TEMPZ ACADEMY (A UNIT OF THECOS LTD) ZEAL TO TRIUMPH

NEET PHYSICS 2018-19 - Chennai

Test ID : 043 **Test date: 23.04.2019**

Number of questions: 60 **Time**: 2HRS

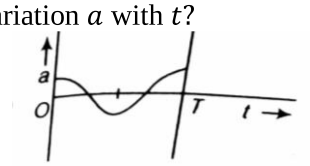
Name: ________________________________

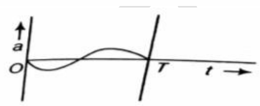
ID No: ____________________

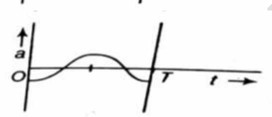
Negative Marks : 4 marks for correct attempt & 1 mark deducted for every wrong attempt.

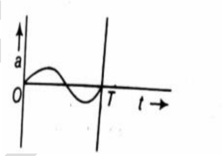
1. A particle is executing a simple harmonic motion. Its maximum acceleration is α and maximum velocity is β. Then, its time period of vibration will be
   a) $\frac{\beta^2}{\alpha^2}$
   b) $\frac{\alpha}{\beta}$
   c) $\frac{\beta^2}{\alpha}$
   d) $\frac{2\pi\beta}{\alpha}$

2. The oscillation of a body on a smooth horizontal surface is represented by the equation, where ,$X = A\cos(\omega t)$
   $X =$ displacement at time t
   $\omega =$ frequency of oscillation
   Which one of the following graphs shows correctly the variation a with t?

   a) 

   b) 

   c) 

   d) 

   Here , a =acceleration at time t
   $T =$ Time period

3. A point performs simple harmonic oscillation of period T and the equation of motion is given by x = $a\sin(\omega t + \frac{\pi}{6})$. After the elapse of what fraction of the time period, the velocity of the point will be equal to half of its maximum velocity?
   a) $\frac{T}{8}$
   b) $\frac{T}{6}$
   c) $\frac{T}{3}$
   d) $\frac{T}{12}$

4. A particle starts simple harmonic motion from the mean position. Its amplitude is a and the time period is T . What is its displacement when its speed is half of its maximum speed?
   a) $\frac{\sqrt{2}}{3}$ a
   b) $\frac{\sqrt{3}}{2}$ a
   c) $\frac{2}{\sqrt{3}}$ a
   d) $\frac{a}{\sqrt{2}}$ a

5. A particle, with resorting force proportional to displacement and resisting force proportional to velocity is subjected to a force F sin ωt. If the amplitude of the particle is maximum for $\omega = \omega_1$, and the energy of the particle is maximum for $\omega = \omega_2$, then
   a) $\omega_1 = \omega_0$ and $\omega_2 \neq \omega_0$
   b) $\omega_1 = \omega_0$ and $\omega_2 = \omega_0$
   c) $\omega_1 \neq \omega_0$ and $\omega_2 = \omega_0$
   d) $\omega_1 \neq \omega_0$ and $\omega_2 \neq \omega_0$

6. A mass m is suspended from the two coupled springs connected in series. The force constant for springs are k_1 and k_2 . The time period of the suspended mass will be

a) $T = 2\pi\sqrt{\frac{m}{k_1 - k_2}}$

b) $T = 2\pi\sqrt{\frac{mk_1 + k_2}{k_1 + k_2}}$

c) $T = 2\pi\sqrt{\frac{m}{k_1 + k_2}}$

d) $T = 2\pi\sqrt{\frac{m(k_1 + k_2)}{k_1 k_2}}$

7. The angular velocity and the amplitude of a simple pendulum is ω and $a$respectively. At a displacement x from the meat position, if its kinetic energy is T and potential energy is U, then the ratio of T to U is

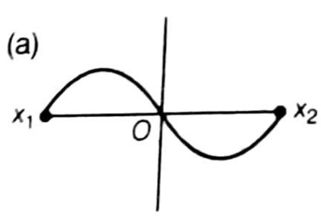
a) $\left(\frac{a^2 - x^2\omega^2}{x^2\omega^2}\right)$

