PHYSICS

BOOKS - D MUKHERJEE PHYSICS (HINGLISH)

ELECTROSTATICS

Others

1. A charge q is placed at the centre of the line joining two equal charges Q. The system of the three charges will be in equilibrium if q is equal to:

A. $-Q/2$

B. $-Q/4$

C. $+Q/4$

D. $+Q/2$

Answer: B

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

A. 10^{-5}

B. 10^{-10}

C. 10^{-15}

D. 10^{-20}

Answer: B

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

A. The system will be in equilibrium if the charges have the same magnitude but not all have the same sign.

B. The system will be in equilibrium if the charges have different magnitudes and not all have the same sign.

C. The system will be in equilibrium if the charges rotate about the centre of the triangle.

D. The system can never be in equilibrium.

Answer: D

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4. Charge Q is divided into two parts which are then kept some distance apart . The force between them will be maximum if the two parts are

A. $Q/2$ each

B. $Q/4$ and $3Q/4$

C. $Q/3$ and $2Q/3$

D. e and $(Q-e)$, where $e=$ electronic charge

Answer: A

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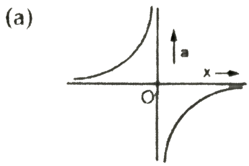
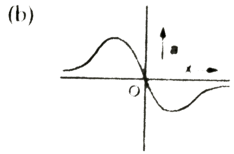
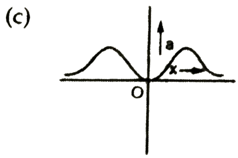
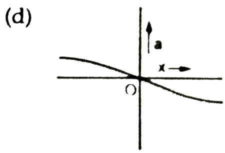
5. Two identical positive charges are fixed on the y-axis, at equal distances from the origin O. A particle with a negative charges starts on the x-axis at a large distance from O. moves along the x-axis passes through O, and moves far away from O on the other side. Its acceleration a is taken as positive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

A. 

B. 

C. 

D. 

Answer: B

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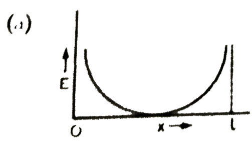
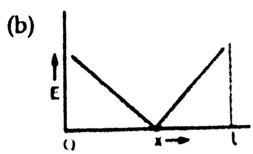
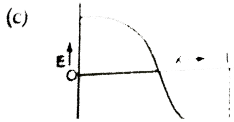
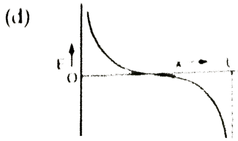
6. Two ideantical point charges are placed at a separation of d. P is a point on the line joining the charges, at a distance x from any one charge. The field at P is E, E is plotted against x for value of x from close to zero to slightly less then d. Which of the following represents the resulting curve

A. 

B. 

C. 

D. 

Answer: D

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7. Two identical simple pendulums, A and B are suspended from the same point. The bobs are given positive charges, with A having more charge than B making angles θ_1 and θ_2

with the vertical respectively. Which of the following is correct?

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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8. A point charge Q is moved along a ciruclar path around another fixed point charge. The work done is zero

A. only if Q returns to its starting point

B. only if the twoi charges have the same magnitude

C. only if the two charges have the same magnitude and opposite signs

D. in all case

Answer: D

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9. In a regular polygon of n sides, each corner is at a distance r from the centre. Identical charges of magnitude Q are placed at $(n-1)$ corners. The field at the centre is

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

B. $(n-1)k\frac{Q}{r^2}$

C. $\frac{n}{n-1}k\frac{Q}{r^2}$

D. $\frac{n-1}{n} k \frac{Q}{r^2}$

Answer: A

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10. A half ring of radius r has a linear charge density λ.The potential at the centre of the half ring is

A. $k\frac{\lambda}{R}$

B. $k\frac{\lambda}{\pi R}$

C. $k\frac{\pi\lambda}{R}$

D. $k\pi\lambda$

Answer: D

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

A. F

B. $F/2$

C. $F/4$

D. $F/8$

Answer: D

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12. Charge Q is given a displacement $r = a\hat{i} + b\hat{j}$ in electric field $E = E_1\hat{i} + E_2\hat{j}$. The work done is

A. $Q(E_1a + E_2b)$

B. $Q\sqrt{(E_1a)^2 + (E_2b)^2}$

C. $Q(E_1 + E_2\sqrt{a^2 + b^2}$

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

Answer: A

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13. Let V_0 be the potential at the origin in an electric field $\overrightarrow{E} = E_x\hat{i} + E_y\hat{j}$. The potential at the point (x, y) is

A. $V_0 - xE_x - yE_y$

B. $V_0 + xE_x + yE_y$

C. $xE_x + yE_y - V_0$

D. $\left(\sqrt{x^2 + y^2}\right)\sqrt{E_x^2 + E_y^2} - V_0$

Answer: A

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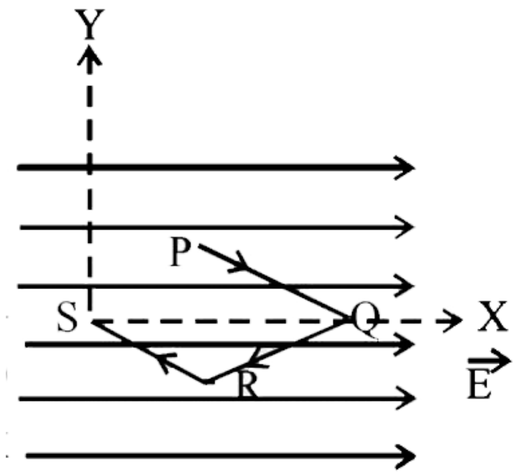
14. A point charge q moves from point P to pont S along the path PQRS (fig.) in a uniform electric field E pointing parallel to the poistive direction of the X-axis. The coordinates of the points P, Q, R and S are(a, b, O), (2a, O, O)(a, -b, $\underline{O}$) and `(O, O, O) respectively. The work done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



A. qaE

B. $-qaE$

C. $q\left(\sqrt{a^2 + b^2}\right)E$

D. $3qE\sqrt{a^2 + b^2}$

Answer: B

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

A. $-8\hat{i}$

B. $8\hat{i}$

C. -16

D. $8\sqrt{5}$

Answer: A

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16. A non-conducting ring of radius $0.5m$ carries a total charge of 1.11×10^{-10}C distributed non-uniformly on its circumference producing an electric field E everywhere is space. The value of the integral

$$\int_{l=\infty}^{l=0} -E.\, dI(l = 0 \text{ being centre of the ring})$$

in volt is

A. $+2$

B. -1

C. -2

D. 0

Answer: A

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17. A charge $+q$ is fixed at each of the points $x=x_0,\ x=3x_0,\ x=5x_0$,............$x=\infty$ 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. $\frac{q}{8\pi\varepsilon_0 x_0 In2}$

C. ∞

D. $\frac{qIn2}{4\pi\varepsilon_0 x_0}$

Answer: D

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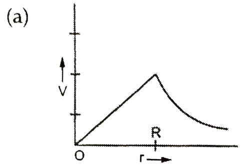
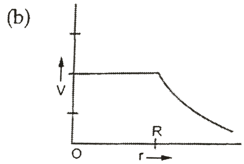
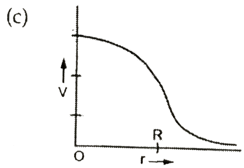
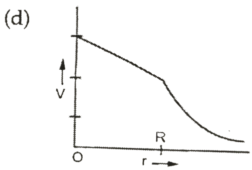
18. A solid sphere of radius R is charged uniformly. The electrostatic potential V is plotted as a function of distance r from the centre of th sphere. Which of the following best represents the resulting curve?

