Competishun

52/6, Opposite Metro Mas Hospital, Shipra Path, Mansarovar

Date: 26/08/2024

Time: 3 hours **Max. Marks:** 300

PRAVEEN-2 (24-25)_MCT-3

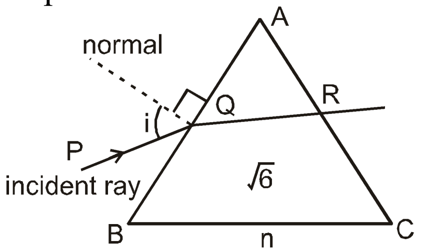
Physics

Single Choice Question

Q1 A loaded vertical spring executes SHM with period of 4s. The difference between the kinetic energy and the potential energy of this system oscillates with a period of

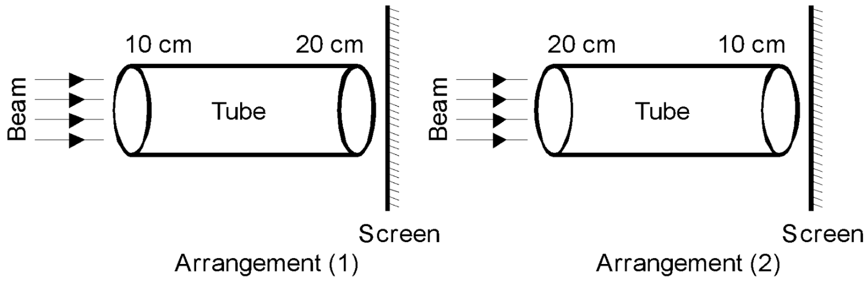
a) 8s **b)** 1s **c)** 2s **d)** 4s

Q2 A prism of angle $\angle BAC = 45°$ and refractive index $\sqrt{6}$ is surrounded by medium of refractive index n. A ray of light PQ is incident on side AB of prism. The refracted ray QR is incident on side AC. The angle of incidence of ray PQ is i such that $0 \leq i \leq 90°$. Then the possible value of n such that the ray suffers no deviation by face AC of prism is.



a) $\sqrt{2}$ **b)** 1.5 **c)** $\frac{\sqrt{3}}{2}$ **d)** 2.5

Q3 A tube of length 30 cm has its inner lateral surface which is completely absorbing. Two lenses of focal lengths 10 cm and 20 cm are fixed at the ends of the tube. For same beam, intensities of spots on screen are I_1 and I_2 for arrangement (1) and arrangement (2) respectively. $\frac{I_1}{I_2}$ equals

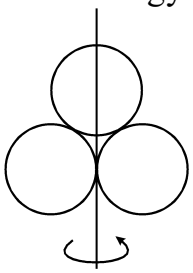


a) 1 **b)** 16 **c)** $\frac{1}{16}$ **d)** 0.25

Q4 A charge (-2Q) is distributed uniformly on a spherical balloon of radius R. Another point charge (+Q) is situated at the centre of the balloon. The balloon is now inflated to twice the radius. Neglecting the elastic energy involved in the process, the change in total electric energy of the system is

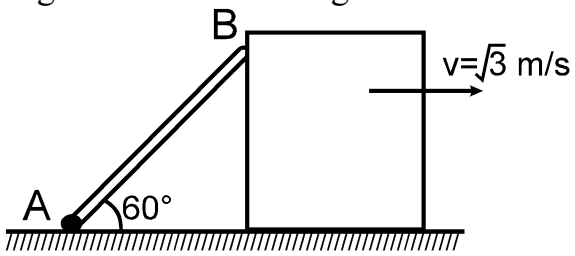
a) $\frac{-Q^2}{2\pi\varepsilon_0 R}$ **b)** $\frac{-Q^2}{4\pi\varepsilon_0 R}$ **c)** $\frac{+Q^2}{4\pi\varepsilon_0 R}$ **d)** zero

Q5 Three rings each of mass m and radius r are so placed that they touch each other. The radius of gyration of the system about the axis as shown in the figure is :



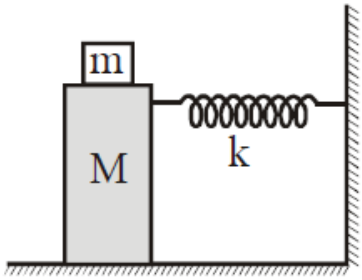
a) $\sqrt{\frac{5}{3}}$ r **b)** $\sqrt{\frac{5}{6}}$r **c)** $\sqrt{\frac{7}{3}}$ r **d)** $\sqrt{\frac{7}{6}}$r

Q6 A rod AB is shown in figure. End A of the rod is fixed on the ground. Block is moving with velocity $\sqrt{3}$ m/s towards right. The velocity of end B of rod when rod makes an angle of 60° with the ground is:



a) $\sqrt{3}$m/s **b)** 2 m/s **c)** $2\sqrt{3}$ m/s **d)** 3 m/s

Q7 In the given figure, a mass M is attached to a horizontal spring which is fixed on one side to a rigid support. The spring constant of the spring is k. The mass oscillates on a frictionless surface with time period T and amplitude A. When the mass is in equilibrium position, as shown in the figure, another mass m is gently fixed upon it. The new amplitude of oscillation will be :



a) $A\sqrt{\frac{M-m}{M}}$ **b)** $A\sqrt{\frac{M}{M+m}}$ **c)** $A\sqrt{\frac{M+m}{M}}$ **d)** $A\sqrt{\frac{M}{M-m}}$

