Competishun

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

Date: 18/12/2023

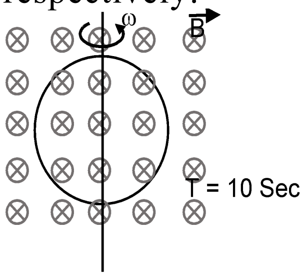
Time: 3 hours **Max. Marks:** 300

MFST-5 (23-24)

Physics

Single Choice Question

Q1 A ring is rotated about diametric axis in a uniform magnetic field perpendicular to the plane of the ring. If initially the plane of the ring is perpendicular to the magnetic field. Find the instant of time at which EMF will be maximum & minimum respectively:



a) 2.5 sec, 5 sec **b)** 5 sec, 7.5 sec **c)** 2.5 sec, 7.5 sec **d)** 10 sec, 5 sec

Q2 A plate, of uniform thickness and uniform density, has shape in the x-y plane defined by the lines x = 0, y = 2, and curve $y = \frac{1}{2}x^2$. The plate lies in first quadrant of x-y plane. Then the x-coordinate of centre of mass of this plate is:

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

Q3 A nucleus with mass number 184 initially at rest emits an α-particle. If the Q value of the reaction is 5.5 MeV, calculate the kinetic energy of the α-particle.

a) 5.0 MeV **b)** 5.5 MeV **c)** 0.12 MeV **d)** 5.38 MeV

Q4 A plane electromagnetic wave is propagating along the direction $\frac{\hat{i}+\hat{j}}{\sqrt{2}}$, with its polarization along the direction $\hat{k}$. The correct form of the magnetic field of the wave would be (here B_0 is an appropriate constant)

a) $B_0\frac{\hat{i}-\hat{j}}{\sqrt{2}}cos\left(\omega t-k\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$

b) $B_0\hat{k}cos\left(\omega t-k\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$

c) $B_0\frac{\hat{i}+\hat{j}}{\sqrt{2}}cos\left(\omega t-k\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$

d) $B_0\frac{\hat{i}-\hat{j}}{\sqrt{2}}cos\left(\omega t+k\frac{\hat{i}+\hat{j}}{\sqrt{2}}\right)$

Q5 When photon of energy 4.0 eV strikes the surface of a metal A, the ejected photoelectrons have maximum kinetic energy T_A eV and de-Broglie wavelength λ_A.The maximum kinetic energy of photoelectrons liberated from another metal B by photon of energy 4.50 eV is $T_B = (T_A - 1.5)$ eV. If the de-Broglie waelength of these photoelectrons $\lambda_B = 2\lambda_A$, then the work function of metal B is :

a) 1.5 eV b) 4 eV c) 3 eV d) 2 eV

Q6 A particle of mass m is fixed to one end of a light spring having force constant k and unstretched length l. The other end is fixed. The system is given an angular speed ω about the fixed end of the spring such that it rotates in a circle in gravity free space. Then the stretch in the spring is

a) $\frac{ml\omega^2}{k-\omega m}$ b) $\frac{ml\omega^2}{k+\omega^2 m}$ c) $\frac{ml\omega^2}{k+\omega m}$ d) $\frac{ml\omega^2}{k-\omega^2 m}$

Q7 Velocity of a wave in a wire is v when tension in it is 2.06×10^4 N. Find value of tension in wire when velocity of wave become $\frac{v}{2}$.

a) 5.15×10^3 N b) 8.24×10^4 N c) 6×10^4 d) 5.15×10^4 N

Q8 Electric potential at any point is $V = -5x + 3y + \sqrt{15}z$; then the magnitude of electric field is –

a) $3\sqrt{2}$ b) $4\sqrt{2}$ c) $5\sqrt{2}$ d) 7

Q9 An organ pipe open at one end is vibrating in first overtone and is in resonance with another pipe open at both ends and vibrating in third harmonic. The ratio of length of two pipes is -

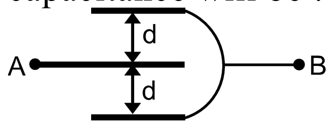
a) 3 : 8 b) 8 : 3 c) 1 : 2 d) 4 : 1

Q10 For a series RLC circuit $R = X_L = 2X_C$. The impedance of the circuit and phase difference (between) V and I will be :-

a) $\frac{\sqrt{5}R}{2}, tan^{-1}(2)$ b) $\frac{\sqrt{5}R}{2}, tan^{-1}(\frac{1}{2})$ c) $\sqrt{5}X_c, tan^{-1}(2)$

d) $\sqrt{5}R, tan^{-1}(\frac{1}{2})$

Q11 Three plates of common surfaces area A are connected as shown. The effective capacitance will be :-

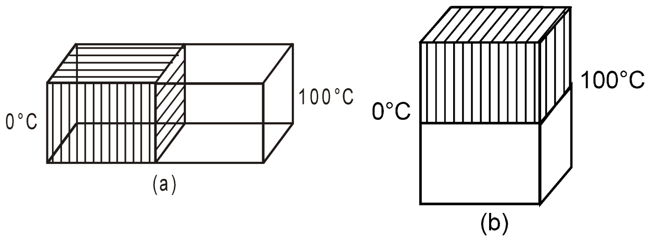


a) $\frac{\varepsilon_0 A}{d}$ b) $\frac{3\varepsilon_0 A}{d}$ c) $\frac{3}{2}\frac{\varepsilon_0 A}{d}$ d) $\frac{2\varepsilon_0 A}{d}$

Q12 A thin metal ring of radius r and mass m is resting on a liquid. Surface tension of the liquid is.

