PHYSICS

BOOKS - SAI PHYSICS (TELUGU ENGLISH)

ELECTRIC CURRENT AND ELECTROSTATIC POTENTIAL

Mcq

1. The energy of a parallel plate capacitor when connected to a battery is E. With the battery still in connection, if the plates of the capacitor are separated so that the distance between them is twice the original distance, then the electrostatic energy becomes

A. 2E

B. $\frac{E}{4}$

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

D. 4E

Answer: (c)

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2. Two point charger $+8\mu$ and $+12\mu$ repel each other with a force of 48 N. When an additional charge of -10μ is given to each of these charges (the distance between the charges is unaltered) then the new force is

A. Repulsive force of 24 N

B. Attractive force of 24 N

C. Repulsive force of 2 N

D. Attractive force of 2 N

Answer: (d)

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3. Charges Q are placed at the ends of a diagonal of a square and charges q are placed at the other two corners. The condition for the net electric force on Q to be zero is

A. Q = $-2\sqrt{2}$q ,q being- ve

B. (b) Q = -$\frac{q}{2}$, q be -ve

C. (a) Q = $2\sqrt{2}$q ,q being- ve

D. q = 2q , q be -ve

Answer: (a)

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4. In the arrangement of capacitors shown in the figure, if each capacitor is 9 PF, then the effective capacitance between the points A

and B is

A. 10 PF

B. 15 PF

C. 20 PF

D. 5 PF

Answer: (b)

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

A. Q

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

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

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

Answer: (c)

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6. Two concentric hollow spherical shells have radii r and R(R >> r). A charge Q is distributed on them such that the surface charge densities are equal. The electric potential at the centre is

A. $Q\frac{R+r}{4}\pi\varepsilon_0\left(R^2+r^2\right)$

B. $Q\frac{R_2+r_2}{4}\pi\varepsilon_0(R+r)$

C. $\frac{Q}{R+r}$

D. Zero

Answer: (a)

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7. Two metal plates each of area 'A' form a parallel plate capacitor with air in between the plates. The distance between the plates is 'd'. A metal plate of thickness $\frac{d}{2}$ and of same area A is inserted between the plates to form two capacitors of capacitances C_1 and C_2 as shown in figure. If the effective çapacitance of the two capacitors is C' and the capacitance of the capacitor initially is C, then $\frac{C'}{C}$ is

A. 4

B. 2

C. 6

D. 1

Answer: (b)

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8. A parallel plate capacitor has a capacity 80×10^{-6} F, when airs present between the plates. The volume between the plates is then

completely filled with a dielectric slab of dielectric constant 20. The capacitor is now connected to a battery of 30 V by wires. The dielectric slab is then removed. Then, the charge that passes now through the wire is

A. 4.56×10^{-3} C

B. 25.3×10^{-3} C

C. 120×10^{-3} C

D. 125×10^{-3} C

Answer: (a)

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9. Two small spheres each having equal positive charge Q Coulomb) on each are suspended by two insulating strings of equal length L (metre) from a rigid hook (shown) in figure). The whole set up is taken into satellite where there is 'no gravity. The two balls are now held by electrostatic forces in horizontal position, the tension in each string is then

A. $\frac{Q^2}{16}\pi\varepsilon_0 L^2$

B. $\frac{Q^2}{8}\pi\varepsilon_0 L^2$

C. $\frac{Q^2}{4}\pi\varepsilon_0 L^2$

D. $\frac{Q^2}{2}\pi\varepsilon_0 L^2$

Answer: (a)

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10. A fully charged capacitor has a capacitance C. It is discharged through a small coil of resistance wire, embedded in block of specific heat s and mass m under thermally isolated

conditions. If the temperature of the block is raised by ΔT, the potential difference V across the capacitor initially is

A. $\left(2ms\Delta\frac{T}{C}\right)^2$

B. $\left(2ms\Delta\frac{T}{C}\right)^{\frac{1}{2}}$

C. $\left(2ms\Delta\frac{T}{C}\right)$

D. $2ms\Delta TC$

Answer: (b)