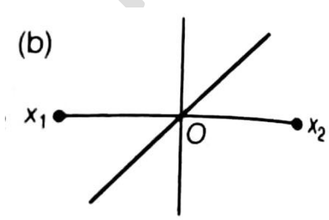
b) $\frac{x^2\omega^2}{(a^2 - x^2\omega^2)}$

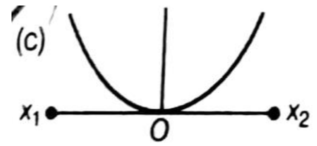
c) $\frac{(a^2 - x^2)}{x^2}$

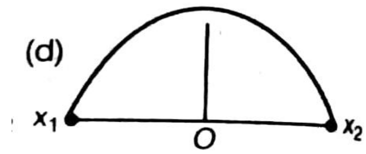
d) $\frac{x^2}{(a^2 - x^2)}$

8. A particle of mass m oscillates with simple harmonic motion between points x_1 and x_2, the equilibrium position being O . Its potential energy is plotted. It will be as given below in the graph

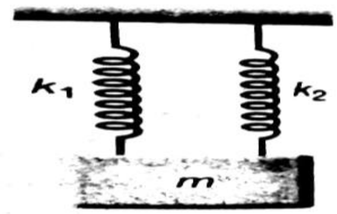








9. A mass is suspended separately by two springs of spring constants k_1 and k_2 in successive order. The time periods of oscillations in the two cases are T_1 and T_2 respectively. If the same mass be suspended by connecting the two springs in parallel, (as shown in figure) then the time period of oscillations is T. The correct relation is



a) $T^2 = T_1^2 + T_2^2$
b) $T^{-2} = T_1^{-2} + T_2^{-2}$
c) $T^{-1} = T_1^{-1} + T_2^{-1}$
d) $T = T_1 + T_2$

10. A body of mass m is attached to the lower end of a spring whose upper end is fixed. The spring has negligible mass. When the mass m is slightly pulled down and released, it oscillates with a time period of 3 s. When the mass m is increased by 1 kg, the time period of oscillations becomes 5 s. The value of m in kg is

a) $\frac{3}{4}$

b) $\frac{4}{3}$

c) $\frac{16}{9}$

d) $\frac{9}{16}$

11. A particle executes linear simple harmonic motion with an amplitude of 3 cm. When the particle is at 2 cm from the mean position, the magnitude of its velocity is equal to that of its acceleration. Then, its time period in seconds is
   a) $\frac{\sqrt{5}}{\pi}$
   b) $\frac{\sqrt{5}}{2\pi}$
   c) $\frac{4\pi}{\sqrt{5}}$
   d) $\frac{2\pi}{\sqrt{3}}$

12. A rectangular block of mass m and area of cross-section A floats in a liquid of density ρ. If it is given a small vertical displacement from equilibrium, it undergoes oscillation with a time period T. Then
   a) $T \propto \sqrt{\rho}$
   b) $T \propto \frac{1}{\sqrt{A}}$
   c) $T \propto \frac{1}{\rho}$
   d) $T \propto \frac{1}{\sqrt{m}}$

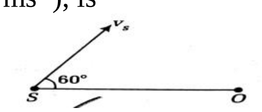
13. Two springs of spring constants k_1 and k_2 are joined in series. The effective spring constant of the combination is given by
   a) $\sqrt{k_1 k_2}$
   b) $\frac{(k_1 + k_2)}{2}$
   c) $k_1 + k_2$
   d) $\frac{k_1 k_2}{(k_1 + k_2)}$

14. A simple pendulum is suspended from the roof of a trolley which moves in a horizontal direction with an acceleration $\propto$, then the time period is given by $T = 2\pi\sqrt{\left(\frac{l}{g}\right)}$, where g is equal to
   a) g
   b) $g - \propto$
   c) $g + \propto$
   d) $\sqrt{(g^2 + \propto^2)}$

15. Two simple pendulums of length 0.5 m and 0.2 m respectively are given small linear displacement in one direction at the same time. They will again be in the same phase when the pendulum of shorter length has completed oscillations
   a) 5
   b) 1
   c) 2
   d) 3

16. A siren emitting a sound of frequency 800 Hz moves away from an observer towards a cliff at a speed of 15 ms $^{-1}$. Then, the frequency of sound that the observer hears in the echo reflected from the cliff is (Take, velocity of sound in air = 330 ms $^{-1}$)
   a) 800 Hz
   b) 838 Hz
   c) 885 Hz
   d) 765 Hz