Q8 For point charges –q, +q, +q and –q are placed on y-axis at y = –2d, y = –d, y = +d and y =+2d, respectively. The magnitude of the electric field E at a point on the x-axis at x = D, with D >> d, will behave as:

a) $E \propto \frac{1}{D^3}$ **b)** $E \propto \frac{1}{D}$ **c)** $E \propto \frac{1}{D^4}$ **d)** $E \propto \frac{1}{D^2}$

Q9 Consider the force F on a charge ‘q’ due to a uniformly charged spherical shell of radius R carrying charge Q distributed uniformly over it. Which one of the following statements is true for F, if ‘q’ is placed at distance r from the centre of the shell ?

a) $F = \frac{1}{4\pi\varepsilon_0}\frac{Qq}{r^2}$ for all r

b) $\frac{1}{4\pi\varepsilon_0}\frac{qQ}{R^2} > F > 0$ for $r < R$

c) $F = \frac{1}{4\pi\varepsilon_0}\frac{Qq}{r^2}$ for $r > R$

d) $F = \frac{1}{4\pi\varepsilon_0}\frac{Qq}{R^2}$ for $r < R$

Q10 A person of mass M is, sitting on a swing of length L and swinging with an angular amplitude θ_0. If the person stands up when the swing passes through its lowest point, the work done by him, assuming that his centre of mass moves by a distance l (l<<L), is close to :

a) Mgl

b) $Mgl(1+\theta_0^2)$

c) $Mgl\left(1+\frac{\theta_0^2}{2}\right)$

d) $Mgl(1-\theta_0^2)$

Q11 The time period of a satellite in a circular orbit of radius R is T. The period of another satellite in a circular orbit of radius 9R is :

a) 9 T

b) 27 T

c) 12 T

d) 3 T

Q12 For what value of displacement the kinetic energy and potential energy of a simple harmonic oscillation become equal ?

a) $x = 0$

b) $x = \pm A$

c) $x = \pm\frac{A}{\sqrt{2}}$

d) $x = \frac{A}{2}$

Q13 Force acting on a particle is $\vec{F} = (\alpha y\hat{i} + \beta x\hat{j})$. Find the work done by this force , when particle is moved along the line 2x = 3y from origin to the point (3,2) {take all quantities in SI units and α = 1 , β = 1}

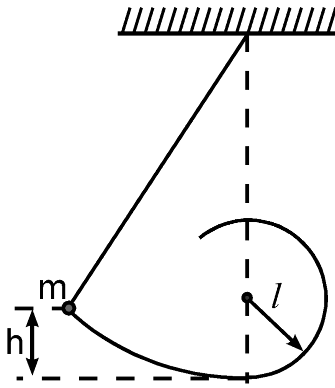
a) 5

b) 7

c) 11

d) 13

Q14 A peg is placed directly below the pendulum’s point of support at a distance $\ell = 0.5$m from the lowest point of the pendulum swing as shown in the fig. The minimum height h from which the pendulum can be released such that the string remains taut for at least one full revolution around the peg is



a) 0.75 m

b) 0.5 m

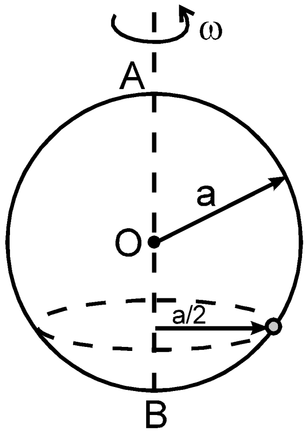
c) 1.25 m

d) 0.2 m

Q15 A disc is hinged such that it can freely rotate in a vertical plane about a point on its radius. If radius of disc is 'R', then what will be minimum time period of its simple harmonic motion?

a) $2\pi\sqrt{\frac{R}{g}}$ **b)** $2\pi\sqrt{\frac{3R}{2g}}$ **c)** $2\pi\sqrt{\frac{\sqrt{2}R}{g}}$ **d)** $2\pi\sqrt{\frac{R}{2g}}$

Q16 A smooth wire is bent into a vertical circle of radius ***a***. A bead P can slide smoothly on the wire. The circle is rotated about vertical diameter AB as axis with a constant speed ω as shown in figure. The bead P is at rest w.r.t. the wire in the position shown. Then ω^2 is equal to :



a) $\frac{2g}{a}$ **b)** $\frac{2g}{a\sqrt{3}}$ **c)** $\frac{g\sqrt{3}}{a}$ **d)** $\frac{2a}{g\sqrt{3}}$

Q17 The minimum work done required to accelerate a truck on a horizontal road from rest to speed v

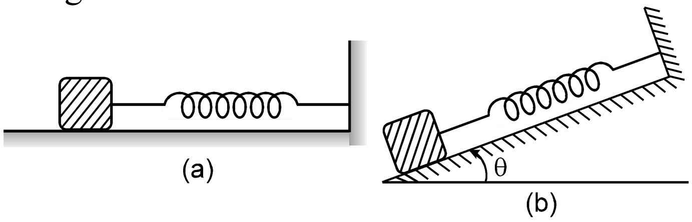
a) is less than that required to accelerate if from v to 2v.

b) is equal than that required to accelerate it from v to 2v.

c) is more than that required to accelerate it from v to 2v.