A. 

B. 

C. 

D. 

Answer: C

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19. A solid sphere of radius R has charge q uniformly distributed over its volume. The distance from it surfce at which the electrostatic potential is equal to half of the potential at the centre is

A. R

B. $R/2$

C. $R/3$

D. $2R$

Answer: C

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20. A large solid sphere with uniformly distributed positive charge has a smooth narrow tunnel along its direction. A small particle with negative charge, initially at rest far from the sphere, approaches it along the line of the tunnel, reaches its surface with a speed v, and passes through the tunnel. Its speed at the centre of the sphere will be

A. 0

B. v

C. $\sqrt{2v}$

D. $\sqrt{1.5v}$

Answer: D

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21. Which of the following is not true for a region with a uniform electric field?

A. It can have free charges.

B. It may have uniformly distributed charge

C. It may contain dipoles

D. none of the above

Answer: D

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22. All charge on a conductor must reside on its outer surface.' This statement is true

A. in all cases

B. for spherical conductors only (both solid any hollow)

C. for hollow spherical conductors only

D. for conductors whicih do not have any sharp points or corners

Answer:

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23. A point charge Q is placed outside a hollow spherical conductor of radius R , at a distance $r(r > R)$ from its centre C . The field at C due to the inducted charges on the conductor is

A. zero

B. $k\frac{Q}{(r-R)^2}$

C. $k\frac{Q}{r^2}$, directed towards Q

D. $k\frac{Q}{r^2}$, directed away from Q

Answer: C

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

A. move towards the centre

B. move towards the nearer wall of the conductor

C. remain stationary

D. oscillate between the centre and the nearer wiall

Answer: C

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

A. zero

B. $\varepsilon_0 E_0 a^3$

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

D. $\frac{1}{6} \varepsilon_0 E_0 a^2$

Answer: B

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

A. zero

B. Q/ε_0

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

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

Answer: C

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27. A long string with a charge of λ per unit length passes through an imaginary cube of edge a. The maximum flux of the electric field through the cube will be

A. $\lambda a / \varepsilon_0$

B. $\sqrt{2}\lambda a / \varepsilon_0$

C. $6\lambda a^2 / \varepsilon_0$

D. $\sqrt{3}\lambda a / \varepsilon_0$

Answer: D

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28. A spherical conductor A of radius r is placed concentrically inside a conducting shell B of radius $R(R > r)$. A charge Q is given to A , and then A is joined to B by a metal wire. The charge flowing from A to B will be

A. $Q\left(\frac{R}{R+r}\right)$

B. $Q\left(\frac{r}{R+r}\right)$

C. Q

D. zero

Answer: C

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29. A spherical equipotential surface is not possible

A. for a point chargge

B. for a dipole

C. inside a uniformly charged sphere

D. inside a spherical capacitor

Answer: B

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30. In a certain charge distribution, all points having zero potetnial can be joined by a circles S. Points inside S have positive potential and points outside S have negative potential. A positive charg, which is free to move, is placed inside S

A. It will remainin equilibrium

B. It can move inside S, but it cannot cross S

C. It must cross S at some time.

D. It may move, but will ultimately return to its starting point.

Answer: C

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31. If the earth's surface is treated as a conducting surface with some charge , then the order of magnitude of the charge per unit area $\sigma \text{in} C / m^2$, so that a proton remains suspended in space near the earh's surface will be

A. 10^{-18}

B. 10^{-12}

C. 10^{-6}

D. 1

Answer:

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32. A simple pendulum of time period T is suspended above a large horizontal metal sheet with uniformly distributed positive charge. If the bob is given some negative charge , its time period of oscillation will be

A. $>T$

B. $<T$

C. T

D. proportinal to its amplitude

Answer: B

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33. A spring - block system undergoes vertical oscillation above a large horizontal metal sheet with uniform positive charge. The time period of the oscillation will be 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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34. A large flat metal surface has a uniform charge density $+\sigma$. An electron of mass m and charge u and returns to it at point B. Disregard gravity . The maximum value of AB is

A. $\frac{u^2 m \varepsilon_0}{\sigma e}$

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

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

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

Answer: A

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35. A and B are two points on the axis and the perpendicular bisector, respectively, of and electric dipole. A and B are far away from the dipole and at equal distance from it. The fields at A and B are $\overrightarrow{E}_A$ and $\overrightarrow{E}_B$. Then

A. $\overrightarrow{E}_A = \overrightarrow{E}_B$

B. $\overrightarrow{E}_A = 2\overrightarrow{E}_B$

C. $\overrightarrow{E}_A = -2\overrightarrow{E}_B$

D. $|E_B| = \frac{1}{2}|E_A|$, and $\vec{E}_B$ is perpendicular to $\vec{E}_A$

Answer: C

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

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

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

C. $\theta = 45^{\circ}$

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

Answer: B

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37. An electric dipole of moment $\vec{p}$ is placed in a uniform electric field $\vec{E}$, with $\vec{p}$ parallel to $\overrightarrow{E}$. It is then rotated by an angle θ. The work done is

A. $pE\sin\theta$

B. $pE\cos\theta$

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

D. $pE(1-\sin\theta)$

Answer: C

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38. The radius of the earth is $6400 km$, what is its capacitance?

A. $1 \mu F$

B. $1 mF$

C. $1 F$

D. $10^3 F$

Answer: B

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39. When two uncharged metal balls of radius $0.09mm$ each collide, one electron is transferred between them. The potential difference between them would be

A. $16\mu V$

B. $16pV$

C. $32\mu V$

D. $32pV$

Answer: C

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40. A conducting sphere of radius R and carrying a charge Q is joined to an uncharged conducting sphere of radius $2R$. The charge flowing between them will be

A. $Q/4$

B. $Q/3$

C. $Q/2$

D. $2Q/3$

Answer: D

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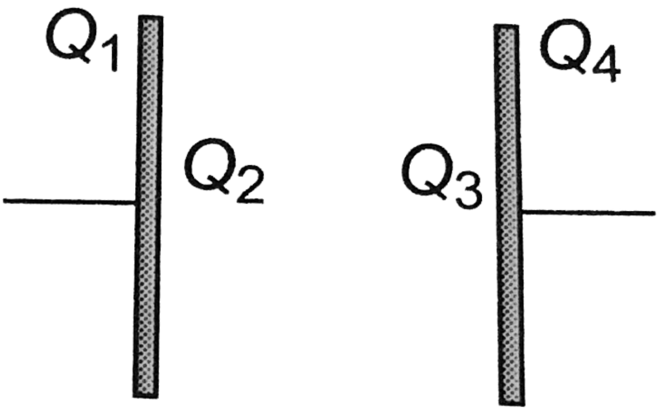
41. In an isolated parallel plate capacitor of capacitance C, the four surfaces have charges Q_1, Q_2, Q_3 and Q_4 as shown. The potential difference between the plates is



A. $\dfrac{Q_1 + Q_2 + Q_3 + Q_4}{2C}$

B. $\dfrac{Q_2 + Q_3}{2C}$

C. $\dfrac{Q_2 - Q_3}{2C}$

D. $\dfrac{Q_1 + Q_4}{2C}$

Answer: C

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42. A capacitor of capacitance C is charged to a potential difference V from a cell and then disconnected from it. A charge $+Q$ is now given to its positive plate. The potential difference across the capacitor is now.

