Competishun

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

Date: 05/08/2024

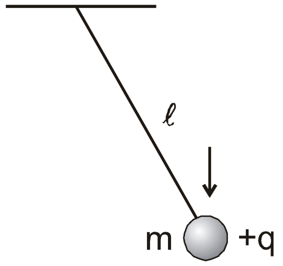
Time: 3 hours **Max. Marks:** 300

PRAVEEN-2_MPT-3 (24-25)

Physics

Single Choice Question

Q1 A simple pendulum having bob of mass m and charge +q has length ℓ. It is placed in downward vertical electric field. The time period of small oscillation is

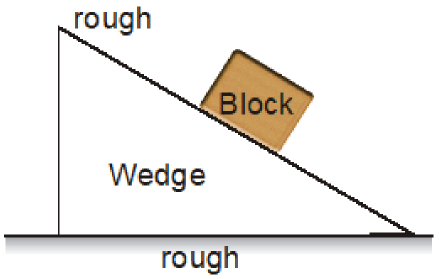


a) equal to $2\pi\sqrt{\frac{\ell}{g}}$ **b)** greater than $2\pi\sqrt{\frac{\ell}{g}}$ **c)** less than $2\pi\sqrt{\frac{\ell}{g}}$ **d)** not defined

Q2 Two similar very small conducting spheres having charges 40 μC and –20 μC are some distance apart. Now they are touched and kept at same distance. The ratio of the initial to the final force between them is :

a) 8 : 1 **b)** 4 : 1 **c)** 1 : 8 **d)** 1 : 1

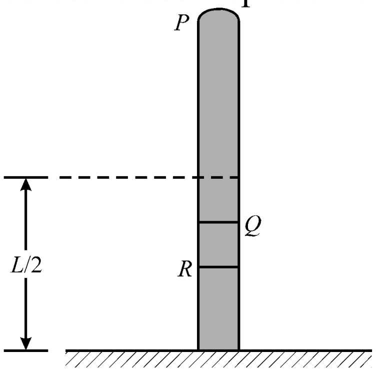
Q3 When a block is placed on a wedge as shown in figure, the block starts sliding down and the wedge also start sliding on ground. All surfaces are rough. The centre of mass of (wedge + block) system will move



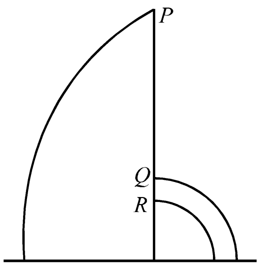
a) leftward and downward. **b)** right ward and downward.

c) leftward and upwards. **d)** only downward.

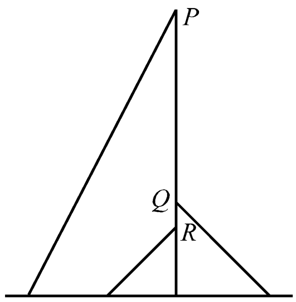
Q4 A uniform rod of mass M and length L falls when it is made to stand on a smooth horizontal floor. The trajectories of the points P, Q and R as shown in the figure given below is best represented by :



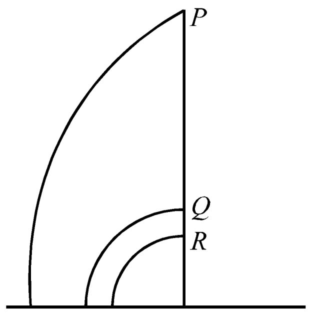
a)



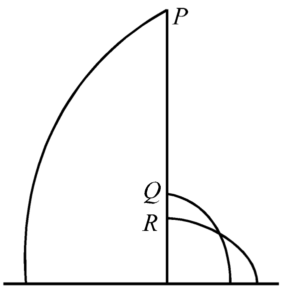
b)



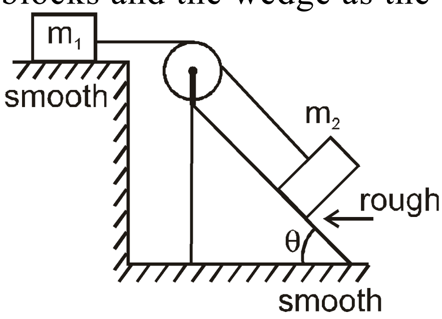
c)



d)



Q5 Two blocks m_1 and m_2 are connected by an inextensible string. The string is passing over a pulley attached with movable wedge. All the fixed surfaces are smooth and the inclined surface of the wedge is rough. The system is released from rest. Consider two blocks and the wedge as the system and m_2 slides on the wedge.



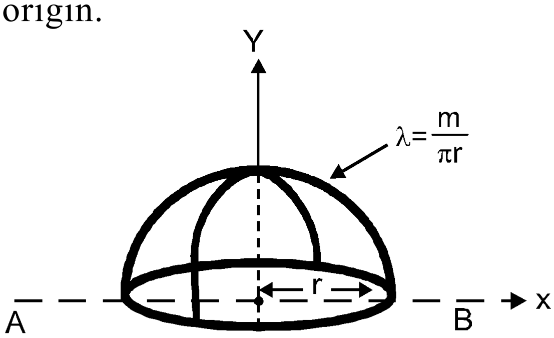
a) The centre of mass of system moves towards right

b) The centre of mass of the system moves towards left.

c) The centre of mass of the system moves downward

d) The centre of mass of the system does not move at all.

