $\frac{3Q^2}{\pi R^3}$

D. $\frac{3Q}{\pi R}$

Answer:

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96. A sphere of radius R contains charge density $\rho(r) = A(R - r)$, for $0 < r < R$. The total electric charge inside the sphere is Q.

The electric field inside the sphere is

A. $\frac{3Q}{\in_0 R^2}\left[\frac{1}{3}\left(\frac{r}{R}\right) - \frac{1}{4}\left(\frac{r}{R}\right)^2\right]$

B. $\frac{12Q^2}{R^3}\left[\frac{1}{3}\left(\frac{r}{R}\right) - \frac{1}{4}\left(\frac{r}{R}\right)^2\right]$

C. $\frac{120Q}{5 \in_0 R^2}\left[\frac{1}{4}\left(\frac{r}{R}\right) - \frac{1}{3}\left(\frac{r}{R}\right)^2\right]$

D. $\frac{12}{R^2Q}\left[\frac{1}{3}\left(\frac{r}{R}\right) - \frac{1}{4}\left(\frac{r}{R}\right)^2\right]$

Answer:

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97. A sphere of radius R contains charge density $\rho(r) = A(R - r)$, for $0 < r < R$. The total electric charge inside the sphere is Q.

The electric outside the sphere is $\left(k = \frac{1}{4\pi \in_0}\right)$

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

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

C. $\frac{kQ}{r^2}$

D. $\frac{kQ^2}{r^2}$

Answer:

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98. Assetrion: Electric lines of force never cross each other.

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

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

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

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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

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

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

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

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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100. Statement-1 : Direction of electric field at a point signifies direction of force experienced by a point charge placed at that point.

Statement-2 : Electric field is a vector quantity.

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

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

C. Statement -1 is False, Statement-2 is True.

D. Statement -1 is True, Statement-2 is False.

Answer:

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