A. V

B. $V + \frac{Q}{C}$

C. $V + \frac{Q}{2C}$

D. $V - \frac{Q}{C}$, if $V < CV$

Answer: C

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43. A capacitor is conneted to a cell emf E having some internal resistance r. The potential difference across the

A. cell is ε

B. cell is $< \varepsilon$

C. capacitor is $< \varepsilon$

D. capacitor is $> \varepsilon$

Answer: A

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44. In a parallel plate capacitor of capacitance C, a metal sheet is inserted between the plates, parallel to them. If the thickness of the sheet is half of the separation between the plates. The capacitance will be

A. $4C$

B. $2C$

C. $C/2$

D. $C/4$

Answer: B

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45. 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. zero

B. $3V$

C. $4V$

D. $6V$

Answer: C

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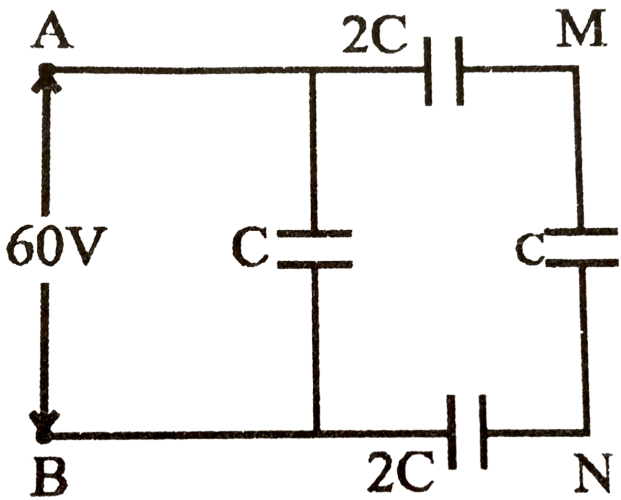
46. In the circuit shown, a potential difference of $60V$ is applied acrodd.AB. The potential difference between the point M and N is-



A. $10V$

B. $15V$

C. $20V$

D. $30V$

Answer: D

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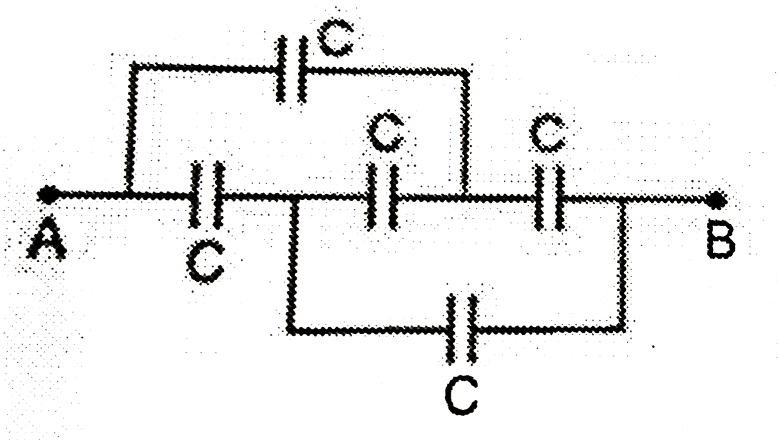
Electrostatics

47.



In the circuit shown, the equivalent capacitance between the points A and B is

A. $C/5$

B. $C/3$

C. $C/2$

D. C

Answer: D

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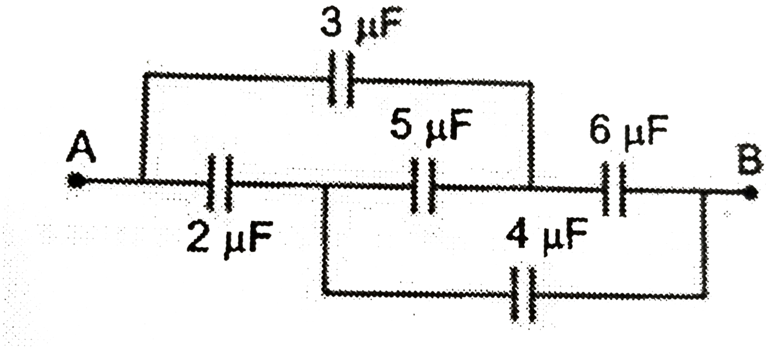
48. 

In the circuit shown, the equivalent capacitance between the points A and B is

A. $\frac{10}{3}\mu F$

B. $\frac{15}{4}\mu F$

C. $\frac{12}{5}\mu F$

D. $\frac{25}{6}\mu F$

Answer: A

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49. Let u_a and u_d represent the energy density (energy per unit volume) in air and in a dielectric respectively, for the same field in both. Let $K =$ dielectric constant. Then

A. $u_a = u_d$

B. $u_a = Ku_d$

C. $u_d = Ku_a$

D. $u_a = (K-1)u_d$

Answer: C

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50. In a parallel-plate capacitor, the region between the plates is filled by a dielectric slab. The capacitor is connected to a cell and the slab is taken out. Then

A. Some charge is drawn form the cell

B. Some charge is returned to the cell.

C. The potential differences across the capacitor is reduced.

D. No work is done by an external agent in taking the slab out.

Answer: B

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51. Three charged particle sare in equilibrium under their electrostatic forces only. Then

A. The particles must be collinear.

B. All the charges cannot have the same magnitude

C. All the charges cannot have the same sign.

D. The equilibrium is unstable.

Answer: B

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52. Four identical charges are placed at the points $(1, 0, 0), (0, 1, 0), (-1, 0, 0)$, and $(0, -1, 0)$. Then,

A. The potential at the origin is zero.

B. The field at the origin is zero

C. The potential at all ponts on the z-axis, othehr than the origin, is zero.

D. The field at all points on the z- axis, other than the origin, acts along the z- axis.

Answer: A::B::C::D

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53. Four charges , all of the same magnitude , are placed at the four corners of a square . At the centre of the square , the potential is V and the field is E. By suitable choice of the signs of the four charges ,which of the following can be obtained?

(i) $V = 0, E = 0$

(ii) $V = 0, E \neq 0$

(iii) $V \neq 0, E = 0$

(iv) $V \neq 0, E \neq 0$

A. $V = 0, E = 0$

B. $V = 0, E \neq 0$

C. $V \neq 0, E = 0$

D. $V \neq 0, E \neq 0$

Answer: B::D

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

(i) $F_1 = F_2$

(ii) $F_1 \neq F_2$

(iii) $a_1 = a_2$

(iv) $a_1 \neq a_2$

A. $F_1 = F_2$

B. $F_1 \neq F_2$

C. $a_1 = a_2$

D. $a_1 \neq a_2$

Answer: A::B::C::D

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55. Two identical charges $+Q$ are kept fixed some distance apart.A small particles P with charge q is placed midway between them . If P is given a small displacement Δ ,it will undergo simple harmonic motion if

(i) q is positive and Δ is along the line joining the charges

(ii) q is positive and Δ is perpendicular to the line joining the charges

(iii) q is negative and Δ is perpendicular to the line joining the charges

(iv) q is positive and Δ is along the line joining the charges

A. q is positive and Δ is along the line joining the charges.

B. q is negative and Δ is perpendicular to the line joining the charges.

C. q is negative and Δ is perpendicular to the line joining the charges.

D. q is positive and Δ is along the line joining the charges.

Answer: B::C

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

A. the field at the origin is zero

B. The potential at the origin is $k\frac{Q}{R}$.

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

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

Answer: A::C

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

A. periodic, for all value of z_0 satisfying $0 < z_0 < \infty$

B. simple harmonic, for all value of z_0 satisfying $0 < z_0 \leq R$

C. approximately simple harmonic, provided $z_0 < < R$

D. such that P crosses O and continues to move along the negative z-axis towards $z = -\infty$

Answer: A::B

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58. A particle A of mass m and charge Q moves directly towards a fixed particle B, which has charge Q. The speed of A is a v when it is far away from B. The minimum separtion between the particles is not proportional to

A. Q^2

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

C. $\frac{1}{v}$

D. $\frac{1}{m}$

Answer: A::C::D

Watch Video Solution

59. The electric field and the electric potential at a point are E and V respectively.

A. If $V = 0$, E must be zero

B. If $V \neq 0$, E cannot be zero

C. If $E \neq 0$, V cannot be zero.

D. None of the these

Answer: A::B::D

Watch Video Solution

60. In a uniform electric field ,

A. all points are at the same potential

B. no two points can have the same potential

C. pairs of points separated by the same distance must have the same difference in potential

D. none of the above

Answer: D

Watch Video Solution

61. Charges Q_1 and Q_2 lie inside and outside, respectively, of a closed surface S. Let E be the field at any point on S and ϕ be the flux of E over S.