Q6 Calculate moment of inertia of the system about axis AB shown in figure. Each segment of the system is made of a uniform wire of mass per unit length $\lambda = \frac{m}{\pi r}$, where r is radius of each segment. The axis of full ring is along Y–axis. The axis of the semicircular rings are along x and z–axis. The centres of all rings coincide at the origin.

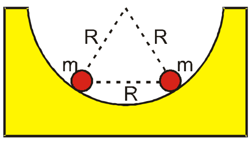


a) $\frac{mr^2}{2}$ **b)** $\frac{5}{2}mr^2$ **c)** $\frac{3}{2}mr^2$ **d)** $4\ mr^2$

Q7 A flywheel rotates with a uniform angular acceleration. Its angular velocity increases from $40\ \pi$ rad/sec to $60\ \pi$ rad/sec. in 10 second. How many rotations did it make in this period ?

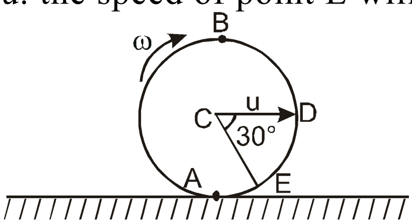
a) 250 **b)** 125 **c)** 500 **d)** 1000

Q8 Two identical small balls each have a mass m and charge q. When placed in a hemispherical bowl of radius R with frictionless, nonconductive walls, the beads move, and at equilibrium the line joining the balls is horizontal and the distance between them is R (figure). Neglect any induced charge on the hemispherical bowl. Then the charge on each bead is: (here $K = \frac{1}{4\pi \epsilon_0}$)



a) $q = R\left(\frac{mg}{K\sqrt{3}}\right)^{1/2}$ **b)** $q = \left(R\frac{mg}{K\sqrt{3}}\right)^{1/2}$ **c)** $q = R\left(\frac{\sqrt{3}\ mg}{K}\right)^{1/2}$ **d)** $q = \left(R\frac{\sqrt{3}\ mg}{K}\right)^{1/2}$

Q9 A ring rolls without slipping on the ground. Its centre C moves with a constant speed u. the speed of point E will be -



a) 0 **b)** u **c)** 2u **d)** $\sqrt{2}u$

Q10 A wheel has a speed of 1200 revolutions per minute and is made to slow down at a rate of 4 radians/s^2. The number of revolutions it makes before coming to rest is. (Take $\pi = 3.14$)

a) 143 **b)** 272 **c)** 314 **d)** 722

Q11 A body of mass m is moving in a circle of radius r with a constant speed v. The force on the body is mv^2/r and is directed towards the centre. What is the work done by the force in moving the body half the circumference of the circle.

a) $\frac{m v^2}{r} \times \pi r$ **b)** $m v^2$ **c)** $\frac{1}{2} m v^2$ **d)** zero

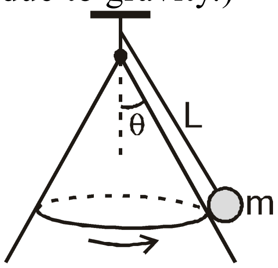
Q12 An aeroplane flying at constant speed 115 m/s towards east, makes a gradual turn following a circular path to fly south. The turn takes 15 seconds to complete. The magnitude of the centripetal acceleration during the turn, is

a) $\frac{23\pi}{8}$ m/s^2 **b)** $\frac{46\pi}{3}$ m/s^2 **c)** $\frac{23\pi}{6}$ m/s^2 **d)** none of these

Q13 A stone of mass M is tied at the end of a string, is moving in a circle of radius R, with a constant angular velocity ω. The total work done on the stone, in any half circle, is:

a) $\pi MR^2 \omega^2$ **b)** $2 MR^2 \omega^2$ **c)** $MR^2 \omega^2$ **d)** 0

Q14 A small sized mass m is attached by a massless string (of length L) to the top of a fixed frictionless solid cone whose axis is vertical. The half angle at the vertex of the cone is θ. If the mass m moves around in a horizontal circle at speed v, what is the maximum value of v for which mass stays in contact with the cone ? (g is acceleration due to gravity.)

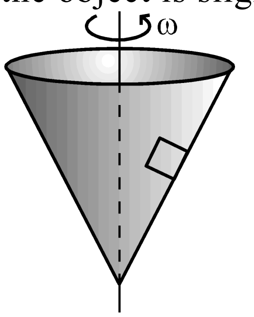


a) $\sqrt{gL\cos\theta}$ **b)** $\sqrt{gL\sin\theta}$ **c)** $\sqrt{gL\sin\theta\tan\theta}$ **d)** $\sqrt{gL\tan\theta}$

Q15 A point mass m is suspended by means of a light metallic wire. The mass is given enough horizontal velocity so that it moves in a vertical circle. Now temperature is increased but the wire continues to move in a vertical circle of increased radius. If T_H and T_L are the value of tension in the wire at its highest and lowest points respectively, then due to increase in temperature the value of $T_L - T_H$ will :

a) decrease **b)** increase **c)** remain same **d)** cannot be determined

Q16 A smooth and vertical cone-shaped funnel is rotated with an angular velocity ω in such a way that an object on the inner wall of the funnel is at rest w.r.t. the funnel. If the object is slightly displaced along the slope from this position and released :