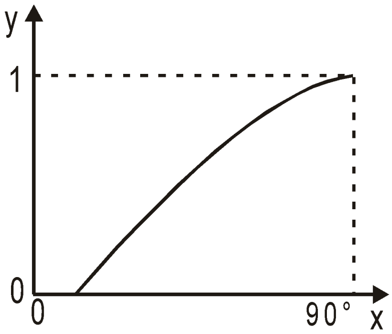
d) may be any one of the above since it depends on the force acting on the truck and the distance over which it acts.

Q18 A block is placed on a rough horizontal plane attached with an elastic spring as shown in figure.

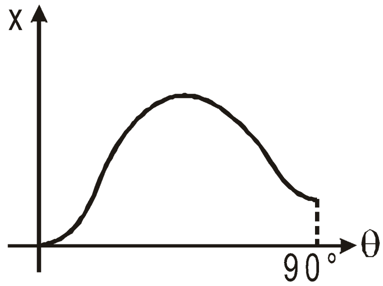


Initially spring is unstretched. If the plane is now slowly lifted from θ = 0° to θ = 90°, then the graph showing extension in the spring (x) versus angle (θ) is

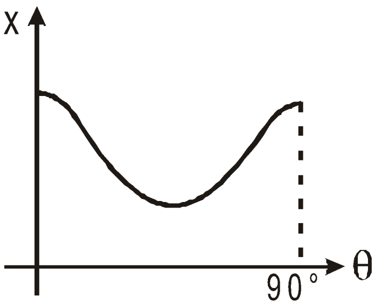
a)



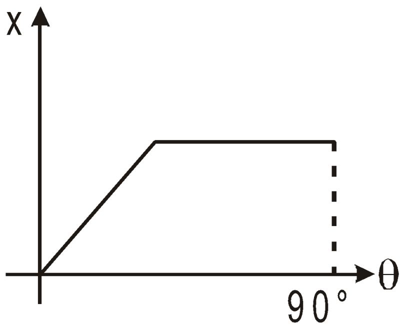
b)



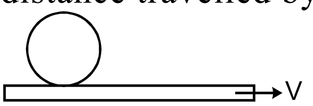
c)



d)

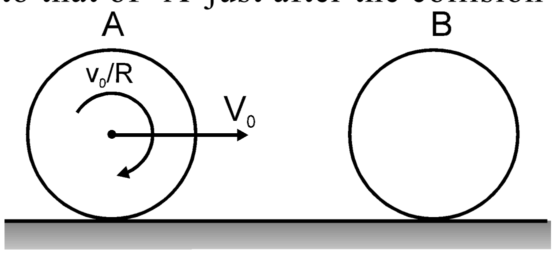


Q19 A solid sphere of mass m and radius r is gently placed on a conveyer belt moving with constant velocity V. If the coefficient of friction between the belt and sphere is $\frac{2}{7}$, the distance travelled by the centre of the sphere before it starts pure rolling is



a) $\frac{V^2}{7g}$ **b)** $\frac{2V^2}{49g}$ **c)** $\frac{2V^2}{5g}$ **d)** $\frac{2V^2}{7g}$

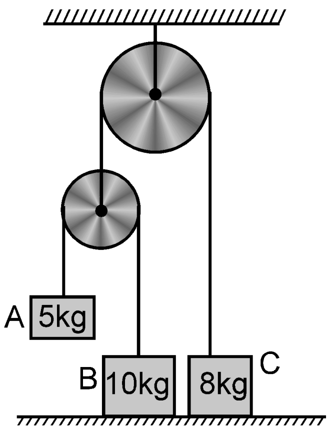
Q20 A hollow smooth uniform sphere A of mass 'm' rolls without sliding on a smooth horizontal surface. It collides elastically and head on with another stationary smooth solid sphere B of the same mass m and same radius. The ratio of kinetic energy of 'B' to that of 'A' just after the collision is :



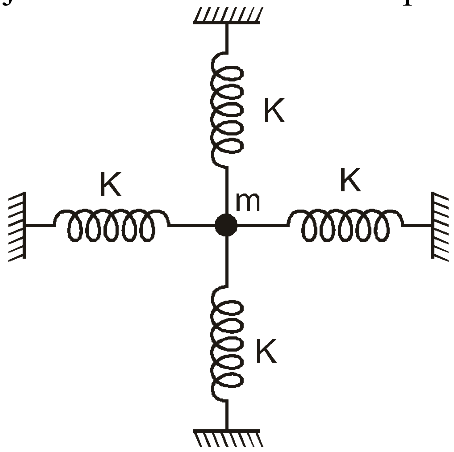
a) 5 : 2 **b)** 1 : 1 **c)** 2 : 3 **d)** 3 : 2

Numerical

Q21 In the following arrangement the system is initially at rest. The 5 kg block is now released. Assuming the pulleys and string to be massless and smooth. If the acceleration of block 'C' is $\frac{x}{10}$ m/s^2, then find value of x. Take g = 9.8 m/s^2.

