Competishun

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

Date: 12/01/2024

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

MFST-12 (23-24) & UT-2_MT-5

Physics

Single Choice Question

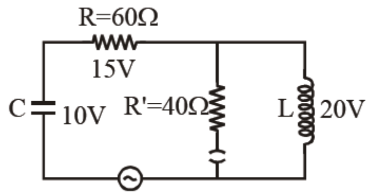
Q1 A tuning fork A of unknown frequency produces 5 beats/s with a fork of known frequency 340 Hz. When fork A is filed, the beat frequency decreases to 2 beats/s. What is the frequency of fork A ?

a) 342 Hz **b)** 345 Hz **c)** 335 Hz **d)** 338 Hz

Q2 The trajectory of a projectile in a vertical plane is $y = \alpha x - \beta x^2$, where α and β are constants and x & y are respectively the horizontal and vertical distances of the projectile from the point of projection. The angle of projection θ and the maximum height attained H are respectively given by :-

a) $\tan^{-1}\alpha, \frac{\alpha^2}{4\beta}$ **b)** $\tan^{-1}\beta, \frac{\alpha^2}{2\beta}$ **c)** $\tan^{-1}\alpha, \frac{4\alpha^2}{\beta}$ **d)** $\tan^{-1}\left(\frac{\beta}{\alpha}\right), \frac{\alpha^2}{\beta}$

Q3 The angular frequency of alternating current in a L-C-R circuit is 100 rad/s. The components connected are shown in the figure. Find the value of inductance of the coil and capacity of condenser.



a) 0.8 H and 150 μF **b)** 0.8 H and 250 μF

c) 1.33 H and 250 μF **d)** 1.33 H and 150 μF

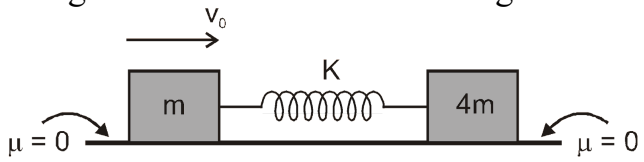
Q4 An isolated parallel plate capacitor has circular plates of radius 4cm. If the gap is filled with a partially conducting material having some dielectric constant and conductivity $5 \times 10^{-14}\ \Omega^{-1}\ m^{-1}$. When the capacitor is charged to a surface density of 15 μC/cm^2 the initial current between the plates is 1μA. If total joule heating produced is 7500 J, the separation of the capacitor plates is :

a) 4 mm **b)** 5 mm **c)** 3 mm **d)** 6 mm

Q5 In the motorcycle stunt called "the well of death" the track is a vertical cylindrical surface of 18 m radius. Take the motorcycle to be a point mass and $\mu = 0.8$. The minimum angular speed of the motorcycle to prevent him from sliding down should be:

a) 6/5 rad/s **b)** 5/6 rad/s **c)** 25/3 rad/s **d)** none of these

Q6 Two blocks of masses m and 4m lie on a smooth horizontal surface connected with a spring in its natural length. Mass m is given velocity v_0 through an impulse as shown in figure. Which of the following is **not true** about subsequent motion ?



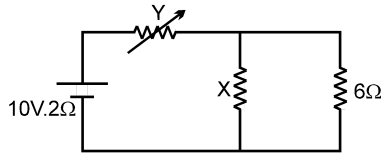
a) Kinetic energy is maximum in ground frame and centre of mass (CM) frame simultaneously.

b) Value of maximum and minimum kinetic energy is same in CM and ground frame.

c) Minimum kinetic energy is zero in CM frame about non-zero in ground frame

d) Maximum and minimum kinetic energy of m in ground frame is, respectively, $1/2\ mv_0^2$ and zero.

Q7 In the figure shown the thermal power generated in ' y ' is maximum when $y = 4\ \Omega$. Then X is:



a) $2\ \Omega$

b) $3\ \Omega$

c) $1\ \Omega$

d) $6\ \Omega$

Q8 A long straight solid cylinder of radius r = 1 mm carries uniformly distributed current $I = 4\pi$ A. If the axis of cylinder is perpendicular to uniform magnetic field $B0 = 7\pi \times 10^{-4}$ Tesla, then minimum magnitude value of magnetic field at a finite distance from cylinder will be :

a) $8\pi \times 10^{-4}$ T **b)** $\pi \times 10^{-4}$ T **c)** $15\pi \times 10^{-4}$ T **d)** Zero

Q9 A conducting wire of length L fixed at both ends is vibrating in its fundamental mode with angular frequency ω and maximum amplitude A. There exists a uniform and constant magnetic field of induction B perpendicular to the plane of oscillations of the wire. The maximum emf induced in the wire is:

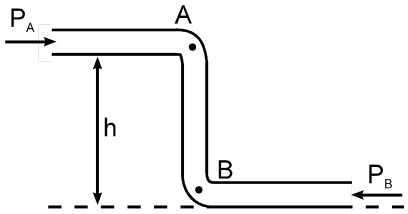
a) $\frac{BA\omega L}{\pi}$

b) $\frac{2BA\omega L}{\pi}$

c) $\frac{BA\omega L}{2\pi}$

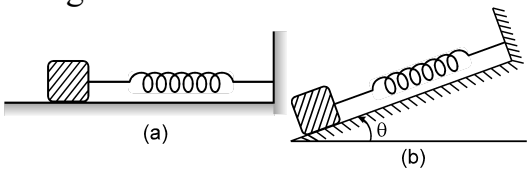
d) $\frac{BA\omega L\pi}{2}$

Q10 Figure shows an ideal fluid flowing through a uniform cross-sectional tube in the vertical tube with liquid velocities v_A & v_B and pressure P_A & P_B. Knowing that tube offers no resistance to fluid flow then which of the following is true.