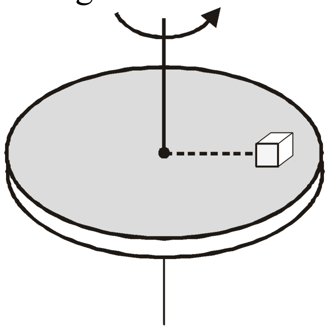
a) it will be in equilibrium at its new position. **b)** it will execute SHM

c) it will oscillate but the motion is not SHM **d)** none of these

Q17 A ball dropped on ground from a height of 1.00 m rises to a height of 75 cm on rebounce. When thrown down from the same height with a velocity of 2.0 m/s, it would rise to (assume g = 10 m/s^2)

a) 80 cm **b)** 90 cm **c)** 85 cm **d)** 95 cm

Q18 A block is kept on a rough horizontal disc which is rotating with uniform angular velocity about fixed axis as shown in figure. Then the direction of frictional force acting on the disc due to block will be (if block is rest relative to disc)



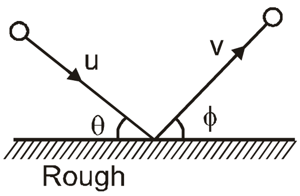
a) towards the centre of the disc.

b) towards radially outwards along the line joining the centre of the disc and block.

c) tangentially to the path of block and in the direction of motion.

d) In between tangential direction and the direction towards the centre from the block.

Q19 A ball is thrown onto a rough floor with speed u at angle θ = 45°. If it rebounds with speed v at the same angle ϕ = 45°. Find the coefficient of kinetic friction between the floor and the ball. The coefficient of restitution is e = 0.6 :



a) 0.5 **b)** 0.6 **c)** 0.1 **d)** 0.25

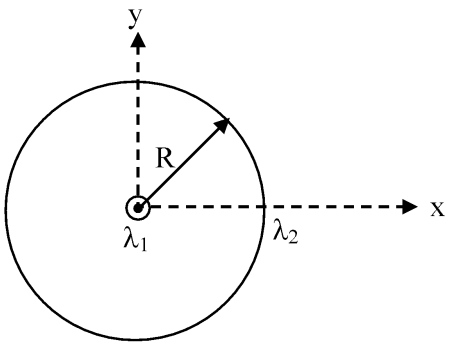
Q20 The work done in carrying a charge q once round a circle of radius r with a charge Q at the centre is :

a) $\frac{qQ}{4\pi\varepsilon_0 r}$ **b)** $\frac{qQ}{4\pi\varepsilon_0^2 r^2}$ **c)** $\frac{qQ}{4\pi\varepsilon_0 r^2}$ **d)** none of these

Numerical

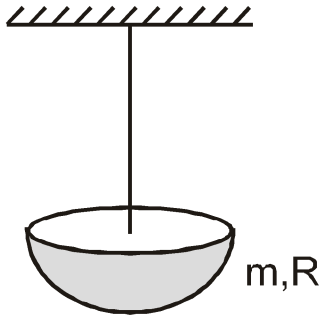
Q21 A particle is moving along a circular path of radius r = $\frac{5}{\pi}$m with a uniform speed 5 ms^{-1}. What is the magnitude of average acceleration (in m/s^2) during the interval in which particle completes half revolution?

Q22 Consider a uniformly charged ring having linear charged density λ_2 and an infinite uniformly charged straight wire having linear charge density λ_1, lying along the axis of ring as shown in figure. If force of interaction between wire and any half of the ring is found to be $F = 4k\lambda_1\lambda_2 R^{(\alpha-3)}$. Where α is an integer find α.

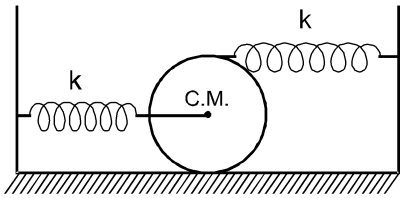


Q23 A uniform solid hemisphere of mass m and radius R is attached to the roof with a chord of torsional constant C and performing torsional SHM. Then the time period (in seconds) of SHM is

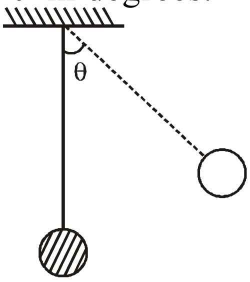
(Take m = 15 kg, R = $\frac{2}{\pi}$m, C = 6 Nm/rad.)



Q24 The uniform solid cylinder can roll without sliding on a horizontal surface as shown in the figure. The mass of cylinder is 10 kg and spring constant for both the ideal springs is 300 N/m. The angular frequency of centre of mass of small oscillations is ω. Find the value of ω.

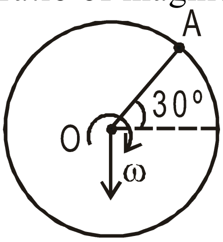


Q25 A simple pendulum of mass 'M' and length 'L' is hanging vertically as shown. It is free to rotate in a vertical plane. At the lowest point it is given a velocity $\sqrt{5gL}$. When it makes an angle 'θ' with the vertical, thread is cut. After cutting the threat it goes to same maximum height as it would have gone if it had completed the circle. Calculate 'θ' in degrees.