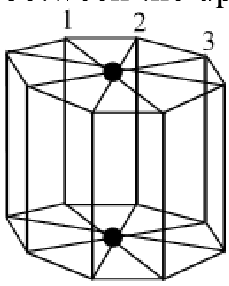
a) $\frac{mg}{4\pi r}$ b) $\frac{mg}{2\pi r}$ c) $\frac{mg}{\pi r}$ d) $\frac{mgr}{2\pi}$

Q13 Two identical square rods of metal are welded end to end as shown in figure (1). Assume that 10 cal of heat flows through the rods in 2 min. Now the rods are welded as shown in figure. (2) The time it would take for 10 cal to flow through the rods now, is -



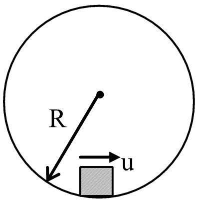
a) 0.75 min b) 0.5 min c) 1.5 min d) 1 min

Q14 In the diagram shown, all the wires have resistance R. The equivalent resistance between the upper and lower dots shown in the diagram is



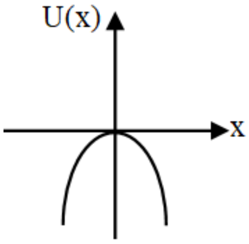
a) R/8 b) R c) 2R/5 d) 3R/8

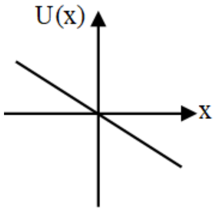
Q15 A particle is given an initial speed u inside a smooth spherical shell of radius R = 1 m that it is just able to complete the circle. Acceleration of the particle when its velocity is vertical is –

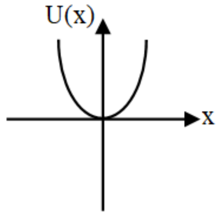


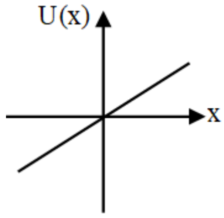
a) $g\sqrt{10}$ b) g c) $g\sqrt{2}$ d) 3g

Q16 A particle is placed at the origin and a force F = kx is acting on it (where k is a positive constant). If U (0) = 0, the graph of U (x) versus x will be: (where U is the potential energy function) –

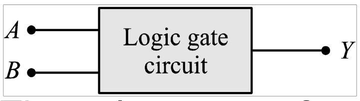
a) 

b) 

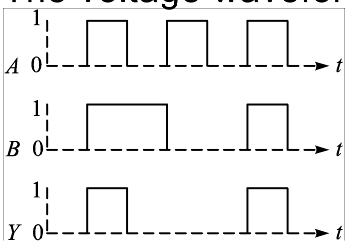
c) 

d) 

Q17 The following figure shows a logic gate circuit with two inputs A and B and the output Y.

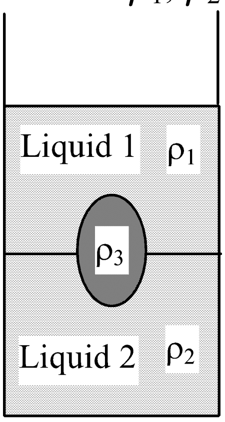


The voltage waveforms of A, B and Y are as shown.



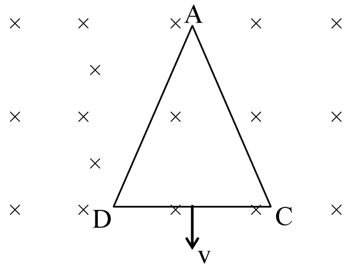
a) AND gate **b)** NAND gate **c)** NOR gate **d)** OR gate

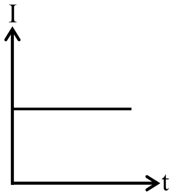
Q18 A jar is filled with two non-mixing liquids 1 and 2 having densities ρ_1 and ρ_2, respectively. A solid ball, made of a material of density ρ_3, is dropped in the jar. It comes to equilibrium in the position shown in the figure. Which of the following is true for ρ_1, ρ_2 and ρ_3?