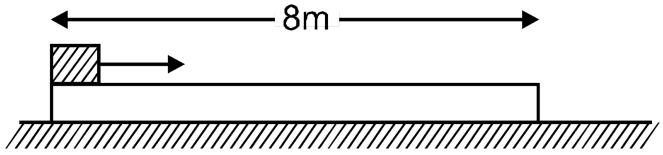


Q22 Figure shows a particle of mass m attached with 4 identical springs each of spring constant K and each of which are initially in their natural length L. The gravitational force is neglected. If the mass is slightly displaced by distance x along a line perpendicular to the plane of the figure and released then the force acting on particle just when it is released is proportional to x^n, find n.

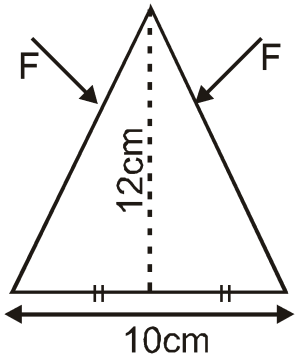


Q23 A ladder AB , 2.5 m long and of weight 150 N has its centre of gravity 1 m from A is lying flat on ground. A weight of 40 N is attached to the end B. The work required (in Joule) to raise the ladder from the horizontal position to vertical position so that the bottom end A is resting in a ditch 1m below the ground level will be :

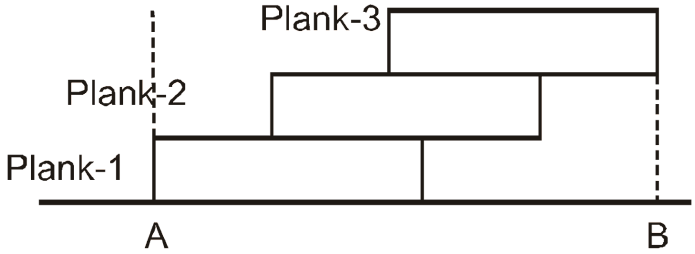
Q24 A small block is projected with some speed on a large block of same mass & of length 8m as shown in figure. Initially larger block is at rest. Friction is present only between the blocks. When the relative motion ends between the blocks, the small block is at the rightmost edge of the larger block. What is the displacement (in m) of the lower block w.r.t. earth in this time ?



Q25 A person is holding a uniform triangular wedge of mass 0.5 kg to avoid its motion under gravity as shown in figure. The static friction coefficient between person's both fingers and the wedge is$\mu_S = 0.5$. The minimum normal force that person must apply with each finger in order to hold up the wedge is $\frac{13x}{2}$ N. Find X (consider no rotation)



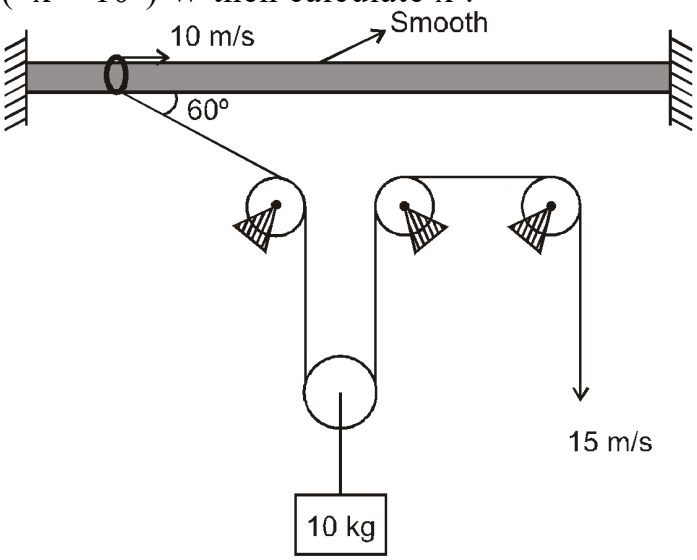
Q26 Three identical planks of uniform mass density and length ℓ are kept on each other as shown.



maximum length of AB so that all the planks remain in equilibrium is $\frac{n\ell}{4}$. Here n is an integer. Find n. (Assume all surfaces to be smooth) :

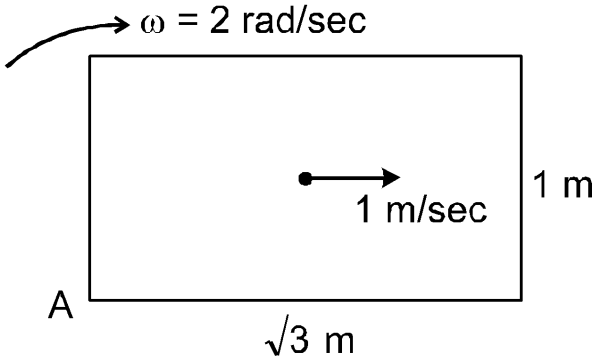
Q27 A thin parallel light beam of diameter d and intensity I_0 falls on a convex lens parallel to the principal axis. Light refracted from lens is obtained on screen, which is perpendicular to the principal axis. Intensity obtained on screen is $9I_0$ for two position of screen seperated by a distance of 10cm. Focal length of lens (in cm) is.