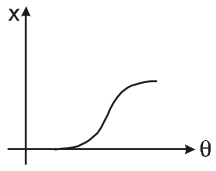


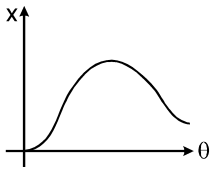
a) $P_B > P_A$ **b)** $P_B < P_A$ **c)** $P_A = P_B$ **d)** none of these

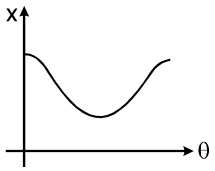
Q11 A block is placed on a rough horizontal plane attached with an elastic spring as shown in figure.

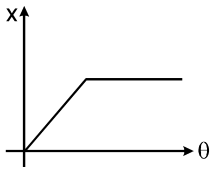


Initially spring is unstretched. If the plane is now slowly lifted from θ = 0° to θ = 90°, then the graph showing extension in the spring (x) versus angle (θ) is

a) 

b) 

c) 

d) 

Q12 Two stars of mass m and 2m separated by distance r are moving in circular path about their centre of mass due to mutual gravitation force. The angular velocity of any star will be :

a) $\sqrt{\frac{Gm}{r^3}}$ **b)** $\sqrt{\frac{2Gm}{r^3}}$ **c)** $\sqrt{\frac{3Gm}{r^3}}$ **d)** $\sqrt{\frac{Gm}{2r^3}}$

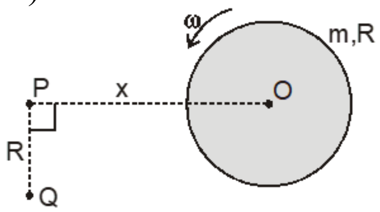
Q13 If the kinetic energy of a free electron doubles, its de-Broglie wavelength changes by the factor :

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

Q14 If an electromagnetic wave propagating through vacuum is described by $E = E_0 \sin(kx - \omega t)$; $B = B_0 \sin(kx - \omega t)$,

a) $E_0 k = B_0 \omega$ **b)** $E_0 B_0 = \omega k$ **c)** $E_0 \omega = B_0 k$ **d)** $E_0 B_0 = \omega / k$

Q15 A uniform disc of mass m and radius R is undergoing fixed axis rotation about its own axis and centre O of disc remains stationary. The angular speed of disc is ω. Then the magnitude of angular momentum of disc about shown point Q is : (OP = x and PQ = R)

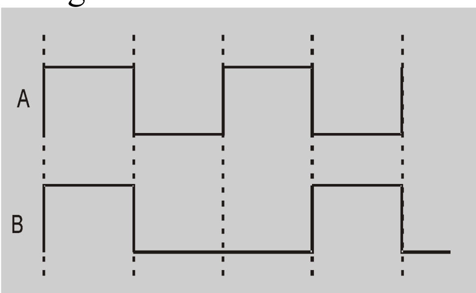


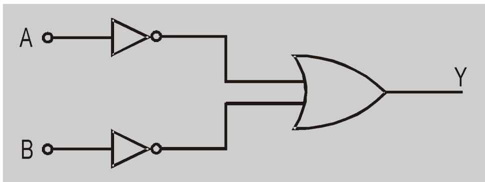
a) $m\frac{(x^2+2R^2)}{2}\omega$ **b)** $m\frac{(x^2+R^2)}{2}\omega$ **c)** $\frac{mx^2}{2}\omega$ **d)** $\frac{mR^2}{2}\omega$

Q16 A disc is hinged in a vertical plane about a point on its radius. What will be the distance of the hinge from the disc centre so that the period of its small oscillations under gravity is minimum?

a) R **b)** $\frac{R}{\sqrt{2}}$ **c)** $\frac{R}{2}$ **d)** $\frac{R}{4}$

Q17 In a given circuit as shown the two inputs waveform A and B applied simultaneously.