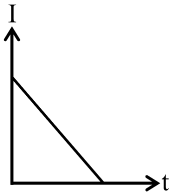


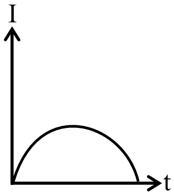
a) $\rho_1 > \rho_3 > \rho_2$ **b)** $\rho_1 < \rho_2 < \rho_3$ **c)** $\rho_1 < \rho_3 < \rho_2$ **d)** $\rho_3 < \rho_1 < \rho_2$

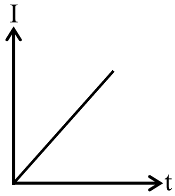
Q19 An equilateral triangular loop ADC of uniform specific resistivity having some resistance is pulled with a constant velocity v out of a uniform magnetic field directed into the paper. At time t = 0, side DC of the loop is at the edge of the magnetic field. The induced current (I) versus time (t) graph will be as :



a) 

b) 

c) 

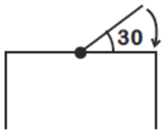
d) 

Q20 A mass m is placed on an inclined plane. If the mass is in equilibrium, the maximum inclination of the plane with the horizontal would be : (where μ is the coefficient of friction between the mass and surface)

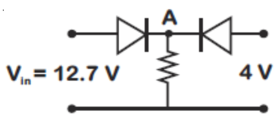
a) $\tan^{-1}(\mu)$ b) $tan^{-1}\left(\frac{\mu}{2}\right)$ c) $tan^{-1}\left(\frac{\mu}{m}\right)$ d) $\cos^{-1}(\mu)$

Numerical

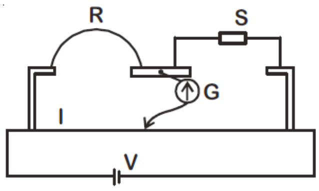
Q21 One end of a straight uniform 1 m long bar is pivoted on horizontal table. It is released from rest when it makes an angle 30° from the horizontal (see figure). Its angular speed when it hits the table is given as $\sqrt{n}s^{-1}$, where n is an integer. The value of n is ______



Q22 Both the diodes used in the circuit shown are assumed to be ideal and have negligible resistance when these are forward biased. Built in potential in each diode is 0.7 V. For the input voltages shown in the figure, the voltage (in Volts) at point A is



Q23 In a meter bridge experiment S is a standard resistance. R is a resistance wire. It is found that balancing length is l = 25 cm. If R is replaced by a wire of half length and half diameter that of R of same material, then the balancing distance l′ (in cm) will now be __________.

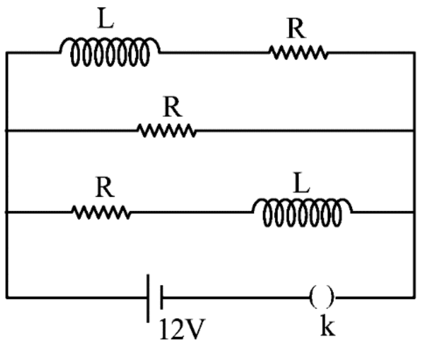


Q24 The magnifying power of a telescope with tube length 60 cm is 5. What is the focal length (in cm) of its eye piece?

Q25 Four resistances of 15 Ω, 12 Ω, 4 Ω and 10 Ω respectively in cyclic order to form Whetstone's network. The resistance that is to be connected in parallel with the resistance of 10 Ω to balance the network is __________ Ω.

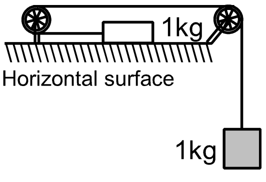
Q26 A point object in air is in front of the curved surface of a plano-convex lens. The radius of curvature of the curved surface is 30 cm and the refractive index of the lens material is 1.5, then the focal length of the lens (in cm) is_______.

Q27 Three identical resistors with resistance R = 12Ω and two identical inductors with sell inductance L = 5 mH are connected to an ideal battery with emf of 12 V as shown in figure. The current through the battery long after the switch has been closed will be ______ A.



Q28 The displacement is given by $x = 10t^2+8t+4$, the acceleration (in m/s^2) at t = 3 sec will be

Q29 Consider the system as shown in the figure. The pulley and the string are light and all the surfaces are frictionless. The tension (in N) in the string is ($g = 10\ m/s^2$)



Q30 The acceleration of charge particle at a certain moment in a magnetic field $\vec{B} = 2\hat{i} + 3\hat{j} + 4\hat{k}$ is $x\hat{i} - 2\hat{j} + \hat{k}$ the value of x is :-

Chemistry

Single Choice Question

Q31 $[Pd(F)(Cl)(Br)(I)]^{2-}$ has n number of geometrical isomers. Then, the spin-only magnetic moment and crystal field stabilisation energy [CFSE] of $[Fe(CN)_6]^{n-6}$, respectively, are [Note : Ignore the pairing energy]

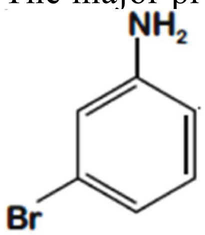
a) 0 BM and $-2.4\ \Delta_0$ **b)** 5.92 BM and 0 **c)** 1.73 BM and $-2.0\ \Delta_0$

d) 2.84 BM and $-1.6\ \Delta_0$

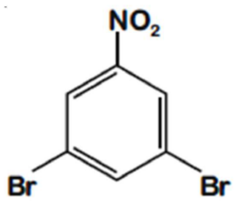
Q32 If enthalpy of atomisation for $Br_{2(l)}$ is x kJ/mol and bond enthalpy for Br_2 is y kJ/mol, the relation between them

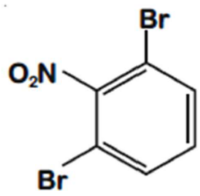
a) is x > y **b)** does not exist **c)** is x = y **d)** is x < y