A. If Q_1 changes, both E and ϕ will change.

B. If Q_2 changes E will change but ϕ will not change

C. If $Q_1 = 0$ and $Q_2 \neq 0$ then $E \neq 0$ but $\phi = 0$

D. If $Q_1 \neq 0$ and $Q_2 = 0$ then $E = 0$ but $\phi \neq 0$

Answer: D

Watch Video Solution

62. Charges Q_1 and Q_2 lie inside and outside respectively of an uncharged conducting shell. Their separation is r.

(i) The force on Q_1 is zero

(ii) The force on Q_1 is $k\left(\frac{Q_1 Q_2}{r^2}\right)$

(iii) The force on Q_2 is $k\left(\frac{Q_1 Q_2}{r^2}\right)$

(iv) The force on Q_2 is zero

A. The force on Q_1 is zero

B. The force on Q_1 is $k\frac{Q_1 Q_2}{r^2}$

C. The force on Q_2 is $k\frac{Q_1 Q_2}{r^2}$

D. The force on Q_2 is zero.

Answer: A::B::C::D

Watch Video Solution

63. A spherical conductor A lies inside a hollow spherical conductor B. Charges Q_1 and Q_2 are given to A and B respectively (Choose the incorrect option)

A. Charge Q_1 will appear on the outer surface of A

B. Charge $-Q_1$ will appear on the inner surface of B

C. Charge Q_2 will appear on the outer surface of B

D. Charge $Q_1 + Q_2$ will appear on the outer surface of B

Answer: A::C

Watch Video Solution

64. A, B and C are three concentric metallic shells . Shell A is the innermost and shell C is the outermost. A is given some charge

(i) The inner surfaces of $B$and C will have the same charge

(ii) The inner surfaces of B and C will have the same charge density

(iii) The outer surfaces of A, B and C will have the same charge

(iv) The outer surfaces of A, B and C will have the same charge density

A. The inner surfaces of B and C will have the same charge.

B. The iner surface of B and C will be the same charge density.

C. The outer surfaces of A, B and C will have the same charge.

D. The outer surfaces of A, B and C will have the same charge density.

Answer: A::B::D

Watch Video Solution

65. Consider two large ,identical parallel conducting plates having surface X and Y .facing each other.The charge per unit area on X is σ_1 and charge per unit surface area of Y is σ_2 .Then,

A. $\sigma_1 = -\sigma_2$ in all cases

B. $\sigma_1 = -\sigma_2$ only if a charge is given to one plate only.

C. $\sigma_1 = \sigma_2 = 0$ if equal charges are given to both the plates.

D. $\sigma_1 > \sigma_2$ if X is given more charge than Y.

Answer: A::C

Watch Video Solution

66. P i sa point on an equipotential surface S. The field at P is E.

A. E must be perpendicular to S in all cases .

B. E will be perpendicular to S only if S is a plane surface.

C. E canot have a component along a tangent to S.

D. E may have a nonzero component along a tangent to S if S is a curved surface.

Answer: A::C

Watch Video Solution

67. S_1 and S_2 are two equipotential surfaces on which the potentials are not equal

A. S_1 and S_2 cannot intersect.

B. S_1 and S_2 cannot both be plane surfaces.

C. In the region between S_1 and S_2 the field is maximum where they are closest to each other.

D. A line of force from S_1 and S_2 must be perpendicular to both.

Answer: A::C

Watch Video Solution

68. In a uniform electric field , equipotential surface must

(i) be plane surfaces

(ii) be normal to the direction to the filed

(iii) be spaced such that surfaces having equal difference in potential are separated by equal distances

(iv) have decreasing potentials in the direction of field

A. be plane surfaces

B. be normal to the direction of the field

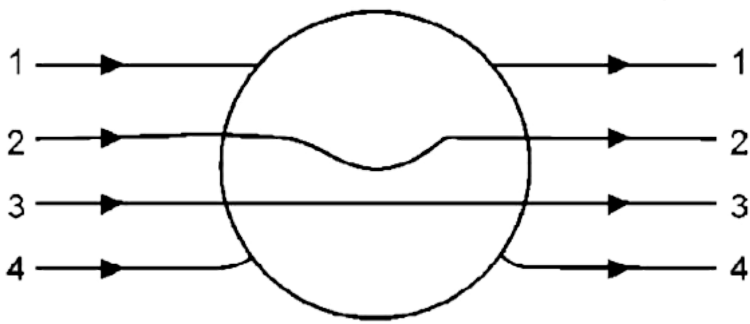
C. be sapced such that surfaces having equal differences in potential are separated by equal distances

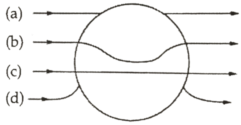
D. have decreasing potentials in the direction of the field

Answer: A::C::D

Watch Video Solution

69. A metallic solid sphere is placed in a uniform electric fied. The lines of force follow the path(s) shown in Figure as



A. 

B.

C.

D.

Answer: A::C::D

Watch Video Solution

70. The electric field at a distance r from a long wire having charge per unit length λ is

A. $k\frac{\lambda}{r^2}$

B. $k\frac{\lambda}{r}$

C. $k\frac{\lambda}{2r}$

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

Answer: D

Watch Video Solution

71. Two points are at distance a and $b(a < b)$ from a long string of charge per unit length λ.

The potential difference between th epoints is proportional to

A. b/a

B. b^2/a^2

C. $\sqrt{b/a}$

D. $In(b/a)$

Answer: D

Watch Video Solution

72. A charge moves with a speed v in a circular path of radius r around a long uniformly charged conductor.

A. $v \propto r$

B. $v \propto \frac{1}{r}$

C. $v \propto \frac{1}{\sqrt{r}}$

D. v is independent of r

Answer: D

Watch Video Solution

73. A simple pendulum of length l has a bob of mass m , with a charge q on it. A vertical sheet of charge , with the vertical . Its time period of oscillation is T in this position

(i) $\tan \theta = \frac{\sigma q}{2 \varepsilon_0 m g}$

(ii) $\tan \theta = \frac{\sigma q}{\varepsilon_0 m g}$

(iii) $T < 2\pi \sqrt{\frac{l}{g}}$

(iv) $T > 2\pi \left(\frac{l}{g}\right)$

A. $\tan \theta = \frac{\sigma q}{2 \varepsilon_0 m g}$

B. $\tan \theta = \frac{\sigma q}{\varepsilon_0 m g}$

C. $T < wp\sqrt{l/g}$

D. $T > 2\pi\sqrt{l/g}$

Answer: A::C

Watch Video Solution

74. A dipole of moment $\overrightarrow{p}$ is placed in a uniform electric field $\overrightarrow{E}$. The force on the dipole is $\overrightarrow{F}$ and the torque is $\overrightarrow{\tau}$