The resultant wave form Y is-

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

Q18 A vertical capillary tube with inner radius 0.5 mm, is submerged into water so that the length of its part above the water surface is h = 25 mm. Radius of curvature of meniscuses formed will be (surface tension of water = 0.075 N/m. Density of water = 10^3 kg/m^3, angle of contact = 0°)

a) 0.5 mm **b)** 0.6 mm **c)** 0.7 mm **d)** 0.8 mm

Q19 If $\vec{A} = \hat{i} + 2\hat{j} + 3\hat{k}$ & $\vec{B} = 3\hat{i} - 2\hat{j} + \hat{k}$, then the area of parallelogram formed with $\vec{A}$ and $\vec{B}$ as the sides of the parallelogram is:

a) $\sqrt{3}$

b) $8\sqrt{3}$

c) 64

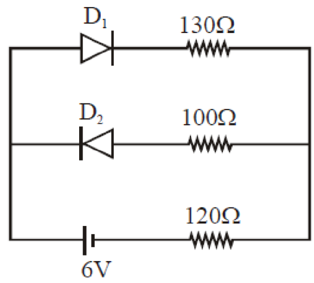
d) 0

Q20 The potential energy of a particle of mass m free to move along x-axis is given by $U = \frac{1}{2}kx^2$ for $x < 0$ and $U = 0$ for $x \geq 0$ (x denotes the x-coordinate of the particle and k is a positive constant). If the total mechanical energy of the particle is E, then its speed at $x = -\sqrt{\frac{2E}{k}}$ is:

a) zero
b) $\sqrt{\frac{2E}{m}}$
c) $\sqrt{\frac{E}{m}}$
d) $\sqrt{\frac{E}{2m}}$

Numerical

Q21 The circuit contains two diodes each with a forward resistance of 50 Ω and with infinite reverse resistance. If the battery voltage is 6 V, the current through the 120 Ω resistance is mA.



Q22 Two identical thin biconvex lenses of focal length 15 cm and refractive index 1.5 are in contact with each other. The space between the lenses is filled with a liquid of refractive index 1.25. The focal length of the combination is _______ cm.

Q23 The volume V of a given mass of one mole monoatomic gas changes with temperature T according to the relation $V = KT^{2/3}$. The workdone when temperature changes by 90 K will be xR. The value of x is [R = universal gas constant]

Q24 The electric field in a region is given $\vec{E} = \left(\frac{3}{5}E_0\hat{i} + \frac{4}{5}E_0\hat{j}\right)\frac{N}{C}$. The ratio of flux of reported field through the rectangular surface of area 0.2 m^2 (parallel to y – z plane) to that of the surface of area of 0.3 m^2 (parallel to x – z plane) is a : 2, where a = _______.
[Here $\hat{i}$, $\hat{j}$ and $\hat{k}$ are unit vectors along x, y and z axes respectively]

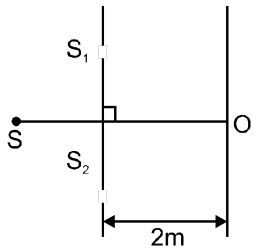
Q25 The same size images are formed by a convex lens when the object is placed at 20cm or at 10cm from the lens. The focal length of convex lens is ______ cm.

Q26 A person standing on the bank of a river wants to cross the river in minimum possible time. Find the distance (in km) travelled by the person with respect to ground when he reaches the opposite bank of the river.
Width of river = 1km
Speed of river flow = 10 m/sec
Swimming capacity of man in still water = $\frac{10}{\sqrt{3}}$ m/sec

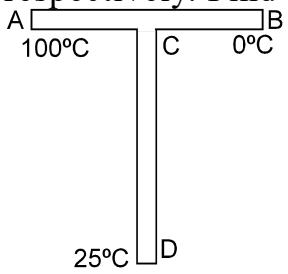
Q27 On a horizontal flat ground, a person is standing at a point A. At this point he installs a 5 m long pole vertically. Now he moves 5 m towards east and then 2 m towards north and reaches at a point 'B'. There he installs another 3 m long vertically pole. A bird files from the top of first pole to the top of second pole. The magnitude of displacement of bird is observed to be $(\sqrt{11\times(n)})$ meters. The value of n is

Q28 The length of an elastic string is 5 metre when the longitudinal tension is 4 N and 6 metre when the tension is 5 N. If the length of the string (in metre) is "2X" when the longitudinal tension is 9 N is(assume Hooke's law is valid) then the value of X will be :

Q29 A point source 'S' which is symmetrically placed (as shown in figure) emits light rays of wavelength 4000 Å and 6000 Å. If distance between slits S_1 and S_2 is 1mm then least (non–zero) distance of point on screen from 'O' at which both the wavelengths produces maxima together is $\frac{6X}{10}$ mm then calculate 'X' :



Q30 A rod CD of thermal resistance 5.0 K/W is joined at the middle of an identical rod AB as shown in figure. The ends A, B and D are maintained at 100ºC, 0ºC and 25ºC respectively. Find the heat current in CD (in watt).



Chemistry

Single Choice Question

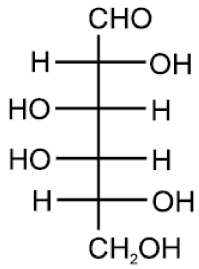
Q31 [X] + $H_2SO_4 \longrightarrow$ [Y] a colourless gas with irritating smell.
[Y] + $K_2Cr_2O_7$ + $H_2SO_4 \longrightarrow$ green colour solution : [X] and [Y] are :

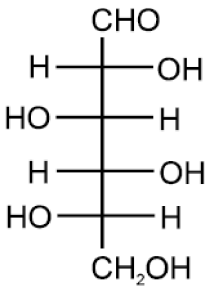
a) SO_3^{2-}, SO_2 **b)** Cl^-, HCl **c)** S^{2-}, H_2S **d)** SO_3^{2-}, CO_2

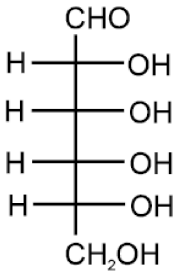
Q32 Which of the following is not a pyrimidine base?