17. A source of sound S emitting waves of frequency 100 Hz and an observer O are located at some distance from each other. The source is moving with a speed of 19.4 ms $^{-1}$ at an angle of 60^0 with the source observer line as shown in the figure. The observer is at rest. The apparent frequency observed by the observer (velocity of sound in air is 330 ms^{-1}), is



   a) 100 Hz
   b) 103 Hz
   c) 106 Hz
   d) 97 Hz

18. When a string id divided into three segments of lengths l_1, l_2 and l_3, the fundamental frequencies of these three segments are v_1, v_2 and v_3 respectively. The original fundamental frequency (v) of the string is
   a) $\sqrt{v} = \sqrt{v_1} + \sqrt{v_2} + \sqrt{v_3}$
   b) $v = v_1 + v_2 + v_3$
   c) $\frac{1}{v} = \frac{1}{v_1} + \frac{1}{v_2} + \frac{1}{v_3}$
   d) $\frac{1}{\sqrt{v}} = \frac{1}{\sqrt{v_1}} + \frac{1}{\sqrt{v_2}} + \frac{1}{\sqrt{v_3}}$

19. Sound waves travel at 350 m/s through a warm air and at 3500 m/s through brass. The wavelength of a 700 Hz acoustic wave as it enters brass from warm air
   a) increases by a factor 20
   b) increased by a factor 10
   c) decreased by a factor 20
   d) decreases by a factor 10

20. Two strings A and B have lengths l_A and l_B and carry masses M_A and M_B at their lower ends, the upper ends being supported by rigid supports. If n_A and n_B are the frequencies of their vibrations and
   a) $l_A = 4l_B$, regardless of masses
   b) $l_B = 4l_A$, regardless of masses
   c) $M_A = 2M_B$, $l_A = 2l_B$
   d) $M_B = 2M_A$, $l_B = 2l_A$

21. A wave in a string has an amplitude of 2cm. The wave travels in the positive direction of x- axis with a speed of 128 ms $^{-1}$ and it is noted that 5 complete waves fit in 4 m length of the string. The equation describing the wave is
   a) y = (0.02) m sin (7.85 × + 1005t)
   b) y = (0.02) m sin (15.7 × - 2010t)
   c) y = (0.02) m sin (15.7 × + 2010t)
   d) y = (0.02) m sin (7.85 × - 1005t)

22. Two cars moving in opposite directions approach each other with speed of 22 m/s and 16.5 m/s respectively. The driver of the first car blows a horn having a frequency 400 Hz. The frequency heard by the driver of the second car is [velocity of sound 340 m/s]
   a) 350 Hz
   b) 361 Hz
   c) 411 Hz
   d) 448 Hz

23. The two nearest harmonics of a tube closed at one end and open at other end are 220 Hz and 260 Hz. What is the fundamental frequency of the system ?
   a) 10 Hz
   b) 20 Hz
   c) 30 Hz
   d) 40 Hz

24. Three sound waves of equal amplitudes have frequencies (n -1), n,(n+1). They superimpose to give beats. The number of beats produced per second will be
   a) 1
   b) 4
   c) 3
   d) 2

25. The number if possible natural oscillations of air column in a pipe closed at one end of length 85 cm whose frequencies lie below 1250 Hz are (velocity of sound = 340 ms $^{-1}$)
   a) 4
   b) 5
   c) 7
   d) 6

26. Equation of progressive wave is given by $y = 4\sin\left[\pi\left(\frac{t}{5} - \frac{x}{9}\right) + \frac{\pi}{6}\right]$ Then, which of the following is correct?
   a) $v = 5$ cm
   b) $\lambda = 18$ cm
   c) $a = 0.04$ cm
   d) $f = 50$ Hz