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11. Two identical condensers M and N are connected in series with a battery. The space between the plates of M is completely filled with a dielectric medium of dielectric constant 8 and a copper plate of thickness $\frac{d}{2}$ is introduced between the plates of N. (d is the distance between the plates). Then potential differences across M and N are, respectively, in the ratio

A. $1:4$

B. $4:1$

C. $3:8$

D. $1:6$

Answer: (a)

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12. The potential difference between two parallel plates is 10^4 V. If the plates are separated by 0.5 cm, the force on an electron between the plates is

A. $32 \times 10_{-13}$N

B. $0.32 \times 10_{-13}$N

C. $0.032 \times 10_{-13}$N

D. $3.2 \times 10_{-13}$N

Answer: (d)

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13. Two capacitors of capacities 1μF and C μF are connected in series and the combination is charged to a potential difference of 120 V. If

the charge on the combination is 80 μC, the energy stored in the capacitor of capacity C in μJ is

A. 1800

B. 1600

C. 14400

D. 7200

Answer: (b)

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14. A capacitor of capacity 0.1 μF connected in series to a resistor of 10 Mω is charged to a certain potential and then made to discharge through the resistor. The time in which the potential will take to fall to half its original value is (Given, $\log_{10} 2 = 0.3010$)

A. 2s

B. 0.693s

C. 0.5s

D. 1.0s

Answer: (b)

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15. The time constant of inductance coil is 3 ms. When a 90 ω resistance is joined in series, then the time constant becomes 0.5 ms. The inductance and the resistance of the coil are

A. 54 mH , 18ω

B. 14 mH , 42ω

C. 42 mH , 14ω

D. 14 mH , 60ω

Answer: (a)

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16. A proton, a neutron and an α-particle having thye same momentum, enters a region of uniform electric field between the parallel plates of a capacitor. The electric field is perpendicular to the initial path of the

particles. Then the ratio of deflections suffered by them is

A. $1:2:8$

B. $1:2:4$

C. $1:1:2$

D. None of these

Answer: (a)

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17. An infinitely long thin straight wire has uniform linear charge density of $\frac{1}{3}Cm^{-1}$ .Then, the magnitude of the electric intensity at'a point 18 cm away is

(given $\varepsilon_0 = 8.8 \times 10^{-12}C^2Nm^{-2}$)

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

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

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

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

Answer: (a)

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18. Two point charges-q and +q are located at points (0, 0,-a) and (0, 0, a) respectively. The electric potential at a point (0, 0, z), where z> a is

A. $q\frac{a}{4\pi\varepsilon_0 z^2}$

B. $q\frac{a}{4\pi\varepsilon_0 a}$

C. $2q\frac{a}{4\pi\varepsilon_0(z^2-a^2)}$

D. $2q\frac{a}{4\pi\varepsilon_0(z^2+a^2)}$

Answer: (c)

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19. A charge of $1\mu C$ is divided into parts such that their charges are in the ratio of 2: 3. These two charges are kept at a distance 1 m apart in vacuum. Then, the electric force between them (in N) is

A. 0.216

B. 0.00216

C. 0.0216

D. 2.16

Answer: (b)

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20. Two charges +q and-q are kept apart, Then at any point on the right bisector of line joining the two charges

A. The electric field strength is zero

B. The electric potential is zero

C. Both electric potential and electric field strength are zero

D. Both electric potential and electric field strength are non-zero

Answer: (a)

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21. Along the x-axis, three charges $\frac{q}{2}$, -q and $\frac{q}{2}$ and are placed at x = 0 ,x = a and x = 2a respectively. The resultant electric potential at a point P located at a distance r from the Charge $-q(a < \ < r)$ is (ε_0 is the permittivity of free space).