Q28 All the pulleys are ideal, string is massless then rate of work done by gravity at the given instant is
$(-x \times 10^2)$ W then calculate x :



Q29 A bullet is fired from horizontal ground at some angle passes through the point $\left(\frac{3R}{4}, \frac{R}{4}\right)$, where 'R' is the range of the bullet. Assume point of the fire to be origin and the bullet moves in x-y plane with x-axis horizontal and y-axis vertically upwards. Then angle of projection (in degree) is

Q30 A uniform rectangular plate of mass 1 kg is performing combined rotational motion and translational motion with constant angular speed 2 rad./sec (as shown in figure). Speed of centre of mass of plate is 1m/sec. If the kinetic energy of plate with respect to a point A (point A is on the plate) is $\frac{K}{3}$ Joule then 'K' is :



Chemistry

Single Choice Question

Q31 A complex anion is formed by Osmium (in some oxidation state) with ligands (in proper number so that coordination number of osmium becomes six). Which of the following can be its correct IUPAC name?

a) pentachloridonitridoosmium(VI) **b)** pentachloridonitridoosmate(VI)

c) azidopentachloridoosmate(VI) **d)** None of these

Q32 In a 1 L container following equilibrium is establlished with equal moles of $NO_2(g)$ & $N_2O_4(g)$. $N_2O_4(g) \rightleftharpoons 2NO_2(g)$ at equilibrium $M_{avg.} = \frac{184}{3}$, then ratio of KC & total initial moles is.

a) 3 **b)** $\frac{3}{2}$ **c)** $\frac{27}{4}$ **d)** 6

Q33 The sequence of molecular orbitals for the carbide ion (C_2^{2-}) is -

a) $\sigma 1s^2\ \sigma^* 1s^2\ \sigma 2s^2\ \sigma^* 2s^2\ \pi 2p^4$ **b)** $\sigma 1s^2\ \sigma^* 1s^2\ \sigma 2s^2\ \sigma^* 2s^2\ \pi 2p^4\ \sigma 2p^2$

c) $\sigma 1s^2\ \sigma^* 1s^2\ \sigma 2s^2\ \sigma 2p^2\ \pi 2p^4\ \sigma^* 2s^2$ **d)** $\sigma 1s^2\ \sigma^* 1s^2\ \sigma 2s^2\ \sigma^* 2s^2\ \sigma 2p^2\ \pi 2p^4$

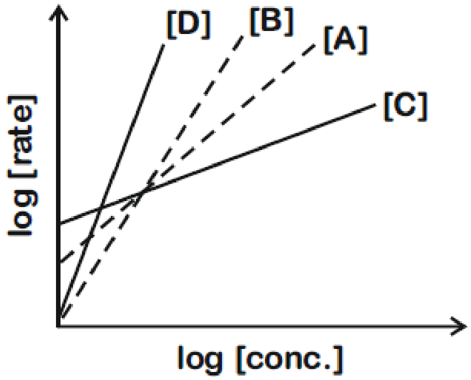
Q34 Aqua regia is used for dissolving noble metals (Au, Pt, etc.). The gas evolved in this process is

a) NO **b)** N_2 **c)** N_2O_5 **d)** N_2O_3

Q35 Consider the following reactions

A → P1 ; B → P2 ; C → P3 ; D → P4,

The order of the above reactions are a, b, c, and d, respectively. The following graph is obtained when log[rate] vs. log[conc.] are plotted



Among the following, the correct sequence for the order of the reactions is

a) d > b > a > c **b)** d > a > b > c **c)** a > b > c > d **d)** c > a > b > d

Q36 The EAN of metal atoms in $[Fe(CO)_2(NO^+)_2]$ and $Co_2(CO)_8$ respectively are :

a) 34, 35 **b)** 34, 36 **c)** 36, 36 **d)** 36, 35

Q37 Which is the correct order of 2^{nd} I.E.

a) Si < S < P < Cl **b)** Si < P < S < Cl **c)** P < Si < Cl < S **d)** Si < P < Cl < S

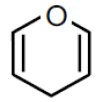
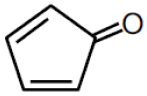
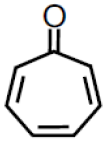
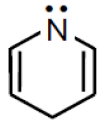
Q38 What is the molar solubility of $Mn(OH)_2$ in a buffer solution containing equal amount of NH_4^+ and NH_3(aq).