A. $\overrightarrow{F} = 0$

B. $\overrightarrow{F} = \left|\overrightarrow{p}\right|\overrightarrow{E}$

C. $\left|\overrightarrow{\tau}\right| = \overrightarrow{p}.\overrightarrow{E}$

D. $\overrightarrow{\tau} = \overrightarrow{p} \times \overrightarrow{E}$

Answer: A::D

Watch Video Solution

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

A. no net force and no torque

B. a net force but a torque

C. a net force and a torque

D. no net force but a torque

Answer: B::C::D

Watch Video Solution

76. Two large parallel conducting plates are placed close to each other ,the inner surface of the two plates have surface charge densities $+\sigma$ and $-\sigma$ .The outer surfaces are without charge.The electric field has a magnitude of

A. $2\sigma / \varepsilon_0$ in the region between the plates

B. σ / ε_0 in the region between the plates

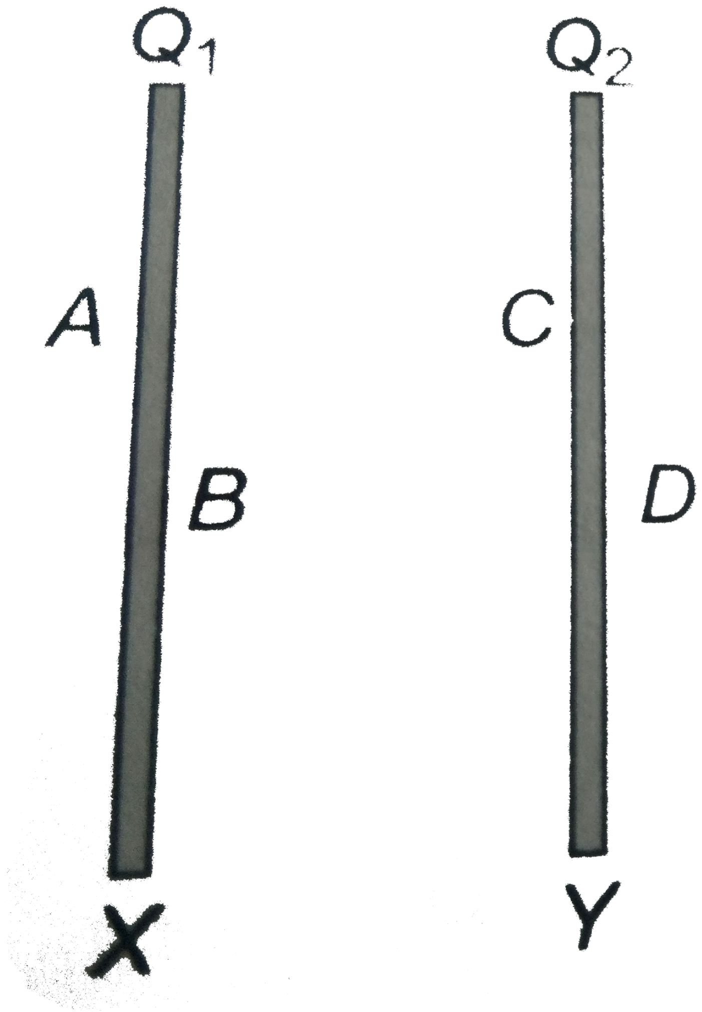
C. σ / ε_0 in the region outside the plates

D. zero in the region outside the plates

Answer: B::D

Watch Video Solution

77. Two large , parallel conducting plates X and Y , kept close to each other , are given Q_1 and $Q_2 (Q_1 > Q_2)$. The four surfaces of the plates are A, B, C and D , as shown



(i) The charge on A is $\frac{1}{2}(Q_1 + Q_2)$

(ii) The charge on B is $\frac{1}{2}(Q_1 - Q_2)$

(iii) The charge on C is $\frac{1}{2}(Q_2 - Q_1)$

(iv) The charge on D is $\frac{1}{2}(Q_1 + Q_2)$

A. The charge on A is $\frac{1}{2}(Q_1 + Q_2)$

B. The charge on B is $\frac{1}{2}(Q_1 - Q_2)$

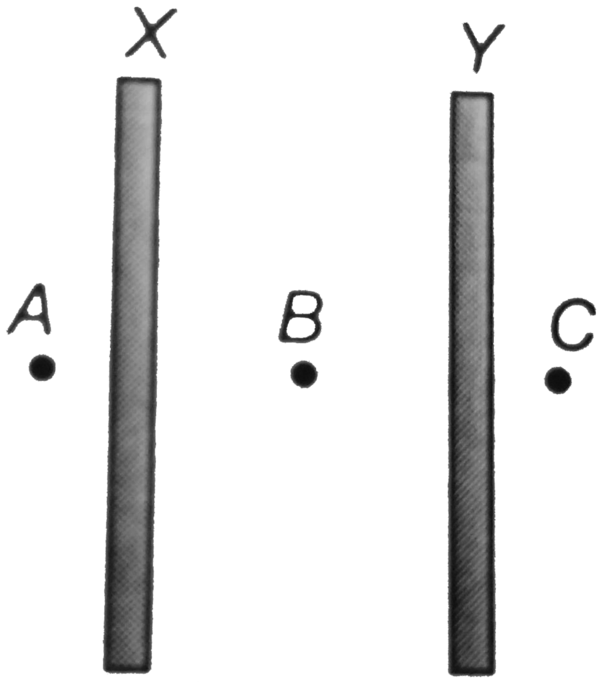
C. The charge on C is $\frac{1}{2}(Q_2 - Q_1)$

D. The charge on D is $\frac{1}{2}(Q_1 + Q_2)$

Answer: A::B::C::D

Watch Video Solution

78. X and Y are large, parallel conducting plates close to each other. Each face has an area A. X is given a charge Q. Y is without any charge. Points A, B and C are as shown in the figure.



A. The field at B is $\frac{Q}{2\varepsilon_0 A}$

B. The field at B is $\frac{Q}{\varepsilon_0 A}$

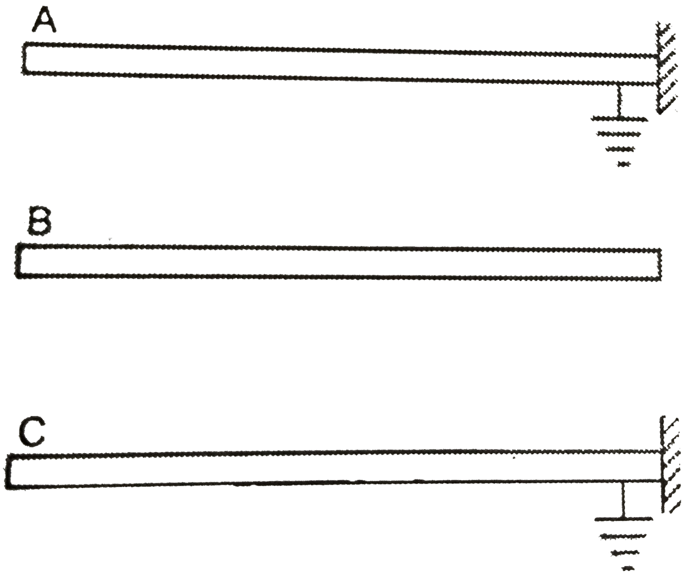
C. The fields at A, B and C are of the same magnitude

D. The field at A and C are of the same magnitude, but in opposite directions

Answer: A::C::D

Watch Video Solution

79.