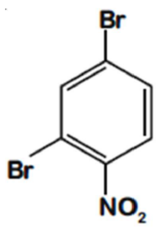
Q33 The major product Z obtained in the following reaction scheme is :

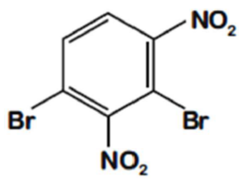


$\xrightarrow[273-278\ K]{NaOH_2/HCl} X \xrightarrow{Cu_2Br} Y \xrightarrow[H_2SO_4]{NHO_3} Z$

a) 

b) 

c) 

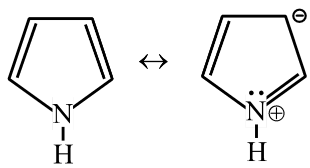
d) 

Q34 Which resonating structure is not correct -

a) $CH_2{=}CH{-}\overset{\oplus}{C}H_2 \leftrightarrow \overset{\oplus}{C}H_2{-}CH{=}CH_2$

b) $NH_2{-}\underset{\overset{\|}{\ \oplus NH_2}}{C}{-}\ddot{N}H_2 \leftrightarrow NH_2{-}\underset{|\ :NH_2}{C}{=}\overset{\oplus}{N}H_2$

c) $\overset{\oplus}{C}H_2{-}CH{=}O \leftrightarrow CH_2{=}CH{-}\overset{\ominus}{O}$

d) 

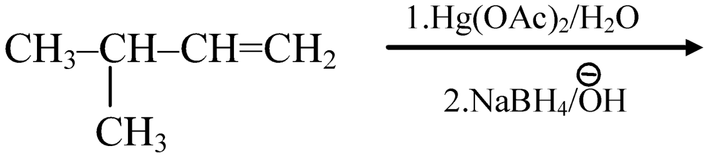
Q35 The decreasing order of rate of S_N1 reaction is -

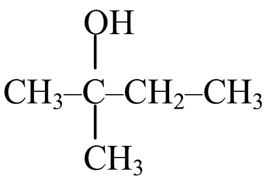
(I) Ph–C(Br)(CH$_3$)–Ph   (II) Ph–CH(Br)–Ph   (III) Ph–CH(Br)–CH$_3$ (IV) PhCH$_2$Br

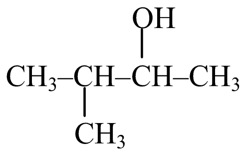
a) (I) > (II) > (III) > (IV) **b)** (II) > (I) > (III) > (IV) **c)** (IV) > (III) > (II) > (I)

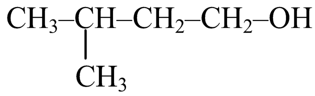
d) (III) > (IV) > (II) > (I)

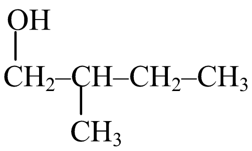
Q36 What is the major product of the following reaction?



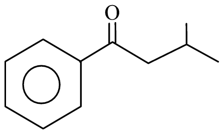
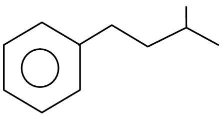
a) 

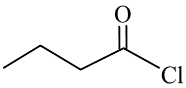
b) 

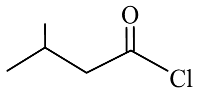
c) 

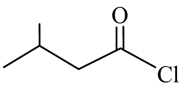
d) 

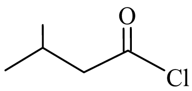
Q37

Benzene on reaction with 'A' forms  which on reaction with 'B' forms  'A' and 'B' are -

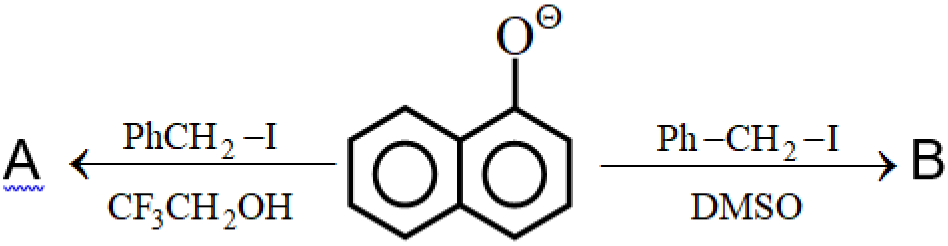
a) Zn (Hg) + conc. HCl, 

b)  , $LiAlH_4$

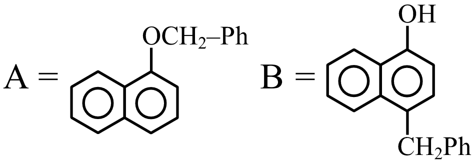
c)  , $NaBH_4$

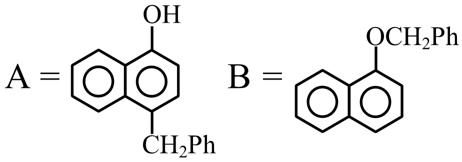
d)  , Zn (Hg) + conc. HCl

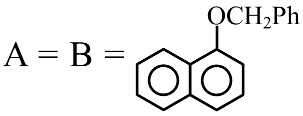
Q38

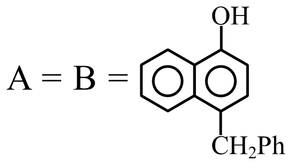


'A' and 'B' respectively are -

a) 

b) 

c) 

d) 