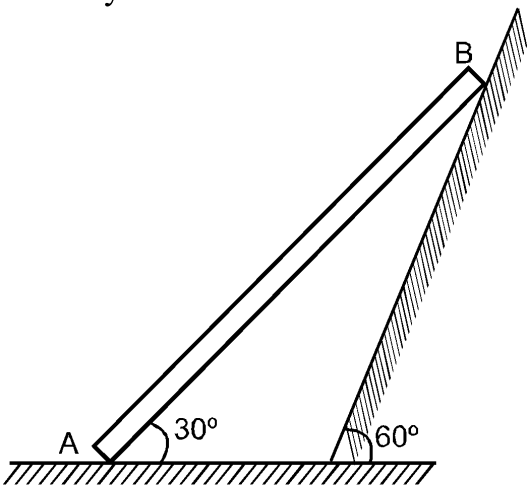


Q26 Starting from mean position a body oscillates harmonically with a period of 24s. After X time (first time) its kinetic energy will be 75% of the total energy. Find x.

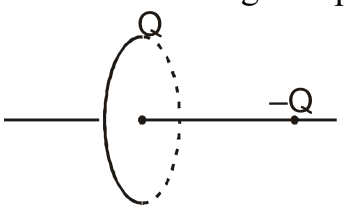
Q27 A sphere of radius 1m is rotating about a horizontal axis with angular speed π rad/s and is released from rest in vertical plane under gravity as shown in figure. Find the ratio of magnitude of displacement of point A to that of point O after 2s from start.



Q28 In the given figure, rod of length 2m is sliding as the situation shown. If end A of the rod is moving in left direction with speed of 4 m/s at any instant than, find the angular velocity of rod at this instant.



Q29 A ring of radius 100 cm has a uniformly distributed charge Q and uniformly distributed mass m. On the axis a point charge –Q of mass 2m is placed at a distance 3 cm from it's centre. Both are released from rest. Assuming only electric interaction between the ring and particle. Find the amplitude (in cm) of SHM of particle.

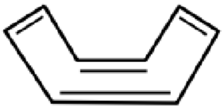


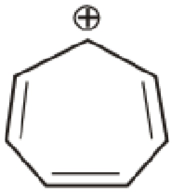
Q30 Find the amplitude (in S.I. units) of resultant SHM of a particle in xy plane due to superposition of SHMs $x = 3 \sin \omega t$ and $y = 4 \cos \omega t$ where x, y and t are in S.I. units and ω is a constant.

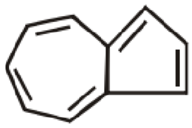
Chemistry

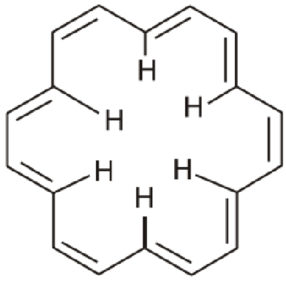
Single Choice Question

Q31 Which of the following is not Aromatic in nature.

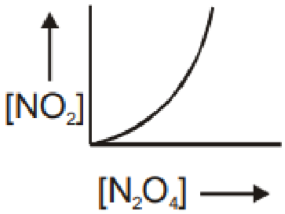
a) 

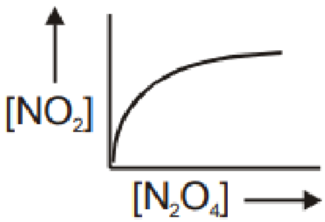
b) 

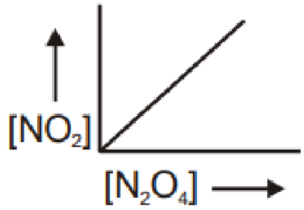
c) 

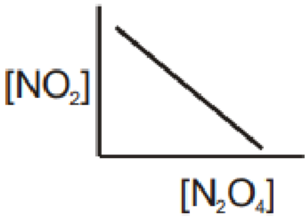
d) 

Q32 The graph which will be representing all the equilibrium concentrations for the reaction,
$N_2O_4(g) \rightleftharpoons 2NO_2$ (g) will be :
(the concentrations of N_2O_4 (g) and of NO_2 (g) for which the following reaction will be at equilibrium will lie on which of the following graphs)

a) 

b) 

c) 

d) 

Q33 An industrial fuel, 'water gas', which consists of a mixture of H_2 and CO can be made by passing steam over red-hot carbon. The reaction is $C(s) + H_2O(g) \rightleftharpoons CO(g) + H_2(g)$, $\Delta H = +131$ kJ
The yield of CO and H_2 at equilibrium would be shifted to the product side by

a) raising the partial pressure of the steam

b) adding carbon (at the temperature of reacting system)

c) reducing the temperature

d) reducing the volume of the system

Q34 Calculate the pH of a 0.1 M K_3PO_4 solution. The third dissociation constant of phosphoric acid is 10^{-12}. Given $(0.41)^{1/2} = 0.64$; log 3 = 0.48

a) 12.5 **b)** 12.44 **c)** 12.25 **d)** 12

Q35 Choose the correct statement(s) :

a) pH of acidic buffer solution decrease if more salt is added.

b) pH of basic buffer solution increases if more base is added.

c) Both (A) and (B)

d) None of these

Q36 For the reaction $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$, the value of K_P is

a) P_{CO_2} **b)** $\frac{P_{CO_2}}{P_{CaCO_3}}$ **c)** $\frac{[CaO][CO_2]}{[CaCO_3]}$ **d)** $\frac{P_{CaCO_3}}{P_{CaO}P_{CO_2}}$