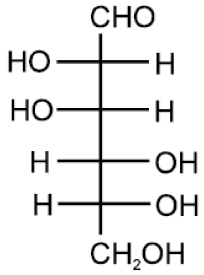
a) Uracil **b)** Guanine **c)** Cytosine **d)** Thymine

Q33 Which of the following is a C-3 epimer of D-glucose.

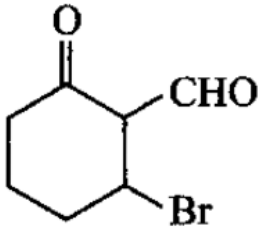
a)


b)


c)


d)


Q34 Correct IUPAC name of the following compound is



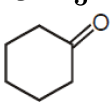
a) 2-bromo-6-oxocyclohexanecarbaldehyde
b) 6-bromo-2-oxocyclohexanecarbaldehyde
c) 3-bromo-2-fomylcyclohexanone
d) 6-bromo-2-oxocyclohexylmethanal

Q35 What volume of 0.2 M $Ba(OH)_2$ must be added to 300 mL of a 0.08 M HCl solution to get a solution in which the molarity of hydroxyl (OH^-) ions is 0.08 M ?

a) 375 mL **b)** 300 mL **c)** 225 mL **d)** 150 mL

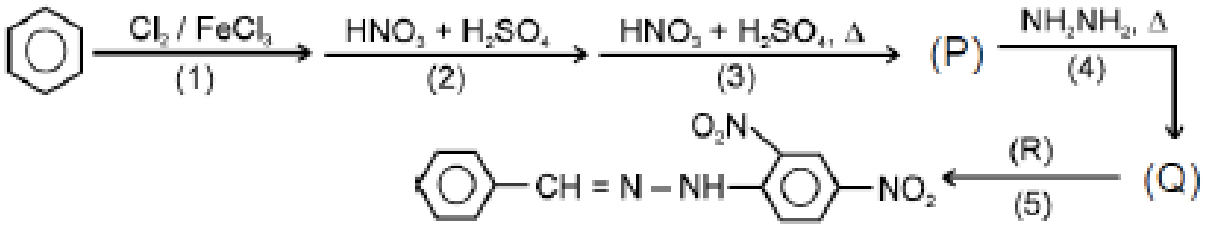
Q36 Reactivity order of following compounds with CH_3MgBr in 'tetrahydrofurane (THF) is :

(i) $CH_3 - CO - CH_3$ (ii) $CH_3 - CHO$

(iii) $CH_2 = O$ (iv) 

a) i > ii > iii > iv **b)** iv > i > ii > iii **c)** iii > ii > iv > i **d)** iii > iv > ii > i

Q37 The correct statement/s about the following reaction sequence is / are



a) 'R' gives an aldol condensation reaction on heating with NaOH solution

b) The compound 'Q' gives a white precipitate in acetone

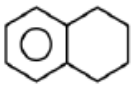
c) Step '4' is an aromatic nucleophilic substitution reaction

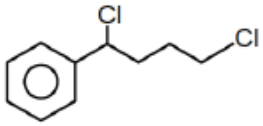
d) The end product is a mixture of three compounds

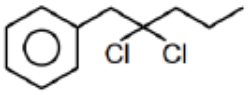
Q38 Ammonium molybdate is used for detection of which element in organic compound:

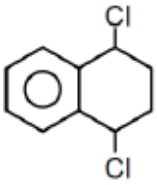
a) C **b)** N **c)** P **d)** S

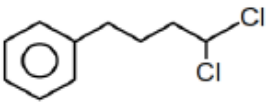
Q39 An aromatic compound (P) $C_{10}H_{12}Cl_2$ on hydrolysis with aqueous KOH gives (Q). Compound Q on reduction with $NaBH_4$ gives (R). R in acidic medium gives a bicyclic product "S'.

If product "S'  is then compound "P' will be –

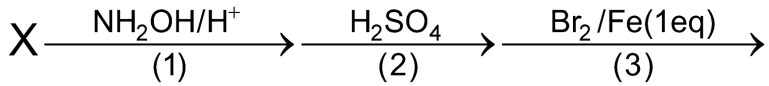
a) 

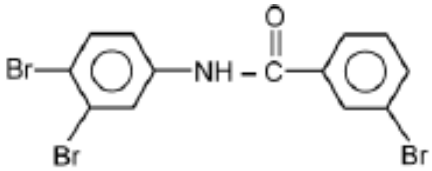
b) 

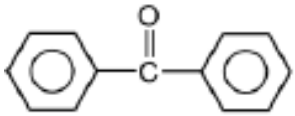
c) 