Given that – $(K_{SP})_{Mn(OH)_2} = 4.5 \times 10^{-14}$

$(K_b)_{NH_3} = 1.8 \times 10^{-5}$

a) 1.38×10^{-3} **b)** 1.38×10^{-4} **c)** 2.38×10^{-4} **d)** 3.2×10^{-4}

Q39 Which of the following compound has aromatic character ?

a)  **b)**  **c)**  **d)** 

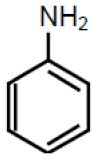
Q40 Which of the following relation is correct with respect to first (I) and second (II) ionization potentials of sodium and magnesium

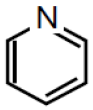
a) $I_{Mg} = II_{Na}$ **b)** $I_{Na} > I_{Mg}$ **c)** $II_{Mg} > II_{Na}$ **d)** $II_{Na} > II_{Mg}$

Q41 Among the following pairs, identify the pair in which both are diamagnetic and bond order is more than one?

a) N_2 , O_2 **b)** B_2, O_2^{2-} **c)** C_2, O_2^{2+} **d)** F_2, O_2

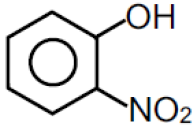
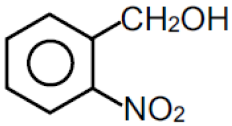
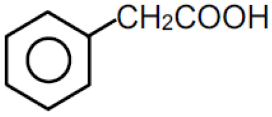
Q42 Arrange the following in order of their pKb value

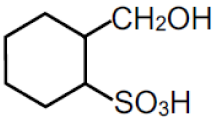
(A)  (B) $CH_3–NH–CH_3$ (C)  (D)



a) C > D > A > B **b)** A > B > D > C **c)** C > D > B >A **d)** D > C > B > A

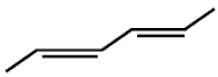
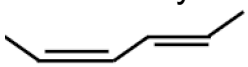
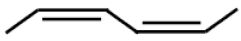
Q43 Acidic strength order of the following compounds is ?

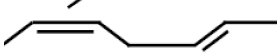
(A)  (B)  (C)  (D)



a) D > C > A > B **b)** D > A > B > C **c)** C > D > A > B **d)** C > A > B > D

Q44 Which is correct order for heat of hydrogenation of the following molecules?

(A)  (B)  (C)  (D)



a) D > C > B > A **b)** A > B > C > D **c)** D > B > A > C **d)** C > D > B > A

Q45 In which pair hybridisation of central atom or dorbitals used in hybridisation or both is/are wrong ?

a) BrF_5; sp^3d^2; $d_{z^2}, d_{x^2-y^2}$ **b)** SF_6; sp^3d^2; $d_{z^2}, d_{x^2-y^2}$ **c)** XeO_2F_2; sp^3d^2; $d_{z^2}, d_{x^2-y^2}$

d) IO_6^{5-}; sp^3d^2; $d_{z^2}, d_{x^2-y^2}$

Q46 In which compound C–Cl bond length is shortest?

a) Cl–CH=CH_2 **b)** Cl–CH=CH–CH_3 **c)** Cl–CH=CH–OCH_3 **d)** Cl–CH=CH–NO_2

Q47 Which of the following names is wrong according to IUPAC rules?

a) 4-Chloropentan-2-ol **b)** 1-Bromohex-4-yne

c) 3-Hydroxybenzene-1-carbonitrile **d)** 3-Bromo-1,1-dimethyl cyclopentane

Q48 Which of the following has the shortest C – Cl bond?

a) Cl – CH = CH – NO_2 **b)** Cl – CH = CH_2 **c)** Cl – CH = CH – CH_3

d) Cl – CH = CH – OCH_3

Q49 The standard reduction potentials at 25°C of Li^+ | Li, Ba^{2+} | Ba, Na^+ | Na and Mg^{2+} | Mg are −3.05, −2.73, −2.71 and −2.37 V, respectively. Which is the strongest reducing agent?

a) Li **b)** Ba **c)** Na **d)** Mg

Q50 Some standard electrode potentials are given:
$Fe^{2+} + 2e^- \rightarrow Fe$; $E° = -0.440$ V
$Fe^{3+} + 3e^- \rightarrow Fe$; $E° = -0.036$ V
The standard electrode potential for: $Fe^{3+} + e- \rightarrow Fe^{2+}$, is

a) −0.476 V **b)** −0.404 V **c)** +0.988 V **d)** +0.772 V

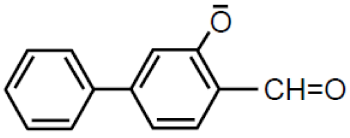
Numerical

Q51 If the solubility product of AB_2 is 3.20×10^{-11} M^3, then the solubility of AB_2 in pure water is _____ $\times 10^{-4}$ mol L^{-1}. [Assuming that neither kind of ion reacts with water]

Q52 For how many species the Ostwald dilution law is not applicable.
(i) H_2SO_4 (ii) KOH (iii) CH_3COOH (iv) $HClO_4$ (v) NaOH (vi) HI

Q53 How many structure isomers of carbonyl compounds (Aldehydes & ketones only) are possible for molecular formula $C_5H_{10}O$?

Q54 Negative charge of the given anion is delocalized at how many carbon atoms?