Q37 For the reaction $I_2(g) \rightleftharpoons 2I(g)$, $K_C = 1.0 \times 10^{-2}$ mol lit^{-1}. What volume of the vessel should be taken so that at equilibrium 1 mole of I_2 and 0.5 mole of 'I' are present at equilibrium?

a) 25 L **b)** 0.04 L **c)** 0.25 L **d)** 5 L

Q38 The equilibrium constant for the reaction $N_2(g) + O_2(g) \rightleftharpoons 2NO(g)$ is K_1 and the equilibrium constant for the reaction $NO\,(g) \rightleftharpoons \frac{1}{2}N_2\,(g) + \frac{1}{2}O_2\,(g)$ is K_2 both at the same temperature. The value of K_1 and K_2 are related as

a) $K_1 = \left(\frac{1}{K_2}\right)^2$ **b)** $K_1 = K_2^2$ **c)** $K_2 = \left(\frac{1}{K_1}\right)^2$ **d)** $K_2 = K_1^2$

Q39 One mole of pure PCl_5 is placed in an evacuated container and maintained at 250°C. The equilibrium is established at total pressure of 2 atm. What is the partial pressure of chlorine at equilibrium ?
$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$: $K_P = 1.6$ atm.

a) 0.4 atm **b)** 0.67 atm **c)** 0.80 atm **d)** 0.64 atm

Q40 For the reaction $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$, the value of equilibrium constant is 9.0. The degree of dissociation of HI will be-

a) 0.5 **b)** 0.33 **c)** 0.4 **d)** 0.67

Q41 One mole each of A and B and 3 moles each of C and D are placed in 1 L flask. If equilibrium constant is 2.25 for the reaction $A + B \rightleftharpoons C + D$, then equilibrium concentrations of A and C will be in the ratio

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

Q42 For a reaction A (g) $\rightleftharpoons$ B(g) at equilibrium. The partial pressure of B is found to be one fourth of the partial pressure of A. The value of $\Delta G°$ of the reaction A$\rightarrow$B is

a) RTℓn 4 **b)** –RTℓn 4 **c)** RT log 4 **d)** – RT log 4

Q43 What is the pH of a neutral solution at 37°C, where Kw equals 2.5×10^{-14} ? (log-2 = 0.3)

a) 7.0 **b)** 13.6 **c)** 6.8 **d)** 6.6

Q44 How many grams of HCl should be dissolved in sufficient water to get 500 ml of an aqueous solution of pH, 2.0?

a) 0.01 **b)** 0.005 **c)** 0.1825 **d)** 0.365

Q45 The dissociation constant of acetic acid is 0.000018 and that for cyanoacetic acid is 0.0036 at 298 K. What would be the ratio of volumes of the two acid solutions, each containing equal moles of the acids, so that the solutions becomes isohydric?

a) 1 : 1 **b)** 1 : 2 **c)** 1 : 200 **d)** 200 : 1

Q46 The donor sites of $(EDTA)^{4-}$ are ?

a) O atoms only **b)** N atoms only **c)** Two N atoms and four O atoms

d) Three N atoms and three O atoms

Q47 The oxidation state of Mo in its oxido-complex species $[Mo_2O_4(C_2H_4)_2(H_2O)_2]^{2-}$ is

a) +2 **b)** +3 **c)** +4 **d)** +5

Q48 Co-ordination number of platinum in $[Pt(NH_3)_4Cl_2]^{2+}$ ion is-

a) 4 **b)** 2 **c)** 8 **d)** 6

Q49 The correct IUPAC name for the compound $[Co(NH_3)_4CI(ONO)]Cl$ is:

a) Tetraamminechloridonitrito–N–cobalt(III) chloride

b) Chloridonitrito–O–tetraamminecobalt(II) chloride

c) Dichloridonitrito–O–tetraamminecobalt(III)

d) Tetraamminechloridonitrito–O–cobalt(III) chloride

Q50 Solution containing 0.1 N NH_4OH and 0.1 N NH_4Cl has pH = 9.25.Then find out pK_b of NH_4OH.

a) 4.5 **b)** 4.75 **c)** 9.25 **d)** 4.25

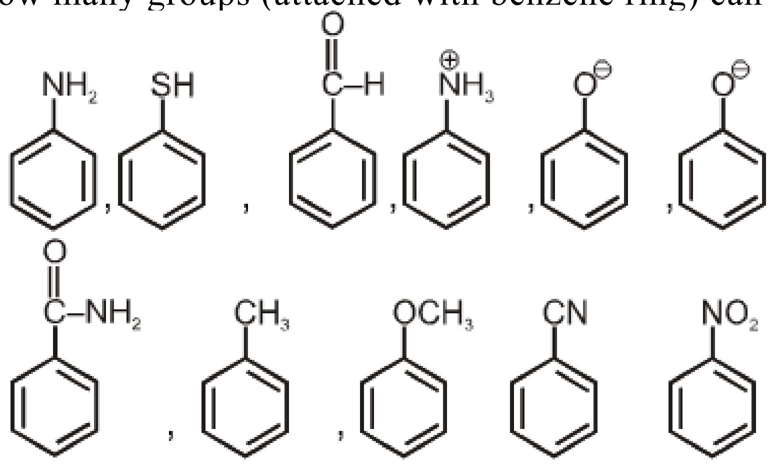
Numerical

Q51 Calculate the pH in a 0.1 M solution of NH_4OCN. K_a (HOCN) = 3.3×10^{-4}, K_b (NH_3) = 1.8×10^{-5},
(Report your answer in terms of nearest integer).