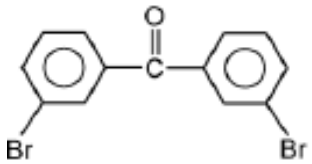
d) 

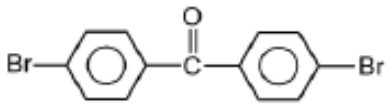
Q40 Observe the following reactions. In this series the compound 'X' can be :

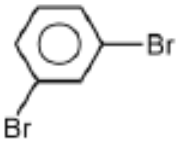




a) 

b) 

c) 

d) 

Q41 Reaction-I :

$$\text{Phenol} \xrightarrow{\text{NaOH}} X \xrightarrow[140^\circ C]{CO_2} Y \xrightarrow{\text{HCl}} Z \xrightarrow[\Delta]{\text{sodalime}} P$$

Reaction- II :

$$\text{Phenol} \xrightarrow[\text{NaOH}]{CCl_4} X \xrightarrow{\text{HCl}} Y \xrightarrow[\Delta]{\text{sodalime}} Q$$

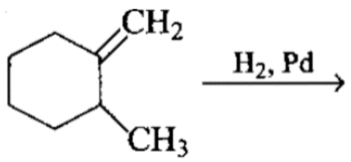
Wrong statement about P and Q is –

a) Both the compounds give violet colour with $FeCl_3$

b) Both the compounds on deoxygenation give benzene

c) Both the compounds contain phenolic -OH group

d) Compound P is phenol and Q is cresol

Q42 

Products of the above reaction will be :

a) racemic mixture

b) diastereomers

c) meso

d) structural isomer

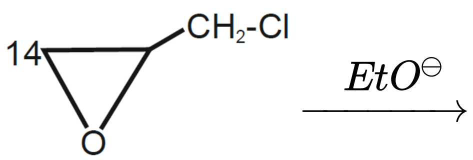
Q43 Give the correct order of initials T or F for following statements. Use T if statement is true and F if it is false.
I. Me–CH=C=C=CH–Br is optically active.
II. All optically active compound are chiral.
III. All chiral pyramidal molecules are optically inactive.
IV. $CH_3–CH_2–CH_2–COOH$ and $CH_3–CH(COOH)–CH_3$ are positional isomers.

a) TTTF

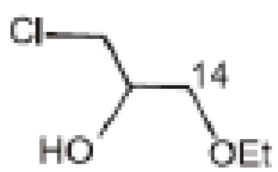
b) FTFT

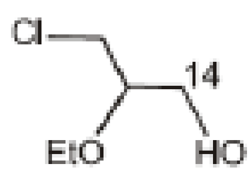
c) FTFF

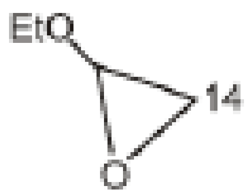
d) TFTT

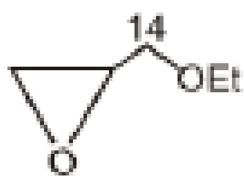
Q44 

[X] Product x will be

a) 

b) 

c) 

d) 

Q45 The normal boiling point of water is 373 K. Vapour pressure of water at temperature T is 19 mm Hg. If enthalpy of vaporisation is 40.67 kJ/mol, then temperature T would be (Use : log 2 = 0.3, R = 8.3 JK^{-1} mol^{-1})

a) 250 K b) 291.4 K c) 230 K d) 290 K

Q46 The equilibrium, SO_2Cl_2 (g) $\rightleftharpoons$ SO_2 (g) + Cl_2 (g) is attained at 298 K in a closed container and an inert gas, He is introduced. Which of the following is/are correct ?

a) Concentration of SO_2 (g), Cl_2 (g) and SO_2 Cl_2 (g) remain unchanged

b) More Cl_2 (g) is formed

c) Concentration of SO_2 (g) is reduced

d) More SO_2Cl_2 (g) is formed

Q47 Which one of the following statements is correct?

a) The elements having large negative values of electron gain enthalpy generally act as strong oxidising agents.

b) The elements having low values of ionisation enthalpies act as strong reducing agents

c) The formation of S^{2-}(g) from S(g) is an endothermic process.

d) All of these

Q48 A 1 M solution of H_2SO_4 is electrolyzed. Select right statement with products at anode and cathode respectively Given :

$2SO_4^{2-} \longrightarrow S_2O_8^{2-} + 2e^-; E^o = -2.01V$

$H_2O(\ell) \longrightarrow 2H^+ (aq) + 1/2 O_2(g) + 2e^-$; E° = – 1.23 V

a) concentration of H_2SO_4 remain constant ; H_2, O_2

b) concentration of H_2SO_4 increases ; O_2, H_2

c) concentration of H_2SO_4 decreases ; O_2, H_2

d) concentration of H_2SO_4 remains constant ; $S_2O_8{}^{2-}$, H_2

Q49 Choose the incorrect statement among the following:

a) A node is a point in space where the wave-function Ψ has zero amplitude

b) The number of maxima (peaks) in radial distribution in n – *l*

c) Radial probability is $4\pi r^2 R_{n,l}^2$ dr

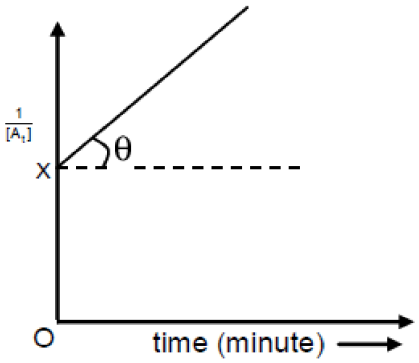
d) Ψ^2 represents probability of finding electron