Q55 Not considering the electronic spin, the degeneracy of the second excited state (n = 3) of H atom is 9, while the degeneracy of the second excited state of H^- is

Q56 The maximum number of electrons that can have principal quantum number, n = 3, and spin quantum number, $m_s = -1/2$, is

Q57 The molarity of HNO_3 in a sample which has density 1.4 g/mL and mass percentage of 63% is _____. (Molecular Weight of HNO_3 = 63)

Q58 If 80 g of copper sulphate $CuSO_4 \cdot 5H_2O$ is dissolved in deionised water to make 5 L of solution. The concentration of the copper sulphate solution is $x \times 10^{-3}$ mol L^{-1}. The value of x is _________.
[Atomic masses Cu : 63.54 u, S : 32 u, O : 16 u, H : 1 u]

Q59 The rate constant of a reaction increases by five times on increase in temperature from 27°C to 52°C. The value of activation energy in kJ mol^{-1} is _______ (Rounded-off to the nearest integer)
[$R = 8.314$ J K^{-1} mol^{-1}]

Q60 An exothermic reaction $X \rightarrow Y$ has an activation energy 30 kJ mol^{-1}. If energy change ΔE during the reaction is –20 kJ, then the activation energy for the reverse reaction in kJ is ____.(Integer answer)

Mathematics

Single Choice Question

Q61 The number of solutions of equation $\log_6(x + 3) = 7 - x$ is

a) 0 **b)** 2 **c)** 1 **d)** None of these

Q62 The sum of all positive integral values of 'a' $a \in [1, 500]$ for which the equation $[x]^3 + x - a = 0$ has solution is (where $[\cdot]$ denotes greatest integer)

a) 469 **b)** 625 **c)** 812 **d)** 904

Q63 If S_r denotes the sum of r terms of an AP and $\frac{S_a}{a^2} = \frac{S_b}{b^2} = c$ then S_c is

a) c^3 **b)** c/ab **c)** abc **d)** $a + b + c$

Q64 Sum of series $\sum_{r=1}^{n}(r^2 + 1)r!$ is

a) (n + 1) ! **b)** (n + 2)! – 1 **c)** n (n + 1)! **d)** none of these

Q65 The number of solutions of the matrix equation $A^2 = \begin{vmatrix} 1 & 0 \\ 0 & 1 \end{vmatrix}$ is -

a) 2 **b)** 4 **c)** 8 **d)** infinitely many

Q66 If $f(x) = \lim_{n\to\infty} \frac{(\sin x)^n - (\sin x)^{-n}}{(\sin x)^n + (\sin x)^{-n}}$, $0 < x < \pi/2$, $n \in N$, then $\int (\cos x)[f(x)]^3 \, dx$ is equal to

a) $\frac{\cos 2x}{2} + c$ **b)** $\sin 2x + c$ **c)** $-\sin x + c$ **d)** None

Q67 The vertices of a triangle are A(–1, –7), B(5, 1) and C(1, 4). The equation of the bisector of the angle $\angle ABC$ is -

a) x + 7y + 2 = 0 **b)** x – 7y + 2 = 0 **c)** x – 7y – 2 = 0 **d)** x + 7y – 2 = 0

Q68 If $f(g(x)) = |\cos x|$, $g(f(x)) = \cos^2\sqrt{x}$, then -

a) f(x) is a periodic function and g(x) is a non-periodic function.

b) f(x) is a non-periodic function and g(x) is a periodic function.

c) Both f(x) and g(x) are periodic functions

d) Neither f(x) nor g(x) is a periodic function

Q69 The locus of the centre of a circle of radius 2 which rolls on the outside of the circle $x^2 + y^2 + 3x - 6y - 9 = 0$ is

a) $x^2 + y^2 + 3x - 6y + 5 = 0$ **b)** $x^2 + y^2 + 3x - 6y + 31 = 0$

c) $x^2 + y^2 + 3x - 6y + \frac{29}{4} = 0$ **d)** None of these

Q70 The curve $y = ax^3 + bx^2 + cx + 8$ touches x- axis at P(–2, 0) and cuts the y-axis at a point Q where its gradient is 3. The values of a, b, c are respectively

a) $-\frac{1}{2}, -\frac{3}{4}, 3$ b) $3, -\frac{1}{2}, -4$ c) $-\frac{1}{2}, -\frac{7}{4}, 2$ d) None of these

Q71 Function $f(x) = x^3 + 6x^2 + (9 + 2k)x + 1$ is increasing function if

a) $k \geq 3/2$ b) $k > 3/2$ c) $k < 3/2$ d) $\leq 3/2$

Q72 If $f(x) = \frac{x}{\sin x}$ and $g(x) = \frac{x}{\tan x}$ where $0 < x \leq 1$, then in this interval

a) both f(x) and g(x) are increasing functions
b) both f(x) and g(x) are decreasing functions
c) f(x) is an increasing function
d) g(x) is an increasing function