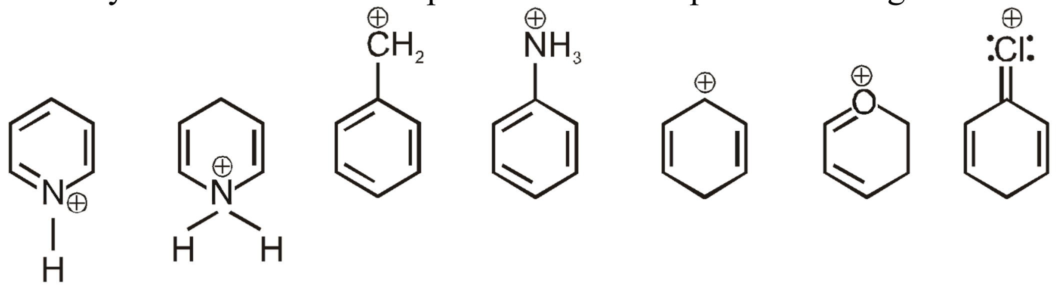
Q52 The EAN of platinum in potassium hexachloridoplatinate(IV) is (Atomic number of Pt = 78):

Q53 How many benzylic alcohols are possible for the molecule formula $C_8H_{10}O$.

Q54 How many groups (attached with benzene ring) can show +M effect ?



Q55 Identify the number of compounds in which positive charge will be delocalised ?



Q56 The pressure at equilibrium obtained upon 50% dissociation of PCl_5 as follows at 250°C is numerically n times of Kp.

$$PCl_5\,(g) \rightleftharpoons PCl_3\,(g) + Cl_2\,(g)$$

Give the value of "n"

Q57 How many of the following species on mixing with water produce acidic solutions ?
$FeCl_3$; $CuSO_4$; CO_2 ; $NaCl$; KCN ; NH_4Cl ; $C_6H_5NH_3^+Cl^-$; BCl_3 ; $CaCO_3$

Q58 The conductivity of a weak acid HA of concentration 0.001 mol L^{-1} is 2.0×10^{-5} S cm^{-1}. If $\Lambda_m^\circ(HA) = 190\ S\ cm^2\ mol^{-1}$, the ionization constant (Ka) of HA is equal to _________ $\times 10^{-6}$.
(Round off to the Nearest Integer)

Q59 Consider the cell
Pt(s) | H_2 (g)(1 atm) | H^+ (aq, $[H^+]$ = 1M) || Fe^{3+} (aq), Fe^{2+} (aq) | Pt(s)

Given : $E^\circ_{Fe^{3+}/Fe^{2+}} = 0.771V$ and $E^\circ_{H^+/\frac{1}{2}H_2} = 0V$, T = 298K

If the potential of the cell is 0.712 V the ratio of concentration of Fe^{2+} to Fe^{3+} is_________
(Nearest integer)

Q60 Potassium chlorate is prepared by the electrolysis of KCl in basic solution.

$$6OH^- + Cl^- \rightarrow ClO_3^- + 3H_2O + 6e^-$$

If only 60% of the current is utilized in the reaction, the time (rounded to the nearest hour) required to produce 10 g of $KClO_3$ using a current of 2 A is_________.
(Given : F = 96,500 C mol^{-1}; molar mass of $KClO_3$ = 122 g mol^{-1})

Mathematics

Single Choice Question

Q61 The intercept cut off from y-axis is twice that from x-axis by the line and line is passes through (1, 2) then its equation is

a) 2x + y = 4 **b)** 2x + y + 4 = 0 **c)** 2x –y = 4 **d)** 2x – y + 4 = 0

Q62 If A = $\begin{bmatrix} 0 & \alpha & \alpha \\ 2\beta & \beta & -\beta \\ \gamma & -\gamma & \gamma \end{bmatrix}$ is an orthogonal matrix, then the number of possible triplets (α, β, γ)

a) 8 **b)** 6 **c)** 4 **d)** 2

Q63 If A = $\begin{bmatrix} 0 & 5 \\ 0 & 0 \end{bmatrix}$ and f(x) = 1 + x + x^2 + ... + x^{16}, then f(A) is equal to

a) 0 **b)** $\begin{bmatrix} 1 & 5 \\ 0 & 1 \end{bmatrix}$ **c)** $\begin{bmatrix} 1 & 5 \\ 0 & 0 \end{bmatrix}$ **d)** $\begin{bmatrix} 0 & 5 \\ 1 & 1 \end{bmatrix}$

Q64 The number of values of $\theta \in [0, \pi]$ such that $\lambda = \cos^3\theta + \sin^3\theta$ and system of equation 3x – y + 4z = 3, x + 2y – 3z = – 2, 6x + 5y + 5λz = – 3 does not have a unique solution is / are

a) 0 **b)** infinite **c)** 1 **d)** none of these

Q65 Equation of circle through intersection of $x^2 + y^2 + 2x = 0$ and x – y = 0, having minimum radius is

a) $x^2 + y^2 – 1 = 0$ **b)** $x^2 + y^2 – x – y = 0$ **c)** $x^2 + y^2 – 2x – 2y = 0$

d) None of these

Q66 A triangle is formed by the lines whose combined equation is given by (x + y – 4) (xy –2x – y + 2) = 0. The equation of its circumcircle is

a) $x^2 + y^2 –5x –3y + 8 = 0$ **b)** $x^2 + y^2 –3x –5y + 8 = 0$

c) $x^2 + y^2 –3x –5y – 8 = 0$ **d)** None of these

Q67 The line 3x – 4y + 7 = 0 is rotated through an angle $\frac{\pi}{4}$ in the clockwise direction about the point (–1, 1). The equation of the line in its new position is

a) 7y + x – 6 = 0 **b)** 7y – x – 6 = 0 **c)** 7y + x + 6 = 0 **d)** 7y – x + 6 = 0