Q50 The ONO angle is maximum in :

a) HNO_3 b) $NO_2{}^+$ c) HNO_2 d) NO_2

Numerical

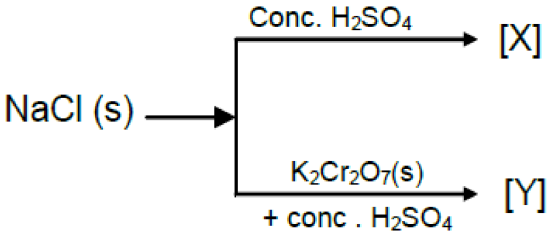
Q51 For a second order reaction $A \longrightarrow$Product, the graph is plotted against $\frac{1}{[A_1]}$ and time 't'



tan θ = 1 and OX = 3L mole^{-1}. The rate of reaction (in M min–1) at beginning is X then 9X is

Q52 A 1.0 g sample of $Co(NH_2CH_2CH_2NH_2)_3\ CI_3$ is dissolved in 25.0 g of water and the freezing point of the solution is –0.87ºC. How may ions are produced per mole of compound? The K_f of water is 1.86ºC/ molal

Q53 Find the difference in the oxidation number of Cl in product X and product Y.



Q54 The percentage by volume of C_3H_8 in a gaseous mixture of C_3H_8, CH_4 and CO is 20. When 100 mL of the mixture is burnt in excess of O_2, the volume of CO_2 produced (in mL) is, if your answer is X then what will be the value of $\frac{X}{10}$:

Q55 How many of the following are mixed anhydride ?
Cl_2O_7 , Cl_2O_3 , ClO_2 , CI_2O_5, SO_2, NO_2, N_2O_5, I_2O_5, Cl_2O

Q56 $[Ti(H_2O)_6]^{3+}$ absorbs light of wavelength 498 nm during a d – d transition. The octahedral splitting energy for the avove complex is _____× 10^{-19}J. (Round off to the Nearest Integer).

H = 6.626 × 10^{-34} Js; c = 3 × 10^8 ms^{-1},

Q57 Two salts A_2X and MX have the same value of solubility product of 4.0 × 10^{-12}. The ratio of their molar solubilities i.e. $\frac{S(A_2X)}{S(MX)}$ =_____.

(Round off to the Nearest Integer).

Q58 The total number of C–C sigma bond/s in acetanilide is ________.

Q59 A perfect gas undergoes a reversible adiabatic expansion from (300K, 200atm) to (90K,10 atm). Find the atomicity of gas.

Q60 In Tollen's test for aldehyde, the overall number of electron(s) transferred to the Tollen's reagent formula $[Ag(NH_3)_2]^+$ per aldehyde group to form silver mirror is_______.(Round off to the Nearest integer)

Mathematics

Single Choice Question

Q61 Sum of three numbers in G.P. be 14. If one is added to first and second and 1 is subtracted from the third, the new numbers are in A.P. The smallest of them is

a) 2 **b)** 4 **c)** 6 **d)** 10

Q62 Given a = x/(y –z), b = y/(z–x) and c = z/ (x –y), where x, y and z are not all zero, then the value of ab + bc + ca is

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

Q63 Let $f(x) = ([a]^2 - 5[a] + 4)x^3 - (6\{a\}^2 - 5\{a\} + 1)x - (\tan x) \times \text{sgn } x$ be an even function for all $x \in R$. Then the sum of all possible values of a is (where [•] and {•} denote greatest integer function and fractional part function, respectively)

a) $\frac{17}{6}$ **b)** $\frac{53}{6}$ **c)** $\frac{31}{3}$ **d)** $\frac{35}{3}$

Q64 The product of the matrices $A = \begin{bmatrix} \cos^2\theta & \cos\theta\sin\theta \\ \cos\theta\sin\theta & \sin^2\theta \end{bmatrix}$ and $B = \begin{bmatrix} \cos^2\phi & \cos 2\phi \sin\phi \\ \cos\phi\sin\phi & \sin^2\phi \end{bmatrix}$ is a null matrix if $\theta - \varphi =$

a) $(2n + 1)\ \frac{\pi}{2}$

b) $n\pi$

c) $2n\pi$

d) $\frac{n\pi}{2}$

Q65 The greatest and the least value of $|z_1 + z_2|$ if $z_1 = 24 + 7i$ and $|z_2| = 6$ are respectively

a) 31, 19 **b)** 25, 19 **c)** 31, 25 **d)** None of these

Q66 A box contains tickets numbered 1 to N. n tickets are drawn from the box with replacement. The probability that the largest number on the tickets is k is

a) $\left(\frac{k}{N}\right)^n$ **b)** $\left(\frac{k-1}{N}\right)^n$ **c)** 0 **d)** None of these