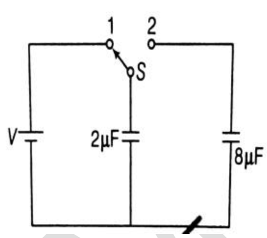
27. A uniform rope of length L and mass m_1 hangs vertically from a rigid support. A block of mass m_2 is attached to the free end of the rope. A transverse pulse of wavelength λ_1 is produced at the lower end of the rope. The wavelength of the pulse when it reaches the top of the rope is λ_2. The ration λ_2/λ_1 is
   a) $\sqrt{\frac{m_1 + m_2}{m_2}}$
   b) $\sqrt{\frac{m_2}{m_1}}$
   c) $\sqrt{\frac{m_1 + m_2}{m_1}}$
   d) $\sqrt{\frac{m_1}{m_2}}$

28. The second overtone of an open organ pipe has the same frequency as the first overtone of a closed pipe L metre long. The length of the open pipe will be
   a) L
   b) $2L$
   c) $L/2$
   d) $4L$

29. A point source emits sound equally in all directions in a non-absorbing medium. Two points P and Q are at distance of 2m and 3m respectively from the source. The ratio of the intensities of the waves at P and Q is
   a) 9 : 4
   b) 2 : 3
   c) 3 : 2
   d) 4 : 9

30. The phase difference between two waves, represented by
   $y_1 = 10^{-6} \sin\left\{100\,t + \left(\frac{x}{50}\right) + 0.5\right\}$ m
   $y_2 = 10^{-6} \cos\left\{100\,t + \left(\frac{x}{50}\right) + 0.5\right\}$ m, where, x is expressed in metre and t is expressed in second, is approximately
   a) 1.07 rad
   b) 2.07 rad
   c) 0.5 rad
   d) 1.5 rad

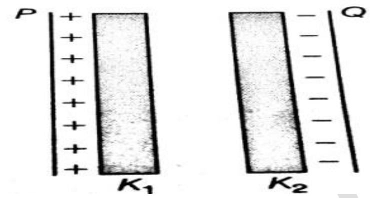
31. A capacitor of 2 μF is charged as shown in the figure. When the switch S is turned to position 2, the percentage of its stored energy dissipated is



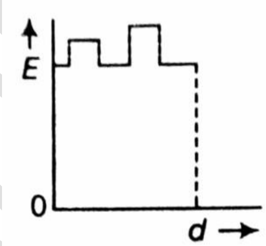
   a) 20%
   b) 75%
   c) 80%
   d) 0%

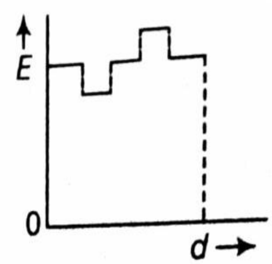
32. The electric field in a certain region is acting radially outward and is given by $E = Ar$. A charge contained in a sphere if radius 'a' centred at the origin of the field′ will be given by
   a) $4\pi\varepsilon_0 A a^2$
   b) $A\varepsilon_0 a^2$
   c) $4\pi\varepsilon_0 A a^3$
   d) $\varepsilon_0 A a^3$

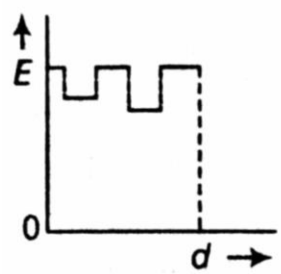
33. Two thin dielectric slabs of dielectric constants K_1 and K_2 ($K_1 < K_2$) are inserted between plates of a parallel plate capacitor, as shown in thefigure.

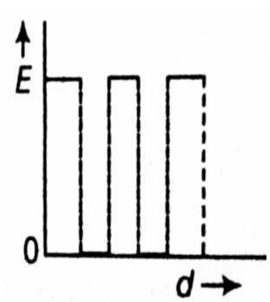


The variation of electric field E between the plates with distance d as measured from plate P is correctly shown by

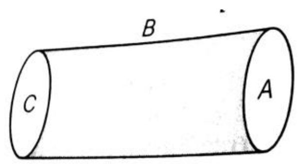
a)


b)


c)


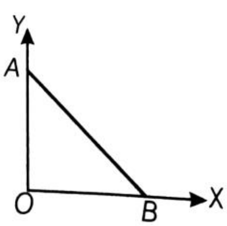
d)