Q68 Given the system of straight lines a (2x+y–3) + b (3x + 2y – 5) = 0, the line of the system situated farthest from the point (4, –3) has the equation

a) 4x + 11y – 15 = 0 **b)** 7x + y – 8 = 0 **c)** 4x + 3y – 7 = 0 **d)** 3x – 4y + 1 = 0

Q69 The exhaustive range of values of a such that the angle between the pair of tangents drawn from (a, a) to the circle $x^2 + y^2 - 2x - 2y - 6 = 0$ lies in the range $\left(\frac{\pi}{3}, \pi\right)$, is

a) $(1, \infty)$ **b)** $(-5, -3) \cup (3, 5)$ **c)** $(-\infty, -2\sqrt{2}) \cup (2\sqrt{2}, \infty)$
d) $(-3, -1) \cup (3, 5)$

Q70 A ray of light incident at the point (–2, –1) gets reflected from the tangent at (0, –1) to the circle $x^2 + y^2 = 1$. The reflected ray touches the circle. The equation of the line along which the incident ray moves, is

a) $4x - 3y + 11 = 0$ **b)** $4x + 3y + 11 = 0$ **c)** $3x + 4y + 11 = 0$
d) $4x + 3y + 7 = 0$

Q71 The equation of a circle through the intersection of $x^2 + y^2 + 2x = 0$ and $x - y = 0$ having minimum radius is

a) $x^2 + y^2 = 1$ **b)** $x^2 + y^2 - x - y = 1$ **c)** $x^2 + y^2 + x + y = 0$ **d)** None of these

Q72 Let $A = \begin{bmatrix} -1 & 2 & -3 \\ -2 & 0 & 3 \\ 3 & -3 & 1 \end{bmatrix}$ be a matrix, then (determinant of A) × (adjoint of inverse of A) is equal to-

a) $O_{3 \times 3}$ **b)** $\begin{bmatrix} -1 & 2 & -3 \\ -2 & 0 & 3 \\ 3 & -3 & 1 \end{bmatrix}$ **c)** I_3 **d)** $\begin{bmatrix} -3 & -3 & 1 \\ 3 & 0 & -2 \\ -1 & 2 & -3 \end{bmatrix}$

Q73 If $f(x) = \begin{cases} \dfrac{\sqrt{4+ax} - \sqrt{4-ax}}{x}, & -1 \le x < 0 \\ \dfrac{3x+2}{x-8}, & 0 \le x \le 1 \end{cases}$ is continuous in [–1, 1] then value of a is

a) 1 **b)** -1 **c)** 1/2 **d)** -1/2

Q74 Let f and g be differentiable functions on R such that fog is the identity function. If for some a, b ∈ R, $g'(a) = 5$ and $g(a) = b$, then $f'(b)$ is equal to :

a) 1 **b)** 5 **c)** $\frac{1}{5}$ **d)** $\frac{2}{5}$

Q75 Let $f(x) = \cos\left(2\tan^{-1}\sin\left(\cos^{-1}\sqrt{\frac{1-x}{x}}\right)\right)$. $0 < x < 1$. Then :

a) $(1 - x)^2 f'(x) - 2(f(x))^2 = 0$ **b)** $(1 + x)^2 f'(x) + 2(f(x))^2 = 0$
c) $(1 - x)^2 f'(x) + 2(f(x))^2 = 0$ **d)** $(1 + x)^2 f'(x) - 2(f(x))^2 = 0$

Q76 Let $\alpha = \lim_{n\to\infty} \frac{1^2 + 2^2 + 3^2 + \ldots.. + n^2}{n^3}$ & $\beta = \lim_{n\to\infty} \frac{(1^3 - 1^2) + (2^3 - 2^2) + \ldots\ldots. + (n^3 - n^2)}{n^4}$ then

a) $\alpha = \beta$ **b)** $\alpha < \beta$ **c)** $4\alpha - 3\beta = 0$ **d)** $3\alpha - 4\beta = 0$

Q77 If $y = \tan^{-1}\sqrt{\frac{1-\sin x}{1+\sin x}}$, then the value of dy/dx at $x = \pi/6$ is

a) $-1/2$ **b)** $1/2$ **c)** 1 **d)** -1

Q78 Let f(x) be defined as follows $f(x) = \begin{cases} (\cos x - \sin x)^{\operatorname{cosec} x} & , -\frac{\pi}{2} < x < 0 \\ a & , x = 0 \\ \frac{e^{1/x} + e^{2/x} + e^{3/x}}{ae^{2/x} + be^{3/x}} & , 0 < x < \frac{\pi}{2} \end{cases}$ If f(x) is continuous at x = 0, then (a, b) =

a) $\left(e, \frac{1}{e}\right)$ **b)** $\left(\frac{1}{e}, e\right)$ **c)** (e, e) **d)** (e^{-1}, e^{-1})