Q67 In a conference 10 speakers are present. If S_1 wants to speak before S_2 and S_2 wants to speak after S_3, then the number of ways all the 10 speakers can give their speeches with the above restriction if the remaining seven speakers have no objection to speak at any number is-

a) ${}^{10}C_3$ **b)** ${}^{10}P_8$ **c)** ${}^{10}P_3$ **d)** $\frac{10!}{3}$

Q68 If α_k, (k = 1,2,3,4) be the roots of the equation $px^4 + qx + p = 0$, then the equation whose roots are $\frac{\alpha_1^5}{(\alpha_2+\alpha_3+\alpha_4)^2.\alpha_2\alpha_3\alpha_4}$, $\frac{\alpha_2^5}{(\alpha_1+\alpha_3+\alpha_4)^2.\alpha_1\alpha_3\alpha_4}$, $\frac{\alpha_3^5}{(\alpha_1+\alpha_2+\alpha_4)^2.\alpha_1\alpha_2\alpha_4}$, $\frac{\alpha_4^5}{(\alpha_1+\alpha_2+\alpha_3)^2.\alpha_1\alpha_2\alpha_3}$ is :

a) $p_4x_4 + 4p^3qx^3 + 6p^2q^2x^2 + (4pq^3 - q^4)x + q^4 = 0$
b) $q^4x^4 + 4p^3x^3 + 6p^2x^2 + (4q - p^4)x + 1 = 0$
c) $p^4x^4 - 4p^3qx^3 + 6p^2q^2x^2 - (4pq^3 - q^4)\ x+1=0$
d) $q^4x^4 - 4p^3x^3 + 6p^2x^2 - (4q - p^4)\ x + 1 = 0$

Q69 If p(x) be a polynomial of degree three that has a local maximum value 8 at x = 1 and a local minimum value 4 at x = 2; then p(0) is equal to

a) -24 **b)** 6 **c)** 12 **d)** -12

Q70

If a function f(x) defined by $f(x)=\begin{cases} ae^x+be^{-x} & , -1\le x<1 \\ cx^2 & , 1\le x\le 3 \\ ax^2+2cx & , 3<x\le 4 \end{cases}$ be continuous for some a, b, c, ∈ and f′(0) + f′(2) = e, then the value of a is

a) $\frac{e}{e^2+3e+13}$ **b)** $\frac{e}{e^2-3e-13}$ **c)** $\frac{1}{e^2-3e+13}$ **d)** $\frac{e}{e^2-3e+13}$

Q71

$\lim_{x\to 0}\left(\tan\left(\frac{\pi}{4}+x\right)\right)^{1/x}$ is equal to :

a) e **b)** 2 **c)** 1 **d)** e^2

Q72 The function, $f(x) = (3x - 7)\ x^{2/3}$, x ∈ R, is increasing for all x lying in

a) $(-\infty, 0) \cup \left(\frac{14}{15}, \infty\right)$

b)

$(-\infty, 0) \cup \left(\frac{3}{7}, \infty\right)$

c)

$\left(-\infty, \frac{14}{15}\right)$

d)

$\left(-\infty, \frac{14}{15}\right) \cup (0, \infty)$

Q73

If $\int_0^y \cos t^2 dt = \int_0^{x^2} \frac{\sin t}{t} dt$. Then $\frac{dy}{dx}$ is equal to -

a) $\frac{2\sin x}{x\cos y}$ **b)** $\frac{2\sin x^2}{x\cos y}$ **c)** $\frac{2\sin x^2}{x\cos y^2}$ **d)** $\frac{2\sin x^2}{\cos y^2}$

Q74 The integral $\int e^{\left(x^2+\frac{1}{x^2}\right)}\left(1+2\left(x^2-\frac{1}{x^2}\right)\right)dx$ is equal to :

a) $\left(e^{x^2+\frac{1}{x^2}}\right)+C$ b) $xe^{\left(x^2+\frac{1}{x^2}\right)}+C$ c) $x^2e^{\left(x^2+\frac{1}{x^2}\right)}+C$ d) $e^{\left(x^2+\frac{1}{x^2}\right)}+x^2+C$

Q75 Let y = y(x) be the solution of the differential equation $(1-x^2)\frac{dy}{dx}-xy=1,\ \ x\in(-1,1)$. If $y(0)=0$, then $y\left(\frac{1}{2}\right)$ is equal to :

a) $\frac{\pi}{3\sqrt{3}}$ b) $\frac{\pi}{\sqrt{3}}$ c) $\frac{\pi}{6}$ d) $\frac{\pi}{3}$