A, B and C are three large, parallel conducting plates, placed horizontally. A and C are rigidly fixed and earthed. B is given some charge. Under electrostatic and gravitational forces, B may be

A. in equilibrium midway between A and C

B. in equilibrium if it is close to A than to C

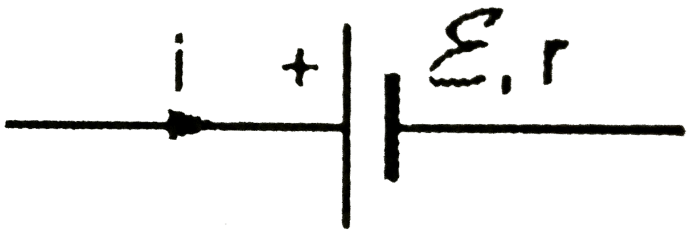
C. in equilibrium if it is closer to C than to A

D. B can never be the stable equilibrium.

Answer: B::D

View Text Solution

80. Three identical, parallel conducting plates, A, B and C are placed as shwon. Switches S_1 and S_2 are open, and can connect A and C to earth when closed $+Q$ charge is given to B.



A. If S_1 is closed with S_2 open a charge of amount Q will pass thorugh S_1

B. If S_2 is closed with S_1 open, a charge of amount Q will pass through S_2

C. If S_1 and S_2 are closed together, a charge of amount $Q/3$ will pass through S_1 and a charge of amount $2Q/3$ will pass through S_2.

D. all the above statements are incorrect.

Answer: A::B::C

View Text Solution

81. A parallel plate capacitor is charged from a cell and then isolated from it. The separation between the plates is now increased

A. The force of attraction between the plates will decrease.

B. The field in the region between the plates will not change.

C. The energy stored in the capacitor will increase.

D. The potential difference between the plates will decrease.

Answer: B::C

Watch Video Solution

82. When a charge of amount Q is given to an isolated metal plate X of surface area A, its surface charge density becomes σ_1. When an isolated identical plate Y is brought close to X the surface charge density on X becomes σ_2.

When Y is earthed the surface charge density on X becomes σ_3. Choose the incorrect option.

A. $\sigma_1 = \frac{Q}{A}$

B. $\sigma_1 = \frac{Q}{2A}$

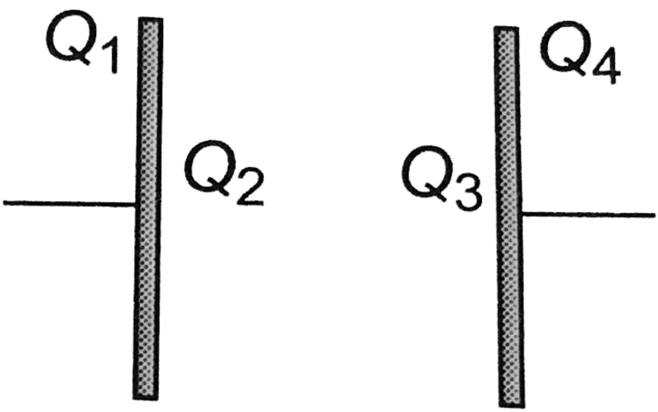
C. $\sigma_1 = \sigma_2$

D. $\sigma_3 = \frac{Q}{A}$

Answer: B::C::D

Watch Video Solution

83. In an isolated parallel plate capacitor of capacitance C, the four surfaces have charges Q_1, Q_2, Q_3 and Q_4 as shown. The potential difference between the plates is



A. $\frac{Q_1 + Q_2}{C}$

B. $\left|\frac{Q_2}{C}\right|$

C. $\left|\frac{Q_3}{C}\right|$

D. $\frac{1}{C}[(Q_1 + Q_2) - (Q_3 - Q_4)]$

Answer: B::C

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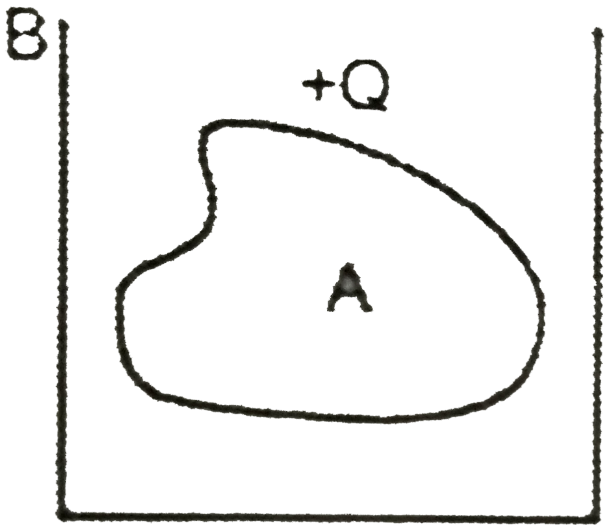

84.

A conductor A is given a charge of amount

$+Q$ and then placed inside a deep metal can B, without touching it

A. The potential of A does not change when it is placed inside B.

B. If B is earthed $+Q$, amount of charge flows from it inot the earth.

C. If B is earthed, the potential of A is reduced.

D. Eigther (b) or (c) are true, or both are true only if the outer surface of B is connected to the earth andnot its inner

surface.

Answer: A::B::C

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85. A conducting sphere of radius R and carrying a charge Q is joined to an uncharged conducting sphere of radius $2R$. The charge flowing between them will be

A. $Q/3$ amount of charge will flow from the sphere to the shell

B. $2Q/3$ amount of charge will flow from the sphere to the shell

C. Q amount of charge will flow from the sphere to the shell

D. $k\frac{Q^2}{4R}$ amount of heat will be produced.

Answer: C::D

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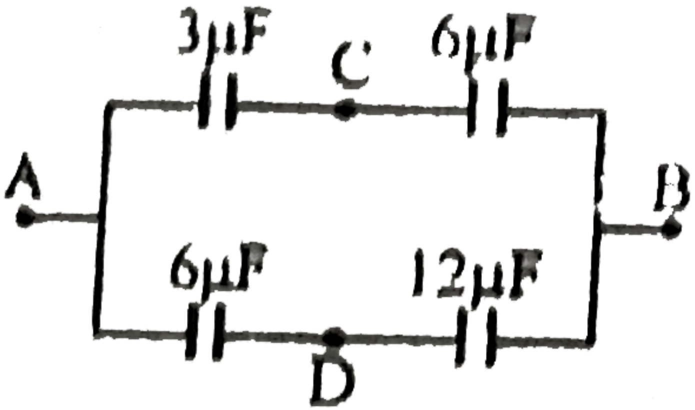
86. In the circuit shown, some potential difference is applied between A and B If C is joined to D



A. no charge will flow between C and D

B. some charge will flow between C and D

C. the equivalent capacitance between C and D will not change

D. the equilvalent capacitance between C and D will change

Answer: A::C

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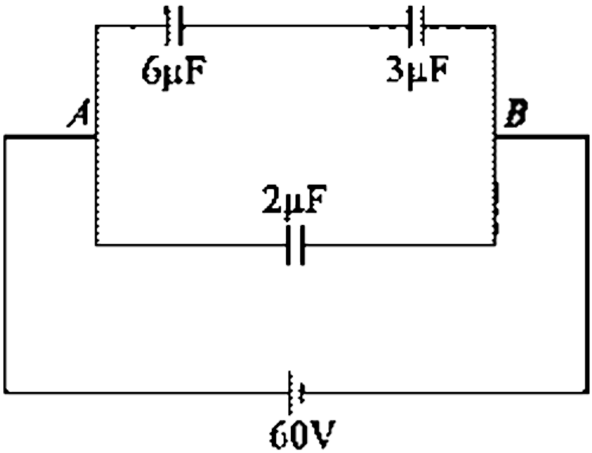
87. In the circuit shown, the potential difference across the $3\mu F$ capacitor is V and the equivalent capacitance between A and B

is C Then:



A. $C(AB) = 4\mu F$

B. $C_{AB} = \frac{18}{11}\mu F$

C. $V = 20V$

D. $V = 40V$

Answer: A::D

Watch Video Solution

88. The two plates X and Y of a parallel-plate capacitor of capacitacne C are given a charge of amount Q each. X is now joined to the positive terminal and Y to the negative terminal of a cell of emf $\varepsilon = Q/C$.