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

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

C. $q\frac{\frac{a^2}{4}}{4}\pi\varepsilon_0 r^3$

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

Answer: (b)

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22. Two unit negative charges placed on a straight line. A positive charge q is placed exactly at the mid point between these unit charges. If the system of these three charges is in equilibrium, the value of q (in C) is

A. 1

B. 0.75

C. 0.5

D. 0.25

Answer: (d)

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23. The bob of simple pendulum is hanging vertically down from a fixed identical bob by means of a string of length l. If both bobs are charged with a charge q each, time period of the pendulum is (ignore the radii of the bobs)

A. $2\pi\sqrt{\frac{1}{g}+\left(\frac{q^2}{l^2}m\right)}$

B. $2\pi\sqrt{\frac{1}{g}-\left(\frac{q^2}{l^2}m\right)}$

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

D. $2\pi\sqrt{\frac{1}{g}-\left(\frac{q^2}{l}\right)}$

Answer: (c)

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24. One end each of resistance, capacitor C and resistance 2r are connected together. The

other ends are respectively connected to the positive terminals of batteries. P, Q. R having respectively emf's E, E and 2E. The negative terminals of the batteries are then connected together. In this circuit, with steady current the potential drop across the capacitor is

A. $\frac{E}{3}$

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

C. $2\frac{E}{3}$

D. E

Answer: (a)

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25. A $4\mu F$ capacitor is charged by a 200 V supply. It is then disconnected from the supply . And is connected to another uncharged $2\mu F$ capacitor. How much electrostatic energy of the first capacitor is lost in the form of heat and electromagnetic radiation ?

A. 3.43×10^{-2}

B. 2.67×10^{-2}

C. 2.67×10^{-4}

D. 3.43×10^{-4}

Answer: (b)

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26. Two charges 2 C and 6 C are separated by a finite distance. If a charge of-4 C is added to each of them,the initial force of 12×10^3 N will change to

A. 4×10^3 (repulsion)

B. 4×10^2 (repulsion)

C. 6×10^3 (attraction)

D. 4×10^3 (attraction)

Answer: (d)

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27. A particle of mass 1×10^{-26} kg and charge 1.6×10^{-19} C travelling with a velocity $1.28 \times 10^6 ms^{-1}$ along the positive x-axis enters a region in which a uniform electric

field $\overrightarrow{E}$ and a uniform magnetic field on induction $\overrightarrow{B}$ are present. It $\overrightarrow{E} = -102.4 \times 10^3 \widehat{K} NC^{-1}$ and $B = 8 \times 10^{-2} \hat{j} Wbm^{-2}$, the direction of motion of the particle is

A. Along the positive x-axis

B. Along the negative x-axis

C. At 45^0 to the positive x-axis

D. At 135^0 to the positive x-axis

Answer: (a)

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28. The plates of a parallel plate capacitor are charged up to 200 V. A dielectric slab of thickness 4 mm is inserted between its plates. Then, to maintain the same potential difference between the plates of the capacitor, the distance between the plates increased by 3.2 mm. The dielectric constant of the dielectric slab is

A. 1

B. 4

C. 5

D. 6

Answer: (c)

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29. Three point charges IC, -2C and -2C are placed at the vertices of an equilateral triangle of side I m. The work done by an external force

to increase the separation of the charges to 2 m in joule is (ε_0 = Permittivity of air)

A. $\frac{1}{4}\pi\varepsilon_0$

B. $\frac{1}{8}\pi\varepsilon_0$

C. $\frac{1}{16}\pi\varepsilon_0$

D. Zero

Answer: (d)

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30. An infinite number of electric charges each equal to 5 nano coulombs are placed along x-axis at x = 1 cm, x-2 cm, x -4 cm, x = 8 cm,.. and so on. In this setup, if the consecutive charges have opposite sign, then the electric field in newton/coulomb at x =0 is

A. 12×10^4

B. 24×10^4

C. 36×10^4

D. 48×10^4

Answer: (c)