34. A hollow cylinder has a charge q coulomb within it. If ϕ is the electric flux in unit of voltmeter associated with the curved surface B, the flux linked with the plane surface A in unit of voltmeter will be



a) $\frac{1}{2}\left(\frac{q}{\varepsilon_0} - \phi\right)$
b) $\frac{q}{2\varepsilon_0}$
c) $\frac{\phi}{3}$
d) $\frac{q}{\varepsilon_0} - \phi$

35. As per this diagram a point charge $+q$ is placed at the origin O. Work done in taking another point charge $-Q$ from the point A [coordinates $(0, a)$] to another point B [coordinates $(0, a)$] along the straight path AB is



a) Zero
b) $\left[\frac{-qQ}{4\pi\varepsilon_0}\ \frac{1}{a^2}\right]\sqrt{2}$ a
c) $\left[\frac{qQ}{4\pi\varepsilon_0}\ \frac{1}{a^2}\right]\frac{a}{\sqrt{2}}$
d) $\left[\frac{qQ}{4\pi\varepsilon_0}\ \frac{1}{a^2}\right]\sqrt{2}$ a

36. Point charges $+4q, -q$ and $+4q$ are kept on the x- axis at points $x = 0$, $x = a$ and $x = 2a$, respectively. Then,
a) only $-q$ is in stable equilibrium
b) None of the charges is in equilibrium
c) all the charges are in unstable equilibrium
d) all the charges are in stable equilibrium

37. A capacitor is charges by a battery. The battery is removed and another identical uncharged capacitor is connected in parallel. The total electrostatic energy of resulting system
a) increases by a factor of 4
b) decreases by a factor of 2
c) remains the same
d) increases by a factor of 2

38. An electric dipole is placed at an angle of 30^0 with an electric field intensity 2×10^5 N/C. It experiences a torque equal to 4 Nm. The charge on the dipole, if the dipole length is 2 cm, is
a) 8 mC
b) 2 mC
c) 5 mC
d) 7 μC

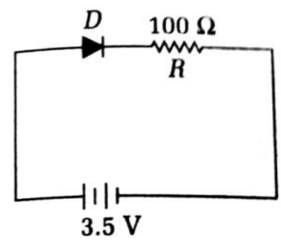
39. Suppose the charge of a proton and an electron differ slightly. One of them is $-e$ and the other is $(e + \Delta e)$. If the net of electrostatic force and gravitational force between two hydrogen atoms placed at a distance d (much greater than atomic size) apart is zero, then Δe is of the order [Given mass of hydrogen, m_h = 1.67×10^{-27} kg]
a) 10^{-20} C
b) 10^{-23} C
c) 10^{-37} C
d) 10^{-47} C

40. A small signal voltage $V(t) = V_0$ sin ωt is applied across an ideal capacitor C
   a) over a full cycle the capacitor C does not consume any energy from the voltage source
   b) current $l(t)$ is in phase with voltage $V(t)$
   c) current $l(t)$ leads voltage $V(t)$ by 180^0
   d) current $l(t)$, lags voltage $V(t)$ by 90^0

41. A parallel plate air capacitor of capacitance C is connected to a cell of emf V 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 energy stored in the capacitor decreases K times
   c) The change in energy stored is $\frac{1}{2}CV^2\left(\frac{1}{K} - 1\right)$
   d) The charge on the capacitor is not conserved

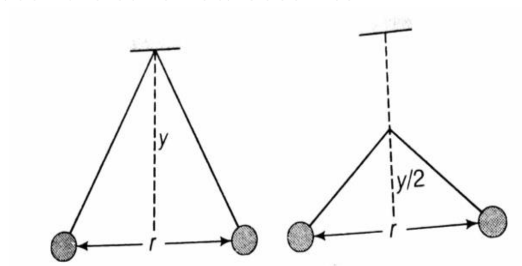
42. If potential (in volts) in a region is expressed as $V(x, y, z) = 6xy - y + 2yz$, the electric field (in N/C) at point (1,1,0) is
   a) $-\left(3\hat{\imath} + 5\hat{\jmath} + 3\hat{k}\right)$
   b) $-\left(6\hat{\imath} + 5\hat{\jmath} + 2\hat{k}\right)$
   c) $-\left(2\hat{\imath} + 3\hat{\jmath} + \hat{k}\right)$
   d) $-\left(6\hat{\imath} + 9\hat{\jmath} + \hat{k}\right)$