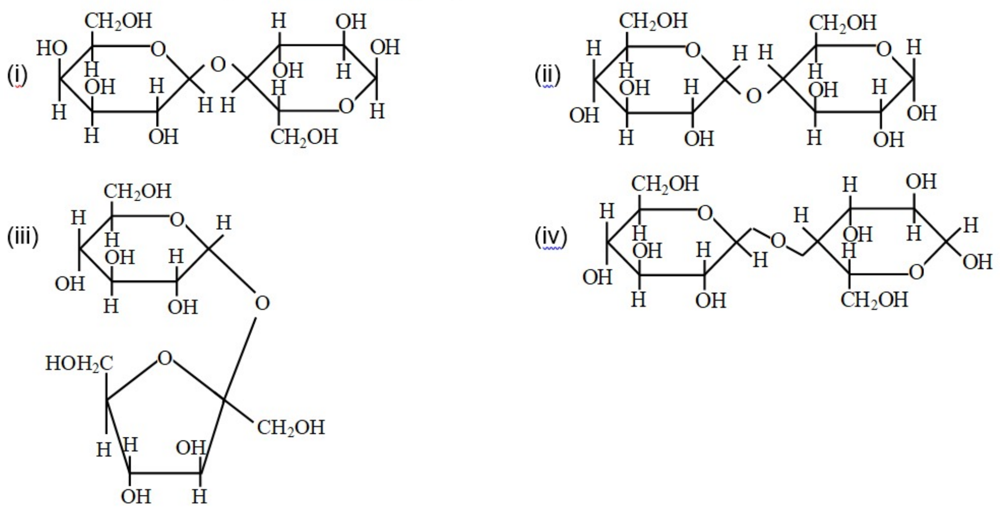
Q39 Phenol reacts with cone. HNO_3 in the presence of cone. H_2SO_4 to give :

a) *meta* nitrophenol **b)** *ortho* nitrophenol **c)** *ortho* and para nitrophenol

d) picric acid

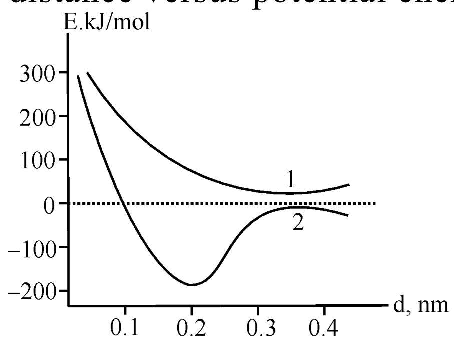
Q40

Which of the following are non reducing sugars-



a) (i) & (iv) **b)** (i), (ii) and (iv) **c)** (iii) **d)** (iii) & (iv)

Q41 Consider the given figure showing the formation of H_2^+ ion depending on internuclear distance versus potential energy of the system.



Which is correct statement:

a) Curve-1 represents the most stable state of the system for H_2^+ ion

b) Curve-2 represents the most stable state of the system for H_2^+ ion

c) Curve-1 indicates that the molecular hydrogen ion is formed

d) Curve-2 represents the energy level of the antibonding region

Q42 Which is the most acidic oxide ?

a) Cl_2O **b)** Cl_2O_3 **c)** Cl_2O_5 **d)** Cl_2O_7

Q43 The order of basic character of given oxides is :

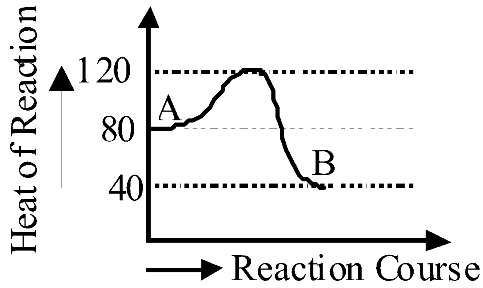
a) $Na_2O > MgO > Al_2O_3 > CuO$ **b)** $MgO > Al_2O_3 > CuO > Na_2O$

c) $Al_2O_3 > MgO > CuO > Na_2O$ **d)** $CuO > Na_2O > MgO > Al_2O_3$

Q44 Equivalent weight of H_3PO_2 when it disproportionates into PH_3 and H_3PO_3 is (mol. wt. of H_3PO_2 = M)

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

Q45 According to the diagram given below, the value of ΔH for conversion of A to B is -



a) – 40 b) +40 c) –120 d) +120

Q46 Graphite is good conductor of current but diamond is non-conductor because :

a) Diamond is hard and graphite is soft

b) graphite and diamond have different atomic configuration

c) Graphite is composed of positively charged carbon ions

d) Graphite has hexagonal layer structure with mobile -electrons while diamond has continuous tetrahedral covalent structure with no free electrons