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31. A parallel plate capacitor of capacity C_0 is charged to a potential V_0. (i) The energy stored in the capacitor when the battery is disconnected and the plate separation is doubled is E_1.(ii) The energy stored in the capacitor when the charging battery is kept connected and the separation between the

capacitor plates is doubled is E_2.Then, $\frac{E_1}{E_2}$, value is

A. 4

B. $\frac{3}{2}$

C. 2

D. $\frac{1}{2}$

Answer: (a)

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32. An infinite number of electric charges each equal to 5 nano coulombs are placed along x-axis at x = 1 cm, x-2 cm, x -4 cm, x = 8 cm,.. and so on. In this setup, if the consecutive charges have opposite sign, then the electric field in newton/coulomb at x =0 is

A. 12×10^4

B. 24×10^4

C. 36×10^4

D. 48×10^4

Answer: (c)

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33. A body of mass 1g and carrying a charge 10^{-8}C passes from two points P and Q. P and Q are at electric potentials 600 V and 0 V respectively. The velocity of the body at Q is 20 cms^{-1}. It velocity in ms^{-1}at P is

A. $\sqrt{.028}$

B. $\sqrt{.056}$

C. $\sqrt{0.56}$

D. $\sqrt{5.6}$

Answer: (a)

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34. A parallel plate capacitor of capacity 100 μ F is charged by a battery of 50 V. The battery remains connected and if the plates of the capacitor are separated so that the distance between them becomes double the original

distance, the additional energy given by the battery to the capacitor in joule is

A. $\frac{125}{2} \times 10^{-3}$

B. 12.5×10^{-3}

C. 1.25×10^{-3}

D. 0.125×10^{-3}

Answer: (a)

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35. The time in second required to produce a potential difference of 20 V across a capacitor of 1000 μF when it is charged at the steady rate of 200 $\mu C / s$ is

A. 50

B. 100

C. 150

D. 200

Answer: (b)

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36. If the charge on a body is increased by 2 C, the energy stored in it increases by 21%. The original charge on the body in coulomb is

A. 10

B. 20

C. 30

D. 40

Answer: (b)

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37. Two electric charges of 9 μC and -3 μC are placed 0.16 m apart in air. There will be a point P at which electric potential is zero on the line joining two charges and in between them. The distance of P from 9 μC is

A. 0.14 m

B. 0.12 m

C. 0.08 m

D. 0.06 m

Answer: (b)

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38. A 20F capacitor is charged to 5 V and isolated. It is then connected in parallel with an uncharged 30 F capacitor. The decrease in the energy of the system will be

A. 25 j

B. 100 J

C. 125 J

D. 150 J

Answer: (d)

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39. There is a uniform electric field of strength $10^3 Vm^{-1}$ along y-axis. A body of mass 1 projected into the field from origin along the positive x-axis with a velocity 10 ms^{-1}, Its speed in ms^{-1} after 10 s is (Neglect gravitation)

A. 10

B. $5\sqrt{2}$

C. $10\sqrt{2}$

D. 20

Answer: (a)

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40. A body of capacity 4 μF is charged to 80 V and another body of capacity 6 μF is charged

to 30 V. When they are connected the energy lost by 4 uF capacitor is

A. 9.8 mJ

B. 4.6 mJ

C. 3.2 mJ

D. 2.5 mJ

Answer: (a)

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41. An infinite number of electric charges each equal to 5 nano coulombs are placed along x-axis at x = 1 cm, x-2 cm, x -4 cm, x = 8 cm,.. and so on. In this setup, if the consecutive charges have opposite sign, then the electric field in newton/coulomb at x =0 is

A. 12×10^4

B. 24×10^4

C. 36×10^4

D. 48×10^4

Answer: (c)

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42. A charged particle of mass 3×10^{-6} kg is held stationary in spacing in an electric field of strength 10^6 NC^{-1} directed vertically downwards. The charge on the particle is (`g = 10 ms^(-2))

A. $-20 \times 10^{-3} \mu C$

B. $-3 \times 10^{-5} \mu C$

C. $5 \times 10^{-5} \mu C$

D. $20 \times 10^{-5} \mu C$

Answer: (b)