Q73 The length of a longest interval in which the function $3 \sin x - 4 \sin^3 x$ is increasing is

a) $\frac{\pi}{3}$ b) $\frac{\pi}{2}$ c) $\frac{3\pi}{2}$ d) π

Q74 Let $f:(0, \infty) \rightarrow R$ defined by $f(x) = x + \frac{9\pi^2}{x} + \cos x$ then minimum value of f(x) is

a) $6\pi - 1$ b) $10\pi - 1$ c) $3\pi - 1$ d) None of these

Q75 If the sum $\sum_{k=1}^{\infty} \frac{1}{(k+2)\sqrt{k} + k\sqrt{k+2}} = \frac{\sqrt{a} + \sqrt{b}}{\sqrt{c}}$ where a, b, c ∈ N and lie in [1, 15], then a + b + c equals to-

a) 6 b) 8 c) 10 d) 11

Q76 Let $a_1, a_2, a_3, \ldots$ be terms of an A.P. If $\frac{a_1 + a_2 + \ldots + a_p}{a_1 + a_2 + \ldots + a_q} = \frac{p^2}{q^2}$, $p \neq q$, then $\frac{a_6}{a_{21}}$ equals-

a) 41/11 b) 7/2 c) 2/7 d) 11/41

Q77 If $a_1 + a_2 + a_3 + a_4 + \ldots + a_n = 1 \ \forall a_i > 0$, i = 1, 2, 3…n. Then the maximum value of $a_1^2 a_2 a_3 a_4 a_5 \ldots a_n$ is

a) $\frac{2}{(n+1)^n}$ b) $\frac{4}{(n+1)^{n+1}}$ c) $\frac{2}{n^n}$ d) $\frac{4}{n^{n+1}}$

Q78 Let $\{a_n\}$ $(n \geq 1)$ be a sequence such that $a_1 = 1$, and $3a_{n+1} - 3a_n = 1$ for all $n \geq 1$. Then a_{2002} is equal to-

a) 666 b) 667 c) 668 d) 669

Q79 The equation of straight line equally inclined to the axes and equidistant from the point (1, –2) and (3, 4) is –

a) $x + y = 1$ b) $y - x - 1 = 0$ c) $y - x = 2$ d) $y - x + 1 = 0$

Q80 If $a^2 + b^2 - c^2 - 2ab = 0$, then the family of straight lines $ax + by + c = 0$ is concurrent at the points –

a) $(-1, 1), (1, -1)$ **b)** $(1, 1), (1, -1)$ **c)** $(-1, -1), (1, 1)$ **d)** $(-1, -1)$

Numerical

Q81 Let P(x) be a cubic polynomial with zeroes α, β, γ if $\frac{P(1/2)+P(-1/2)}{P(0)} = 100$

If $\frac{1}{\alpha\beta} + \frac{1}{\beta\gamma} + \frac{1}{\gamma\alpha} = k$ then [k/10]

Q82 Find the value of $\lim\limits_{x\to\infty} (3^x + 3^{2x})^{1/x}$

Q83 An Apache helicopter of enemy is flying along the curve given by $y = x^2 + 7$. A soldier placed at (3, 7) (with respect to reference point) wants to shoot down the helicopter when it is nearest to him. If all the distances are taken in meter, find the nearest integral value of least distance in cm.

Q84 If the sum of the deviations of 50 observations from 30 is 50, then the mean of these observations is

Q85 The value of $\tan\left(\lim\limits_{n\to\infty}\sum_{r=1}^{n}\tan^{-1}\left(\frac{1+2r}{1+r^2(r+1)^2}\right)\right)$ is ....

Q86 If sum of all solutions of the equation $(x^{\log_{10}3})^2 - (3^{\log_{10}x}) - 2 = 0$ is $a^{\log_b c}$ where a,b,c $\in$ N & a, b are prime numbers then a + b equals

Q87 If equations $ax^2 + bx + c = 0$ & $3x^2 + 4x + 5 = 0$ have a common root when a, b, c are sides of a triangle ABC, then $\angle A + \angle B = 30k$ where k equals

Q88 $\lim\limits_{x\to1} (101\,\pi)(1 - x)\tan\frac{\pi x}{2} = L$, then the value of 10L is

Q89 Let 'S_n' denotes the sum of 1^{st} 'n' terms of an A.P. Then the value of $S = \lim\limits_{x\to\infty}\sum_{r=n}^{\infty}\frac{f(r)}{n}$, where $f(n) = \frac{S(3n)}{S(2n)-S(n)}$

Q90 Find the period of $f(x) = \sin\frac{\pi}{4}[x] + \cos\frac{\pi x}{2}$, where [·] denotes greatest integer function.

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**C**	**D**	**C**	**D**	**D**	**B**	**B**	**C**	**C**	**B**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**B**	**C**	**B**	**C**	**C**	**B**	**A**	**A**	**A**	**D**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**7**	**3**	**60**	**4**	**5**	**7**	**15**	**5**	**53**	**8**
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	**B**	**B**	**B**	**A**	**A**	**C**	**D**	**B**	**C**	**D**
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	**C**	**C**	**A**	**A**	**C**	**D**	**B**	**A**	**A**	**D**
Que.	51	52	53	54	55	56	57	58	59	60
Ans.	**2**	**5**	**7**	**3**	**3**	**9**	**14**	**64**	**52**	**50**
Que.	61	62	63	64	65	66	67	68	69	70
Ans.	**C**	**C**	**A**	**C**	**D**	**C**	**B**	**B**	**B**	**D**
Que.	71	72	73	74	75	76	77	78	79	80
Ans.	**A**	**C**	**A**	**A**	**D**	**D**	**B**	**C**	**D**	**A**
Que.	81	82	83	84	85	86	87	88	89	90
Ans.	**19**	**9**	**224**	**31**	**1**	**5**	**3**	**2020**	**3**	**8**