43. In the given figure, a diode D is connected to an external resistance R = 100 Ω and an e.m.f of 3.5 V. If the barrier potential developed across the diode is 0.5 V, the current in the circuit will be



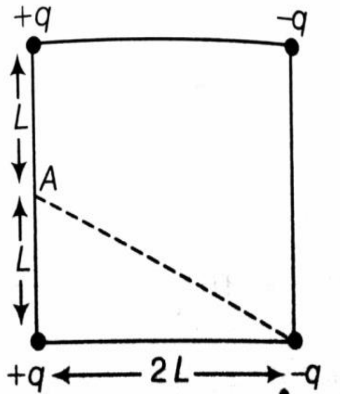
   a) 30 mA
   b) 40 mA
   c) 20 mA
   d) 35 Ma

44. Two pith balls carrying equal charges are suspended from a common point by strings of equal length, the equilibrium separation between them is r. Now, the strings are rigidly clamped at half the height. The equilibrium separation between the balls now becomes



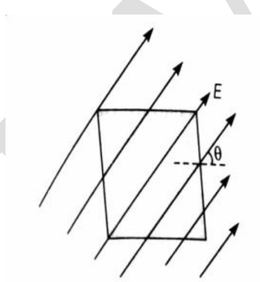
   a) $\left(\frac{1}{\sqrt{2}}\right)^2$
   b) $\left(\frac{r}{\sqrt{2}}\right)$
   c) $\left(\frac{2r}{\sqrt{3}}\right)$
   d) $\left(\frac{2r}{3}\right)$

45. Four electric charges $+q$, $+q, -q$ and $-q$ are placed at the corners of a square of side $2\ L$ (see figure). The electric potential at point A, mid-way between the two charges $+q$ and $+q$ is



a) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1+\frac{1}{\sqrt{5}}\right)$
b) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1-\frac{1}{\sqrt{5}}\right)$
c) zero
d) $\frac{1}{4\pi\varepsilon_0}\frac{2q}{L}\left(1+\sqrt{5}\right)$

46. A square surface of side L metre in the plane of the paper is placed in a uniform electric field E (V/m) acting along the same place at an angle 0 with the horizontal side of the square as shown in figure. The electric flux linked to the surface in unit of V-m, is

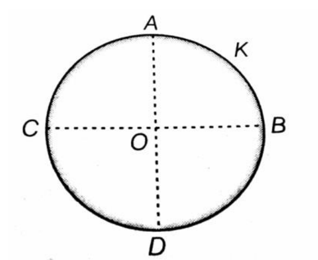


a) EL^2
b) $EL^2 \cos 0$
c) $EL^2 \sin 0$
d) 0

47. A series combination of n_1 capacitors, each of value C_1, is charged by a source of potential difference $4\ V$. When another parallel combination of n_2 capacitors, each of value C_2 is charged by a source of potential difference V, it has the same (total) energy stored in it, as the first combination has. The value of C_2, in terms of C_1, is then

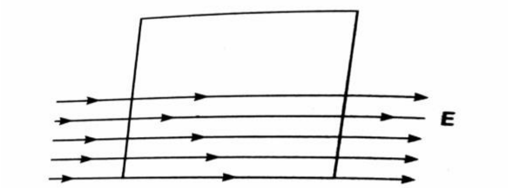
a) $\frac{2C_1}{n_1 n_2}$
b) $16\frac{n_2}{n_1}C_1$
c) $2\frac{n_2}{n_1}C_1$
d) $\frac{16C_1}{n_1 n_2}$

48. Three concentric spherical shells have radii a, b and $c (a < b < c)$ and have surface charge densities $\sigma, -\sigma$ and σ respectively. If V_A, V_B and V_C denote the potentials of the three shells, then for $c = a + b$, we have



a) $V_C = V_A \neq V_B$
b) $V_C = V_B \neq V_A$
c) $V_C \neq V_B \neq V_A$
d) $V_C = V_B = V_A$