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43. Electric charges of $1 \mu C, 1 \mu C$ and $2 \mu C$ are placed in air at the corners of A, B and C respectively of an equilateral triangle ABC having the length of the side 10 cm. The

resultant force of C is

$\left(\frac{1}{4}\pi\varepsilon_0 = 9 \times 10^9 N - \frac{m^2}{C^2}\right)$

A. 0.9 N

B. $1.8\sqrt{3}$N

C. 2.7 N

D. 3.6 N

Answer: (b)

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44. Two electric charges 12 μ C and -6μC are placed 20 cm apart in air, there will be a point P at which electric potential is zero on the line joining these two charges and out side excluding the region between them. The distance of P from -6 μC charge is

A. 0.1. m

B. 0.15 m

C. 0.20 m

D. 0.25 m

Answer: (c)

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45. The displacement r of a charge Q in an electric field $\overrightarrow{E} = c_1\hat{i} + c_2\hat{j} + c_3\hat{k}$ is $\overrightarrow{r} = a\hat{I} + b\hat{j}$ .The work done is

A. $Q(ac_1 + bc_2)$

B. $Q\sqrt{(ac_1)^2 + (bc_2)^2}$

C. $Q(c_1 + c_2)\sqrt{a^2 + b^2}$

D. $Q\left(\sqrt{c_2^2 + c_1^2}(a + b)\right.$

Answer: (a)

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46. Two charges 8 C and -6 C are placed at a distance of separation between them and exerts a force of magnitude F on each other. If a charge 8 C is added to each of these and they are brought nearer to by a distance d/3, the magnitude of force between them will be

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

B. $9\frac{F}{4}$

C. 6 F

D. $2\frac{F}{3}$

Answer: (c)

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47. The electric field intensity in air at a point 20 cm from a point charge Q coulombs is $4.5 \times 10^5 N/C$. The magnitude of Q is

A. $0.1\mu C$

B. $0.2\ \mu C$

C. $1\ \mu C$

D. $2\mu C$

Answer: (d)

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48. A parallel plate capacitor filled with a dielectric of relative permittivity 5 between its plates is charged to acquire an energy E and

isolated. If the dielectric is replaced by another of relative permittivity 2, its energy becomes

A. E

B. 0.4 E

C. 2.5 E

D. 6.25 E

Answer: (c)

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49. The charges +5 μC and +10 μC are placed 20 cm apart. The electric field at the mid point between the two charges is

A. 4.5×10^6 N/C directed towards + 5 μC

B. 4.5×10^6 N/C directed towards +10 μC

C. 13.5×10^6 N/C directed towards + 5 μC

D. 13.5×10^6 N/C directed towards + 10 μC

Answer: (a)

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50. A parallel plate condenser with oil between the plates (dielectric constant of oil K =2) has a capacitance C. If the oil is removed, the capacitance of the capacitor becomes

A. $\sqrt{2}C$

B. 2C

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

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

Answer: (d)

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

A. $+Q/4$

B. $+Q/2$

C. $-Q/2$

D. $-Q/4$

Answer: (d)

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52. The capacity of a parallel plate capacitor with no dielectric but with a separation 0.4 cm is 2 μF. The separation is reduced to half and it is filled with a dielectric of value 2.8. The final capacity of the capacitor is

A. 11.2 μF

B. 5.6 μF

C. 4.0 μF

D. 22.4 μF

Answer: (a)

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53. When a dielectric material is introduced between the plates of a charged condenser the electric field between the plates

A. Decreases

B. Increases

C. Does not changes

D. May increase or decrease

Answer: (a)

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54. A parallel plate condenser is charged and disconnected from the battery. If the plates of the capacitor are moved further apart by means of insulating handles

A. The charge in the capacitor becomes zero

B. The capacitance become infinite

C. The charge in the capacitor increases

D. The voltage across the plates increases

Answer: (d)