A. Charge of amount Q will flow fromte positive terminal to the negative terminal of the cell through the capacitor.

B. The total charge on the plate X will be $2Q$

C. The total charge on the plate Y will be zero.

D. The cell will supply $C\varepsilon^2$ amont of energy.

Answer: A::B::C::D

View Text Solution

89. The seperation between the plates of a parallel -plate capacitor is made double while it remains connected to a cell.

A. The cell absorbs some energy.

B. The electric field in the region between the plates becomes half.

C. The charge on the capacitor becomes half.

D. Some work has to be done by an external agent on the plates.

Answer: A::B::C::D

Watch Video Solution

90. A parallel-plate capacitor is charged from a cell and then disconnected from the cell. The separation between the plates is now double.

A. The potential difference between the plates will become double

B. The field between the plates will not change.

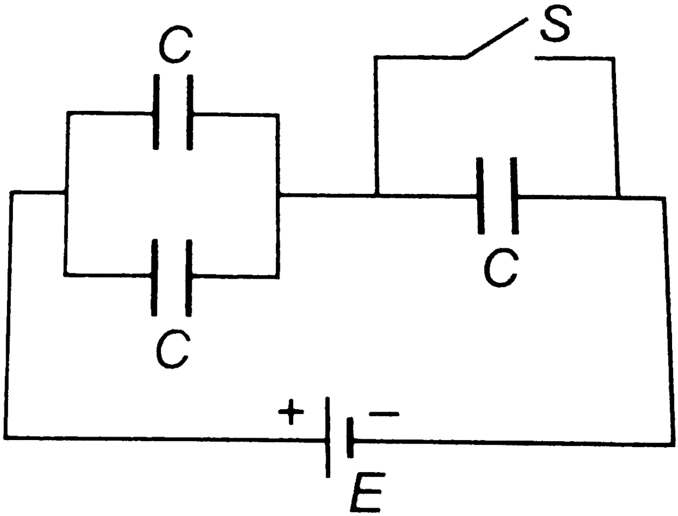
C. The energy of the capacitor doubles.

D. Some work will have to be done by an external agent on the plates.

Answer: A::B::C::D

Watch Video Solution

91. In the circuit shown each capacitor has a capcitance C. The emf of the celll is E. If the switch S is closed then



A. some change will flow out of the positive terminal of the cell

B. some charge will enter the positive terminal of the cell

C. the amount of charge flowing through the cell will be $C\varepsilon$.

D. the amount of charge flowing through the cell will be $\frac{4}{3}C\varepsilon$.

Answer: A::D

Watch Video Solution

92. In a parallel-plate capacitor of plate area A, plate separation d and charge Q the force of attraction between the plates is F.

A. $F \propto Q^2$

B. $F \propto \frac{1}{A}$

C. $F \propto d$

D. $F \propto \frac{1}{d}$

Answer: A::B

Watch Video Solution

93. The capacitance of a parallel -plate capacitor is C_0 when the region between the plates has air. This region is now filled with a dielectric slab of dielectric constant K. The capacitor is connected to a cell of emf ε and the slab is takenout

A. Charge $\varepsilon(C_0(K-1)$ flows through the cell.

B. Energy $\varepsilon^2 C_0(K-1)$ is absorbed by the cell.

C. The energy stored in the capacitor is reduced by $\varepsilon^2 C_0(K-1)$

D. The external agent has to do $\frac{1}{2}\varepsilon^2 C_0(K-1)$ amount of work to take the slab out.

Answer: A::B::D

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94. A parallel plate air capacitor of capacitance C is connected to a cell of $emFV$ and then disconnected from it. A dielectric slab of dielectric constant K, which can just fill the air gap of the capacitor, is now inserted in it.

Which of the following is incorrect ?

A. The potential difference between the plates decreases K times

B. The enerty stored in the capacitor decreased K times

C. The change in energy is $\frac{1}{2}C_0\varepsilon^2(K-1)$

D. The change in energy is $\frac{1}{2}C_0\varepsilon^2\left(1-\frac{1}{K}\right)$

Answer: A::B::D

Watch Video Solution

95. A conducting sphere A of radius a ,with charge Q , is placed concentrically inside a conducting shell B of radius b . B is earthed. C is the common centre of the A and B

A. The field at a distance r from C, where $a \leq r \leq b$, is $k\frac{Q}{r^2}$

B. The potential at a distance r from C where $a \leq r \leq b$ is $k\frac{Q}{r}$.

C. The potential difference between A and B is $kQ\left(\frac{1}{a}-\frac{1}{b}\right)$.

D. The potential at a distance r from C, where $g \leq r \leq b$, is $kQ\left(\frac{q}{r}-\frac{1}{b}\right)$

Answer: A::C::D

Watch Video Solution

96. A non conduction ring of radius R Has uniformly distributed positive charge Q. A small part of the ring of length d, is removed (

$d < < R)$. The electric field at the center of the ring now be .

A. directed towards the gap, inversely proportional to R^3

B. directed towards the gap, inverely proportional to R^2

C. directed away from the gap, inversely proportional to R^3

D. directed away from the gap, inversely proportional to R^2

Answer: A

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97. Two positively charged particles X and Y are initially far away from each other and at rest , X begins to move towards Y with some initial velocity. The total momentum and energy of the system are p and E.

A. If Y is fixed both p and E are conserved.

B. If Y is fixed E is conserved but not p

C. If both are free to move p is conserved but not E

D. If both are free, E conserved, but not p.

Answer: B

Watch Video Solution

98. Two particles X and Y of equal mass and with unequal positive charges, are free to move and are initially far away from each other. With Y at rest,X begins to move towards it with initial velocity u. After a long time, finally

A. X will stop Y will move with velocity u

B. X and Y will both move with velocities $u/2$ each

C. X will stop Y will move with velocity $< u$

D. both will move with velocities $< u/2$

Answer: A

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99. In a uniform electric field, the potential is $10V$ at the origin of coordinates , and $8V$ at each of the points (1, 0, 0), (0, 1, 0) and (0, 0, 1). The potential at the point (1, 1,1) will be .