Q79 The function $f(x) = \lim_{n\to\infty} (\sin x)^n$ is discontinuous at

a) $n\pi + (-1)^n.\frac{\pi}{2}, n \in I$ **b)** $n\pi + \frac{\pi}{2}, n \in I$ **c)** $2n\pi \pm \frac{\pi}{2}, n \in I$ **d)** None of these

Q80 Let $f(x) = \begin{cases} 1, x \le -1 \\ |x|, -1 < x < 1, \text{then} \\ 0, x \ge 1 \end{cases}$

a) f is continuous at $x = -1$ **b)** f is differentiable at $x = -1$

c) f is continuous everywhere **d)** f is differentiable for all x

Numerical

Q81 Six points (x_i, y_i), i = 1, 2,..., 6 are taken on the circle $x^2 + y^2 = 4$ such that $\sum_{i=1}^{6} x_i = 8$ and $\sum_{i=1}^{6} y_i = 4$ y_i = 4. The line segment joining orthocentre of a triangle made by any three points and the centroid of the triangle made by other three points passes through a fixed points (h, k), then h + k is__________

Q82 A line 'L' is drawn from (4, 3) to meet the lines L_1 : 3x + 4y + 5 = 0 and L_2 : 3x + 4y + 15 = 0 at points A and B respectively. From 'A' a line, perpendicular to L is drawn meeting the line L_2 at A_1. Similarly, from point 'B' a line, perpendicular to L is drawn meeting the line L_1 at B_1. Thus parallelogram AA_1BB_1 is formed. Least value of area of parallelogram AA_1BB_1 is.....

Q83 Let C_1 & C_2 are circles defined by $x^2 + y^2 - 20x + 64 = 0$ and $x^2 + y^2 + 30x + 144 = 0$. The length of shortest line segment PQ which is tangent to C_1 at P and C_2 at Q is

Q84 If A = $\begin{bmatrix} 3 & -2 & 3 \\ 2 & 1 & -1 \\ 4 & -3 & 2 \end{bmatrix}$. Solve the system of equations $\begin{bmatrix} 3 & 0 & 3 \\ 2 & 1 & 0 \\ 4 & 0 & 2 \end{bmatrix}\begin{bmatrix} x \\ y \\ z \end{bmatrix} = \begin{bmatrix} 8 \\ 1 \\ 4 \end{bmatrix} + \begin{bmatrix} 2y \\ z \\ 3y \end{bmatrix}$, then find the value of x + $\frac{y}{2}$ + $\frac{z}{3}$

Q85 If a determinant of order 3 × 3 is formed by using the numbers 1 or – 1 then it minimum value of determinant is – λ. find the value of λ.

Q86 If $\sum_{n=1}^{n} \alpha_n = an^2 + bn$, where a, b are constants and $\alpha_1, \alpha_2, \alpha_3 \in \{1, 2, 3, \ldots\ldots, 9\}$ and $25\alpha_1, 37\alpha_2, 49\alpha_3$ be three digit numbers, then $\begin{vmatrix} \alpha_1 & \alpha_2 & \alpha_3 \\ 5 & 7 & 9 \\ 25\alpha_1 & 37\alpha_2 & 49\alpha_3 \end{vmatrix} =$

Q87 If $e^y + xy = e$ then $\frac{d^2y}{dx^2}$ at x = 0 is $e^{-\lambda}$, then numerical quantity λ should be equal to..........

Q88 $\lim_{h\to\infty} h^{-h^2}\left[(h+1)\left(h+\frac{1}{2}\right)\left(h+\frac{1}{2^2}\right)\ldots\ldots\ldots\ldots\left(h+\frac{1}{2^{h-1}}\right)\right]^h = e^S$ then S =...................

Q89 The derivative of $\tan^{-1}\left(\frac{\sin x - \cos x}{\sin x + \cos x}\right)$, with respect to $\frac{x}{2}$, where $\left(x \in \left(0, \frac{\pi}{2}\right)\right)$ is :

Q90 A line through origin is tangent to the curve $y = x^3 + x + 16$, then slope of line is 5k + 3, then k equals -

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**C**	**A**	**B**	**D**	**C**	**B**	**A**	**A**	**B**	**C**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**D**	**C**	**D**	**C**	**C**	**D**	**B**	**B**	**D**	**D**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**10**	**3**	**4**	**10**	**60**	**2**	**1**	**2**	**1**	**5**
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	**A**	**B**	**A**	**B**	**B**	**A**	**A**	**A**	**C**	**C**
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	**A**	**A**	**C**	**C**	**C**	**C**	**B**	**D**	**D**	**B**
Que.	51	52	53	54	55	56	57	58	59	60
Ans.	**6**	**86**	**4**	**5**	**2**	**3**	**6**	**12**	**10**	**11**
Que.	61	62	63	64	65	66	67	68	69	70
Ans.	**A**	**A**	**B**	**C**	**D**	**B**	**A**	**D**	**D**	**B**
Que.	71	72	73	74	75	76	77	78	79	80
Ans.	**C**	**B**	**D**	**C**	**C**	**D**	**A**	**B**	**A**	**A**
Que.	81	82	83	84	85	86	87	88	89	90
Ans.	**3**	**8**	**20**	**3**	**4**	**0**	**2**	**2**	**2**	**2**