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55. An infinite number of charges of equal magnitude q, but of opposite sign are placed along the x-axis at x =1, x = 2, x=4, x = 8 and so on. The electric potential at the point x=0 due to these charges will be proportional to

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

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

C. $2\frac{q}{3}$

D. $3\frac{q}{2}$

Answer: (c)

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56. Two capacitors 2 μF and 4 μF are connected in series and a potential of 100 V is applied across the combination. Energy stored in the capacitors is

A. 0.0067 J

B. 0.067 J

C. 0.0033 J

D. 0.057 J

Answer: (a)

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57. The electric potential at the centre of a charged conductor is

A. Zero

B. Twice that on the surface

C. Half that on the surface

D. Same as on the surface

Answer: (d)

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58. The energy stored in a capacitor is given by

(V = Voltage, C = Capacitance, q = Charge)

A. qV

B. $\frac{1}{2}qV$

C. $1 - \frac{1}{2}CV$

D. $\frac{1}{2}\frac{q}{C}$

Answer: (b)

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59. A parallel plate capacitor has a capacitance of 10 μF without dielectric. A dielectric of dielectric constant 2 is used to fill exactly half the thickness between the plates. The capacitance in μF, now is

A. 10

B. 20

C. 15

D. 13.33

Answer: (d)

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60. When a dielectric slab of the same area of cross-section and thickness equal to $\frac{2}{3}$ of the separation is introduced between the plates of a parallel plate capacitor, its capacitance becomes 2.25 times the original value. The

dielectric constant of the material of the slab is

A. 1.5

B. 4.5

C. 5

D. 6

Answer: (d)

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61. In a parallel plate air capacitor of capacitance 4 F if the lower half of air space is filled with a material of dielectric constant 3, its capacitance changes to

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

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

C. 8 F

D. 12 F

Answer: (c)

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62. A charge + 2 μC is placed at x = 0 and a charge of - 32 μC at x = 60 cm where must a third charge + Q be placed on the x-axis such that it experiences no force? The distance of the point is

A. 20 cm left

B. 20 cm right

C. 30 cm left

D. 30 cm right

Answer: (a)

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63. If 3 capacitors of values 1, 2 and 3 μF are available, the maximum and minimum values of capacitances one can obtain by different combinations of the 3 capacitors together are respectively

A. $\left(\frac{6}{5}\right)\mu$ F

B. $\left(\frac{6}{11}\right)\mu$ F

C. $\left(\frac{11}{6}\right)\mu$ F

D. $\left(\frac{11}{8}\right)\mu$ F

Answer: (b)

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64. A 2μF condenser is charged to 500 V and then the plates are joined through a resistance. The heat produced in the resistance (in joule) is

A. 0.10 J

B. 0.15 J

C. 0.25 J

D. 0.30 J

Answer: (c)

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65. A charged bead is capable of sliding freely through a string held vertically in tension. An electric field is applied parallel to the string, so

that the bead stays at rest at middle of the string. If the electric field is switched off momentarily and switched on

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

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

C. The bead moves downwards with constant acceleration till it reaches the

bottom of the string

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

Answer: (a)

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66. A charge q is placed at the centre of the line joining two equal charges Q to establish

equilibrium. The system of 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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67. A parallel plate condenser is charged and disconnected from the battery. If the plates of the capacitor are moved further apart by means of insulating handles

A. The charge in the capacitor becomes zero

B. The capacitance becomes infinite

C. The capacitance in increases

D. The voltage across the plates increases

Answer:

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68. Five equal capacitors connected in series have resultant capacitance of 4 μF. The total energy stored in these when these are connected in parallel and charged to 400 V, is

A. 1J

B. 8J

C. 16J

D. 4J

Answer: (b)

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69. If 4×10^{20} eV of energy is required to move a charge of 6.25 C between two points, the potential difference between them is

A. 10.24 V

B. 24.10 V

C. 14.50 V

D. 5.12 V

Answer: (a)

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