A. 0

B. $4V$

C. $8V$

D. $10V$

Answer: B

Watch Video Solution

100. Two conducting concentric, hollow spheres A and B have radii a and b respectively, with A inside B. Their common potentials is V. A is now given some charge such that its potential becomes zero. The potential of B will now be

A. 0

B. $V(1 - a/b)$

C. Va/b

D. $V(b-a)/(b+a)$

Answer: B

Watch Video Solution

101. A positive charge is fixed at the origin of coordinates. An electri dipole which is free to move and rotate is placed on the positive x-axis. Its moment is directed away from the origin. The dipole will

A. move towards the origin

B. move away from the origin

C. rotate by $\pi / 2$

D. rotate by π

Answer: A

Watch Video Solution

102. An electric dipole is fixed at the origin of coordinates. Its moment is directed in the positive x- direction. A positive charge is moved from the point $(r, 0)$ to the point

$(-r, 0)$ by an external agent. In this process, the work done by the agent is

A. positive and inversely proportional to r

B. positive and inversely proportional to r^2

C. negative and inversely proportional to r

D. negatie and inversely proportional to r^2

Answer: D

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103. In a regular polygon of n sides, each corner is at a distance r from the centre. Identical charges are placed at $(n-1)$ corners. At the centre, the intensity is E and the potential is V. The ratio V/E has magnitude

A. rn

B. $r(n-1)$

C. $(n-1)/r$

D. $r(n-1)/n$

Answer: B

Watch Video Solution

104. A point charge Q is placed at the centre of an uncharged conducting shell. Let r be the distance of a point from Q. The point may lie either inside or outside the shell. The electric intensity at the point will be $Q/4\pi\varepsilon_0 r^2$ if the pont lies

A. inside the shell but not outside it

B. outside the shell but not inside it

C. either inside or outside the shell

D. close to either of the surfaces of the shell only

Answer: C::D

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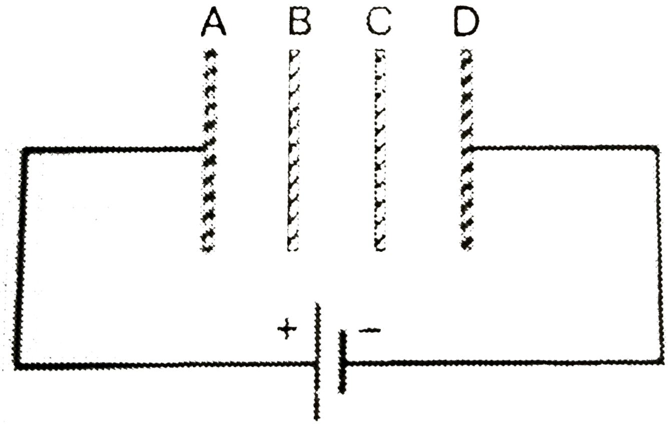

105.

A, B, C and D are identical, parallel , conducting plates arranged as shown, with equal separations between consecuting plates. A and D are connected to a cel. If B is now connected to C, which of the following will occur?

A. Only that some charge will flow through the cell.

B. Only that some charge will flow from B to C

C. Only that there will be no electric field between B and C

D. More than one of the above

Answer: D

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106. A is a nonconducting ring and B is a conducting ring. They have the same radius and equal amounts of charge. This is distributed nonuniformly on A and uniformly on B. X and Y are points on the axes o A and B respectively, at equal distances from their centres X and Y will have

A. the same potential and intensity

B. the same potential but different intensities

C. different potentials but the same intensity

D. different potentials and different intensities

Answer: B

Watch Video Solution

107. A drop of mercury has some charge. If it breaks up into a number of indentifal droplets, the electrostatic energy of the system will

A. increase

B. decrease

C. remain constant

D. any of the above depending on the number of droplets

Answer: B

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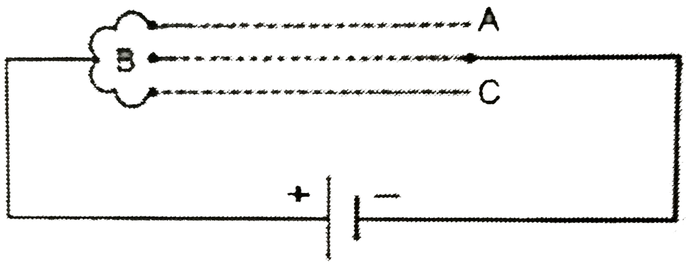
108. 

A, B, C are identical, parallel conducting plates arranged at equal separation B lies between A and C. A and C are joined together and connected to one terminal of a cell. B is joined to the other terminal of the cell. A and C now have charge Q each.B has charge q

A. $Q = -2q$

B. $q = -2Q$

C. $q = -Q$

D. $q = -3Q/2$

Answer: B

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109. A and B are two hollow, concentric, conducting spheres, with A inside B. A and B are given Q_1 and Q_2 respectively. If they are now joined by a thin wire, whtat charge will flow from A to B?

A. $Q_1 - Q_2$

B. $(Q_1 - Q_2)/2$

C. $(Q_1 + Q_2)/2$

D. None of these

Answer: D

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110. The strength of a dielectric is defined as the maximum electric intensity which it can withstand. A paralel-plate capacitor of plate area A on one side is filled with a dielectric of strength E and permittivity ε. The maximum charge which can be given to the capacitor is

A. εEA

B. EA / ε

C. $E / \varepsilon A$

D. $\varepsilon E / A$

Answer: A

View Text Solution

111. A parallel -plate air capacitor has capacity C. A dielectric slab of dielectric constant K, whose thickness is half of the air gap between the plates, is now inserted between the plates. The capacity of the capacitor will now be

A. $KC/2$

B. $2KC/(K+1)$

C. $2KC/(K-1)$

D. $C(K+1)/(K-1)$

Answer: B

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112. When two uncharged, conducting spheres of radius $0.1mm$ each collide 7 electrons get transferred from one to the ther. The potential difference between the spheres will be about

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

B. $2 \times 10^{-6} V$

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

D. $10^{-4} V$

Answer: C::D

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113. In a parallel -plate capacitor, the plates are kept vertical. The upper half of the space between the plates is filled with a dielectric with dielectric constant K and the lower half with a dielectric with dielectri constant K and the lower half with a dielectric with dielectric constant $2K$. The ratio of the charge density on the upper half of the plates to the charge density on the lower half of the plates will be equal to

A. 1

B. 2

C. $1/2$

D. $3/2$

Answer: C::D

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114. A parallel -plate capacitor, whose plates are kept horizotnal is charged from a cell and then isolated from it. A dielectric slab which can just fit in the gap between the plates is now inserted to fill exactly half of the gap and then left alone. Neglect gravity and friction. The slab will

A. remain stationary

B. move further into the gap

C. move out of the gap

D. either (b) and (c) depending on whether its dielectric constant is greater or less than 2

Answer: B

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115. 1000 identical drops of mercury are charged to potential of $1V$ each. They join to form a single drop. The potential of this drop will be

A. $0.01V$

B. $0.1V$

C. $10V$

D. $100V$

Answer: D

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116. Three charge $+Q, +Q$ and $-Q$ are placed at the corners of an equilateral triangle. The ratio of the force on a positive charge to the force on the negative charge will be equal to

A. 1

B. 2

C. $\sqrt{3}$

D. $1/\sqrt{3}$

Answer: D

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117. A simple pendulum has time period T. Charges are now fixed at the point of suspension of the pendulum and on the bob. If the pendulum continues to oscillate, its time period will now be

A. greater than T

B. equal to T

C. less than T

D. either (a) or (c) depending on whether the charges attract or repel each other

Answer: B

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118. A parallel -plate capacitor is connected to a cell. A sheet of dielectric and a metal sheet are now introduced between the plates of the capacitor, parallel to these plates. The electric intensity between the positive plate of the capcitor and the metal sheet is E_2, and between the metal sheet and the negatilve plate is E_3. Then

A. $E_1 = E_2 = E_3$

B. $E_1 = E_2 \neq E_3$

C. $E_1 \neq E_2 = E_3$

D. $E_1 \neq E_2 \neq E_3$

Answer: A

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