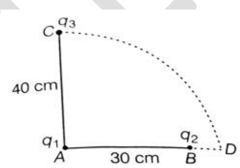
49. A square surface of side L metre is in the plane of the paper. A uniform electric field E (V/m), also in the plane of the paper, is limited only to the lower half of the square surface, (see figure). The electric flux in SI units associated with the surface is



a) $\frac{EL^2}{(2\varepsilon_0)}$
b) $\frac{EL^2}{2}$
c) zero
d) EL^2

50. A bullet of mass 2 g is having a charge of 2 μ C. Through what potential difference must it be accelerated, stating from rest, to acquire a speed of 10 m/s?
a) 5 kV
b) 50 kV
c) 5 V
d) 50 V

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



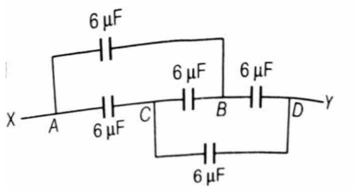
a) 8 q_2
b) 8 q_1
c) 6 q_2
d) 6 q_1

52. Three point charges $+q, -2q$ and $+q$ are placed at points $(x = 0, y = a, z = 0)$, $(x = 0, y = 0, z = 0)$ and $(x = a, y = 0, z = 0)$, respectively. The magnitude and direction of the electric dipole moment vector of this charge assembly are
a) $\sqrt{2}\ qa$ along $+y$ direction
b) $\sqrt{2}\ aq$ along the line joining points $(x = 0,\ y = 0,\ z = 0)$ and $(x = a,\ y = a,\ z = 0)$
c) qa along the line joining points $(x = 0,\ y = 0,\ z = 0)$ and $(x = a,\ y = a,\ z = 0)$
d) $\sqrt{2}\ aq$ along $+x$ direction

53. An electron is moving round the nucleus of a hydrogen atom in a circular orbit of radius r. The coulomb force F between the two is
a) $k\frac{e^2}{r^3}$ r
b) $-k\frac{e^2}{r^3}$ r
c) $k\frac{e^2}{r^3}\hat{r}$
d) $-k\frac{e^2}{r^3}\hat{r}$ (where , $k = \frac{1}{4\pi\varepsilon_0}$)

54. There is an electric field E in x -direction. If the work done on moving a charge of 0.2 C through a distance of 2 m along a line making an angle 60^0 with x-axis is 4 J, then what is the value of E?
a) 3 N/C
b) 4 N/C
c) 5 N/C
d) 20 N/C

55. The effective capacitance between points X and Y of figure shown is



a) 6 μF
b) 12 μF
c) 18 μF
d) 24 μF

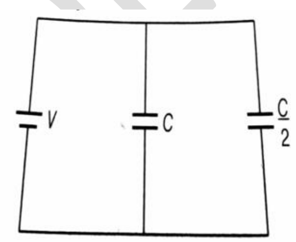
56. An electric dipole, consisting of two opposite charges of 2×10^{-6}C each separated by a distance 3 cm is placed in an electric field of 2×10^{5} N/C. Torque on the dipole is
a) 12×10^{-1} N-m
b) 12×10^{-2} N-m
c) 12×10^{-3} N-m
d) 12×10^{-4} N-m

57. A point Q lies on the perpendicular bisector of an electric dipole of dipole moment p. If the distance of Q from the dipole is r, (much larger then 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}

58. A charged wire is bent in the form of a semicircular arc of radius a. If charge per unit length is λ coulomb/metre, the electric field at the centre O is
a) $\frac{\lambda}{2\pi a^2 \varepsilon_0}$
b) $\frac{\lambda}{4\pi^2 \varepsilon_0 a}$
c) $\frac{\lambda}{2\pi \varepsilon_0 a}$
d) zero

59. A charge $q\mu$C is placed at the centre of a cube of a side 0.1 m, then the electric flux diverging from each face of the cube is
a) $\frac{q \times 10^{-6}}{24\varepsilon_0}$
b) $\frac{q \times 10^{-4}}{\varepsilon_0}$
c) $\frac{q \times 10^{-6}}{6\varepsilon_0}$
d) $\frac{q \times 10^{-4}}{12\varepsilon_0}$

60. Two condensers, one of capacity C and the other of capacity $\frac{C}{2}$, are connected to a V volt battery, as shown.



The work done in charging fully both the condensers is

a) $2CV^2$
b) $\frac{1}{4}CV^2$
c) $\frac{3}{4}CV^2$
d) $\frac{1}{2}CV^2$