Q76 A vector $\vec{\alpha}=a\hat{i}+b\hat{j}+c\hat{k}$ is said to be rational vector if a, b, c are all rational, If this vector $\vec{\alpha}$ having magnitude as positive inter, makes an angle $\frac{\pi}{4}$ with vector $\beta=\sqrt{2}\hat{i}+3\sqrt{2}\hat{j}+4\hat{k}a$, then $\vec{\alpha}$ always -

a) lies in xy plane b) lies in xz plane c) lies in yz palne d) lies on x-axis

Q77 A variable point 'P' is moving such that its distances from a line $\frac{x+1}{3}=\frac{y-2}{4}=\frac{z-7}{2}$ and a point (4, 5, 8) are equal, then vertex of the locus of P, is :

a) $\left(3,\frac{11}{2},\frac{17}{2}\right)$ b) (6, 4, 7) c) (2, 6, 9) d) $\left(5,\frac{9}{2},\frac{15}{2}\right)$

Q78 Area of the ellipse $(2x + 3y - 5)^2 + 4(-3x + 2y + 1)^2 = 52$ is equal to :

a) 8π
b) 4π
c) 2π
d) π

Q79 Let P be a point on the parabola, $y^2 = 12x$ and N be the foot of the perpendicular drawn from P on the axis of the parabola. A line is now drawn through the mid-point M of PN, parallel to its axis which meets the parabola at Q. If the y-intercept of the line NQ is $\frac{4}{3}$, then :

a) $MQ=\frac{1}{4}$ b) PN = 3 c) PN = 4 d) $MQ=\frac{1}{3}$

Q80 A line, with the slope greater than one, passes through the point A(4, 3) and intersects the line x – y – 2 = 0 at the point B. If the length of the line segment AB is $\frac{\sqrt{29}}{3}$, then B also lies on the line :

a) 2x + y = 9 b) 3x – 2y = 7 c) x + 2y = 6 d) 2x – 3y = 3

Numerical

Q81 Let f(x) = max {tan x, cot x}. Then number of roots of the equation $f(x) = \frac{1}{\sqrt{3}}$ in (0, 2π) is:

Q82 If the variance of 10 natural numbers 1, 1, 1,...., 1, k is less than 10, then the maximum possible value of k is ______.

Q83 If (2^{35}. 3^{16}) is divided by 11, then the remainder is :

Q84 Let $\mathbb{N}$ be the set of all integers,
$A = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : (x - 2)^2 + y^2 \leq 4\}$,
$B = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : x^2 + y^2 \leq 4\}$ and
$C = \{(x, y) \in \mathbb{Z} \times \mathbb{Z} : (x - 2)^2 + (y - 2)^2 \leq 4\}$
If the total number of relation from A ∩ B to A ∩ C is 2^p, then the value of p is :

Q85 If $y = \sum_{k=1}^{6} k \cos^{-1}\left\{\frac{3}{5}\cos kx - \frac{4}{5}\sin kx\right\}$, then $\frac{dy}{dx}$ at x = 0 is ....

Q86 If $\lim_{x \to 0}\left\{\frac{1}{x^8}\left(1 - \cos\frac{x^2}{2} - \cos\frac{x^2}{4} + \cos\frac{x^2}{2}\cos\frac{x^2}{4}\right)\right\} = 2^{-k}$, then the value of k is ....

Q87 The number of the real roots of the equation $(x+1)^2 + |x-5| = \frac{27}{4}$ is ________.

Q88 If area bounded by curve $y = \left|\cos^{-1}(\sin x)\right| + \left|\frac{\pi}{2} - \cos^{-1}(\cos x)\right|$, x-axis and $\frac{\pi}{2} \leq x \leq \pi$ is equal to $\frac{\pi^2}{k}$ (where k ∈ I), then k is

Q89 Consider the family of lines x(a + b) + y = 1, where a, b and c are the roots of the equation $x^3 - 3x^2 + x + \lambda = 0$ such that c ∈ [1,2]. If the given family of lines makes triangle of area 'A' with coordinate axis, then maximum value of 'A' (in sq. units) will be -

Q90 Two parallel chords of a circle of radius 2 are at a distance $\sqrt{3} + 1$ apart. If the chords subtend at the center, angles of $\frac{\pi}{K}$ and $\frac{2\pi}{K}$, where K > 0, then the value of [K] is:-
(Where [K] denotes the greatest integer less than or equal to K)

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**C**	**A**	**B**	**B**	**B**	**B**	**B**	**D**	**B**	**A**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**A**	**C**	**C**	**A**	**D**	**B**	**A**	**B**	**B**	**A**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**20**	**10**	**60**	**1**	**15**	**2**	**3**	**5**	**4**	**4**
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	**A**	**B**	**C**	**A**	**D**	**C**	**C**	**C**	**D**	**B**
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	**D**	**B**	**C**	**D**	**B**	**A**	**D**	**B**	**B**	**B**
Que.	51	52	53	54	55	56	57	58	59	60
Ans.	**1**	**4**	**0**	**14**	**2**	**4**	**50**	**7**	**1**	**2**
Que.	61	62	63	64	65	66	67	68	69	70
Ans.	**A**	**C**	**D**	**A**	**A**	**D**	**D**	**A**	**D**	**D**
Que.	71	72	73	74	75	76	77	78	79	80
Ans.	**D**	**A**	**C**	**B**	**A**	**A**	**A**	**C**	**A**	**C**
Que.	81	82	83	84	85	86	87	88	89	90
Ans.	**0**	**11**	**8**	**25**	**91**	**8**	**2**	**4**	**0**	**3**