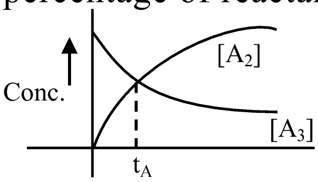
Q47 The acidic solution of a salt produces blue colour with KI starch solution. The reaction indicates the presence of :

a) Sulphite b) Bromide c) Nitrite d) Chloride

Q48 Consider a first order decomposition process

$A_3 \rightarrow \frac{3}{2} A_2$

A plot of concentration of A_3 and A_2 versus time is shown below. At time t_A percentage of reactant de composed is



a) 75% b) 50% c) 40% d) 30%

Q49 The same amount of electricity was passed through two cells containing molten Al_2O_3 and molten NaCl. If 1.8g of Al were liberated in one cell, the amount of Na liberated in the other cell is-

a) 4.6 g b) 2.3 g c) 6.4 g d) 3.2 g

Q50 The f-block of the periodic table contains those elements in which :

a) only 4f orbitals are progressively filled in 6th period.

b) only 5f orbitals are progressively filled in 7th period.

c) 4f and 5f orbitals are progressively filled in 6th and 7th periods respectively.

d) none

Numerical

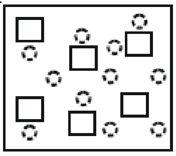
Q51 The molarity of HNO_3 in a sample which has density 1.4 g/mL and mass percentage of 63% is ___. (Molecular Weight of HNO_3 = 63)

Q52 In the given reaction, the percentage of (-) enantiomer formed is :

$$\underset{(\alpha)_{obs} = -15.90^\circ}{CH_3 - \overset{*}{C}HI - CH_2 - CH_3} \xrightarrow{I^\ominus} \underset{(\alpha)_{obs} = -15.26^\circ}{CH_3 - \overset{*}{C}HI - CH_2CH_3}$$

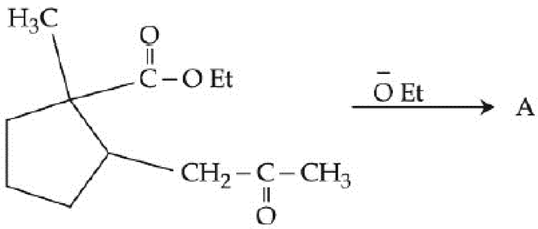
Q53 How many number of chiral carbons in anomer of methyl α-D- fructofuranoside

Q54 In the figure shown below reactant A (represented by square) is in equilibrium with product B (represented by circle). The equilibrium constant is



Q55 10.30 mg of O_2 is dissolved into a liter of sea water of density 1.03 g/mL. The concentration of O_2 in ppm is __________ .

Q56 In the given reaction



(Where Et is $-C_2H_5$)
The number of chiral carbon/s in product A is

Q57 Complexes (ML_5) of metals Ni and Fe have ideal square pyramidal and trigonal bipyramidal geometries, respectively. The sum of the 90°, 120° and 180° L-M-L angles in the two complexes is ___________.

Q58 If the lowest energy x-rays have $\lambda = 4.0 \times 10^{-8}$ m, at what z (minimum) would a transition from the second energy level to the first result in the emission of X-ray ? (Assuming that the electrons in other shells exert no influence)

Q59 For gaseous homogeneous reaction
$2A(g) + B(g) \rightleftharpoons 2C(g) + 2D(g)$
$\Delta G^o = 0.693$ RT at TK. Find Kp for the reaction in k Pa [1 k Pa = 10^3 Pa]

Q60 A mixture of KOH and $Ca(OH)_2$ weighing 6.13 gram is completely neutralised by an acid. If weight percentage of KOH in mixture is 45.68 and normality of acid is 20N then find the volume (in ml) of acid used in neutralisation.

Mathematics

Single Choice Question

Q61 The number of real roots of the equation $x|x|-5|x+2|+6=0$, is

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

Q62 If x_1, x_2, x_3, x_4 are roots of the equation $x^4 - x^3 \sin 2\beta + x^2 \cos 2\beta - x \cos \beta - \sin \beta = 0$ then $\sum_{i=1}^{4} tan^{-1} x_i$ is equal to

a) $\pi - \beta$ b) $\pi - 2\beta$ c) $\frac{\pi}{2} - \beta$ d) $\frac{\pi}{2} - 2\beta$

Q63 ABC is a triangle whose medians AD and BE are perpendicular to each other. If AD = p and BE = q then area of ΔABC is-

a) $\frac{2}{3}pq$ b) $\frac{3}{2}pq$ c) $\frac{4}{3}pq$ d) $\frac{3}{4}pq$

Q64 Let A be a 3 × 3 real matrix such that $A\begin{pmatrix}1\\1\\0\end{pmatrix}=\begin{pmatrix}1\\1\\0\end{pmatrix}; A\begin{pmatrix}1\\0\\1\end{pmatrix}=\begin{pmatrix}-1\\0\\1\end{pmatrix}$ and $A\begin{pmatrix}0\\0\\1\end{pmatrix}=\begin{pmatrix}1\\1\\2\end{pmatrix}$. If $X = (x_1, x_2, x_3)^T$ and I is an identity matrix of order 3, then the system $(A - 2I)X = \begin{pmatrix}4\\1\\1\end{pmatrix}$ has

a) no solution b) infinitely many solutions c) unique solution d) exactly two solutions

Q65 If $-\frac{\pi}{2} < \alpha_1 < \alpha_2 < \alpha_3 < \frac{\pi}{2}$, then number of values of $\theta \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$ satisfying $(\tan\theta - \tan\alpha_1)(\tan\theta - \tan\alpha_2)(\tan\theta - \tan\alpha_3) - (\tan\theta - \tan\alpha_1) - (\tan\theta - \tan\alpha_2) - (\tan\theta - \tan\alpha_3) = 0$

a) 0 b) 1 c) 2 d) 3

Q66 The value of $\cot\frac{\pi}{24}$ is :

a) $\sqrt{2}+\sqrt{3}+2-\sqrt{6}$ b) $\sqrt{2}+\sqrt{3}+2+\sqrt{6}$ c) $\sqrt{2}-\sqrt{3}-2+\sqrt{6}$ d) $3\sqrt{2}-\sqrt{3}-\sqrt{6}$

Q67 The value of 'a' for which one root of quadratic equation $(a^2 - 5a + 3)x^2 + (3a - 1)x + 2 = 0$ is twice as large as other is :

a) 2/3 b) –2/3 c) 1/3 d) –1/3

Q68 The number of ways in which a pack of 52 cards of four different suits can be distributed equally among four players so that each player gets the Ace, King, Queen and Knave of the same suit is

a) $\frac{36!4!}{(9!)^4}$ b) $\frac{36!}{(9!)^4(4!)}$ c) $\frac{52!4!}{(9!)^4}$ d) None of these

Q69 If $A=\left\{(x,y);x^2-y^2=\frac{x}{x^2+y^2},x,y\in R\right\}$, $B=\left\{(x,y);2xy+\frac{y}{x^2+y^2}=3,x,y\in R\right\}$, $C=\left\{(x,y);x^3-3xy^2+3y=1,x,y\in R\right\}$, $D=\left\{(x,y);3x^2y-3x-y^3=0,x,y\in R\right\}$ then which of the following is true

a) $A\cap C=B\cap D$ **b)** $A\cap B=C\cap D$ **c)** $A\cap D=B\cap C$ **d)** $A\cap B\cap C\cap D=\varphi$

Q70 If the domain of the function $f(x) = \log_e(4x^2+11x+6)+\sin^{-1}(4x+3)+\cos^{-1}\left(\frac{10x+6}{3}\right)$ is $(\alpha, \beta]$, Then $36|\alpha+\beta|$ is equal to -

a) 63 **b)** 45 **c)** 72 **d)** 54

Q71 If the focal distance of an end of the minor axis of any ellipse (its axes as x and y axis respectively) is k and the distance between the foci is 2h, then its equation is-

a) $\frac{x^2}{k^2}+\frac{y^2}{h^2}=1$ **b)** $\frac{x^2}{k^2}+\frac{y^2}{k^2-h^2}=1$ **c)** $\frac{x^2}{k^2}-\frac{y^2}{k^2-h^2}=1$ **d)** $\frac{x^2}{k^2}+\frac{y^2}{k^2+h^2}=1$

Q72 Let e_1 and e_2 be the eccentricities of the ellipse, $\frac{x^2}{25}+\frac{y^2}{b^2}=1\ (b<5)$ and the hyperbola, $\frac{x^2}{16}-\frac{y^2}{b^2}=1$ respectively satisfying $e_1e_2=1$. If α and β are the distances between the foci of the ellipse and the foci of the hyperbola respectively, then the ordered pair (α, β) is equal to :

a) (8, 10) **b)** $\left(\frac{24}{5},10\right)$ **c)** $\left(\frac{20}{3},12\right)$ **d)** (8, 12)

Q73 If $y = x + e^x$, then the value of $\frac{d^2x}{dy^2}$ at x = 1, will be-

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

Q74 Let $f(x) = \int_1^x (2(x-1)(x-2)^3 + 3(x-1)^2(x-2)^2)$, then-

a) f has exactly 4 critical points **b)** f has maximum at x = 2

c) $x=\frac{7}{5}$ is minima & x = 1 is maxima **d)** none of these

Q75 The area (in sq. units) of the region $\{(x,y)\in\mathbb{R}^2 : x^2\le y\le 3-2x\}$, is

a) $\frac{31}{3}$ **b)** $\frac{29}{3}$ **c)** $\frac{34}{3}$ **d)** $\frac{32}{3}$

Q76 The integral $\int\cos(\log_e x)dx$ is equal to (where C is a constant of integration)

a) $x[\cos(\log_e x)-\sin(\log_e x)]+C$ **b)** $\frac{x}{2}[\cos(\log_e x)+\sin(\log_e x)]+C$ **c)** $\frac{x}{2}[\sin(\log_e x)-\cos(\log_e x)]+C$

d) $x[\cos(\log_e x)+\sin(\log_e x)]+C$

Q77 A wire of length 22 m is to be cut into two pieces. One of the pieces is to be made into a square and the other into an equilateral triangle. Then, the length of the side of the equilateral triangle, so that the combined area of the square and the equilateral triangle is minimum, is :

a) $\frac{22}{9+4\sqrt{3}}$ b) $\frac{66}{9+4\sqrt{3}}$ c) $\frac{22}{4+9\sqrt{3}}$ d) $\frac{66}{4+9\sqrt{3}}$

Q78 The solution of the differential equation $\frac{dy}{dx} = \frac{\sin y + x}{\sin 2y - x\cos y}$ is

a) $\sin^2 y = x \sin y + \frac{x^2}{2} + c$ b) $\sin^2 y = x \sin y - \frac{x^2}{2} + c$ c) $\sin^2 y = x + \sin y + \frac{x^2}{2} + c$
d) $\sin^2 y = x - \sin y + \frac{x^2}{2} + c$

Q79 The probability that a particular day in the month of July is a rainy day is $\frac{3}{4}$. Two person whose credibility are $\frac{4}{5}$ and $\frac{2}{3}$ respectively claim that 15^{th} July was a rainy day. The probability that it was real a rainy day.

a) $\frac{3}{4}$ b) $\frac{24}{25}$ c) $\frac{8}{9}$ d) none of these

Q80
If $(x+a)^{100} = t_0 + t_1 + \ldots + t_{100}$, where $t_r = {}^nC_r x^{n-r} a^r$, then $\int \frac{2x\,dx}{\left(\sum_{r=0}^{50} (-1)^r t_{2r}\right)^2 + \left(\sum_{r=0}^{49} (-1)^r t_{2r+1}\right)^2} =$

a) $C - \frac{1}{101\left(x^2+a^2\right)^{101}}$ b) $C - \frac{1}{99\left(x^2+a^2\right)^{99}}$ c) $C - 99\left(a^2+x^2\right)^{99}$ d) $C + 99\left(a^2+x^2\right)^{100}$

Numerical

Q81 If the mean and variance of eight numbers 3, 7, 9, 12, 13, 20, x and y be 10 and 25 respectively, then x.y is equal to ___________.

Q82
If the function f defined on $\left(-\frac{1}{3}, \frac{1}{3}\right)$ by f(x) $\begin{cases} \frac{1}{x} \log_e\left(\frac{1+3x}{1-2x}\right), & when\ x \neq 0 \\ k, & when\ x = 0 \end{cases}$ is continuous, then k is equal to __________.

Q83 Let X = {n ∈ N : 1 ≤ n ≤ 50}. If A = {n ∈ X : n is a multiple of 2} and B = {n ∈ X : n is a multiple of 7}, then the number of elements in the smallest subset of X containing both A and B is _________.

Q84 If the sum of the coefficients of all even powers of x in the product
$(1 + x + x^2 + \ldots + x^{2n})(1 - x + x^2 - x^3 + \ldots + x^{2n})$
Is 61, then n is equal to ________.

Q85 Let S be the set of points where the function, f(x) = |2 −| x − 3||, x ∈ R is not differentiable. Then $\sum_{x \in S} f(f(x))$ is equal to______.

Q86 Let vector $\vec{a} = \hat{i} + 5\hat{j} + \alpha\hat{k}$, vector $\vec{b} = \hat{i} + 3\hat{j} + \beta\hat{k}$ and vector $\vec{c} = \hat{i} + 2\hat{j} - 3\hat{k}$ be three vectors such that, $|\vec{b} \times \vec{c}| = 5\sqrt{3}$ and vector $\vec{a}$ is perpendicular to vector $\vec{b}$. Then the greatest amongst the values of $|\beta|^2$ is______

Q87 Let f : R → R be such that for all x∈R $(2^{1+x} + 2^{1-x})$, f(x) and $(3^x + 3^{-x})$ are in A.P., then the minimum value of f(x) is

Q88 $\lim\limits_{n\to\infty} \left(\frac{1}{n}\right)^{tan\ 1/n} =$

Q89 Let a_n be the n^{th} term of a G.P. of positive terms. If $\sum\limits_{n=1}^{100} a_{2n+1} = 200$ and $\sum\limits_{n=1}^{100} a_{2n} = 100$, then $\sum\limits_{n=1}^{200} a_n = \lambda$ then value of $\lambda/10$:

Q90 If sets of 2 and 3 (different) numbers can be formed by using numbers between 0 and 180 (both including) so that 60 is their average is m and n respectively then value of $\left|\frac{2n}{m} - 150\right|$ is

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**A**	**D**	**D**	**A**	**B**	**D**	**A**	**D**	**C**	**B**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**D**	**A**	**B**	**D**	**A**	**A**	**A**	**C**	**B**	**A**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**15**	**12**	**40**	**10**	**10**	**60**	**3**	**20**	**5**	**1**
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	**C**	**A**	**C**	**C**	**A**	**B**	**D**	**B**	**D**	**C**
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	**B**	**D**	**A**	**B**	**A**	**D**	**C**	**C**	**A**	**C**
Que.	51	52	53	54	55	56	57	58	59	60
Ans.	**14**	**98**	**4**	**2**	**10**	**2**	**20**	**2**	**50**	**7**
Que.	61	62	63	64	65	66	67	68	69	70
Ans.	**B**	**C**	**A**	**B**	**D**	**B**	**A**	**A**	**B**	**B**
Que.	71	72	73	74	75	76	77	78	79	80
Ans.	**B**	**A**	**B**	**C**	**D**	**B**	**B**	**A**	**B**	**B**
Que.	81	82	83	84	85	86	87	88	89	90
Ans.	**54**	**5**	**29**	**30**	**3**	**90**	**3**	**1**	**15**	**1**