

Competishun

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

Date: 21/12/2023**Time:** 3 hours**Max. Marks:** 300**MFST-6 (23-24)**

Physics

Single Choice Question

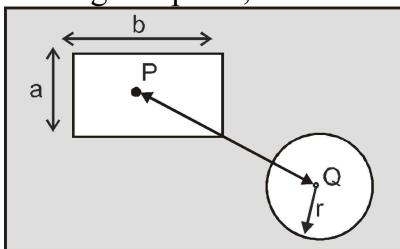
- Q1** A wave is represented by the equation $y = 7 \sin \left(7\pi t - 0.04\pi x + \frac{\pi}{3} \right)$ x is in meters and t is in seconds. The speed of the wave is –
 a) 175 m/sec b) 49π m/sec c) $75/\pi$ m/sec d) 0.28π m/sec

- Q2** The kinetic energy of a body decreases by 36%. The decrease in its momentum is
 a) 36% b) 20% c) 8% d) 6%

- Q3** A thin circular ring of mass M and radius R is rotating about its axis with a constant angular velocity ω . Two objects each of mass m, are attached gently to the opposite ends of a diameter of the ring. The ring now rotates with an angular velocity
 a) $\frac{\omega M}{M+m}$ b) $\frac{\omega(M-2m)}{M+2m}$ c) $\frac{\omega M}{M+2m}$ d) $\frac{\omega(M+2m)}{M}$

- Q4** A rock explodes breaking into three pieces. Two pieces fly off perpendicular to one another. One piece of mass 1 kg has velocity 12 m/s and the second of mass 2 kg has velocity 8 m/s. If the third mass flies off at a velocity of 40 m/s. What is its mass?
 a) 2 kg b) 1 kg c) 1/2 kg d) 3 kg

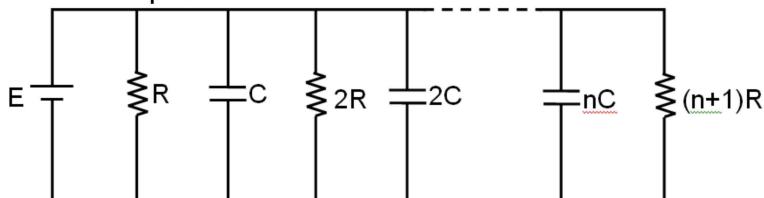
- Q5** There is a rectangular metal plate in which two cavities in the shape of rectangle and circle are made, as shown with dimensions. P and Q are centres of these cavities. On heating the plate, which of the following quantities increase?



- a) area (πr^2) of circular cavity
- b) area (ab) of rectangular cavity
- c) Distance (PQ) between centre of both cavities
- d) All of the above

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Q6 For shown situation, in steady state condition ratio of charge stored in the first and last n^{th} capacitor is :



- a) $1 : (n + 1)$
c) $(n + 1) : 1$

- b) $(n^2 + 1) : (n^2 - 1)$
d) $1 : n$

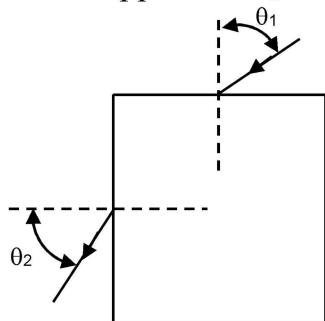
Q7 A galvanometer of resistance 50Ω is connected to a battery of 3V along with a resistance of 2950Ω in series. A full scale deflection of 30 divisions is obtained in the galvanometer. In order to reduce this deflection to 20 division, the resistance in series should be :-

- a) 6050Ω b) 4450Ω c) 5050Ω d) 5550Ω

Q8 An LCR series circuit with 100Ω resistance is connected to an ac source of 400 V and angular frequency 300 rad/s. When only the capacitance is removed, the current lags behind the voltage by 60° . When only the inductance is removed, the current leads the voltage by 60° . The current and power dissipated in the LCR circuit is :-

- a) 400 W, 2 A b) 800 W, 4 A c) 800 W, 2 A d) 1600 W, 4 A

Q9 Light is incident on a glass block as shown in figure. If θ_1 is increased slightly then what happens to θ_2 ?



- a) θ_2 also increases slightly
b) θ_2 unchanged
c) θ_2 decreases slightly
d) θ_2 changes abruptly since the ray experiences total internal reflection

Q10 Current flowing through a conducting wire is given by $I = (1 + 3t^2)$. Where t is in seconds and current I is in amperes. The charge (in coulombs) flown through the resistor in the interval from $t = 0$ to $t = 1$ second is -

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

Q11 The angle of polarisation for any medium is 60° what will be the criticle angle for the medium at air interface :-

a) $\sin^{-1}\left(\frac{1}{\sqrt{3}}\right)$

b) $\sin^{-1}(\sqrt{3})$

c) $\cos^{-1}(\sqrt{3})$

d) $\cos^{-1}\left(\frac{1}{\sqrt{3}}\right)$

Q12 $x_1 = 5 \sin \omega t$

$x_2 = 5 \sin (\omega t + 53^\circ)$

$x_3 = -10 \cos \omega t$

Find amplitude of resultant SHM

a) 5

b) 10

c) 15

d) 20

Q13 A body of mass m is kept on a rough fixed inclined plane of angle of inclination θ . It remains stationary. Then magnitude of force acting on the body by the inclined plane is equal to:

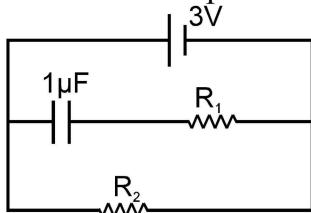
a) mg

b) $mg \sin \theta$

c) $mg \cos \theta$

d) none

Q14 A $1 \mu\text{F}$ capacitor is connected in the circuit shown below. The e.m.f. of the cell is 3 volts and internal resistance is 0.5 ohms. The resistors R_1 and R_2 have values 4 ohms and 1 ohm respectively. The charge on the capacitor in steady state must be :



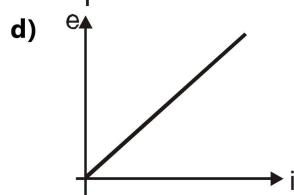
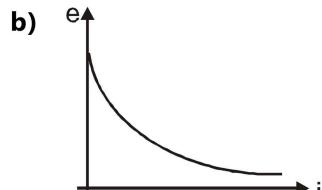
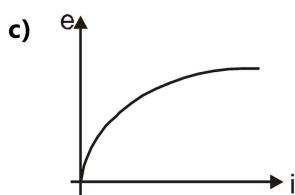
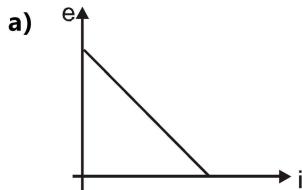
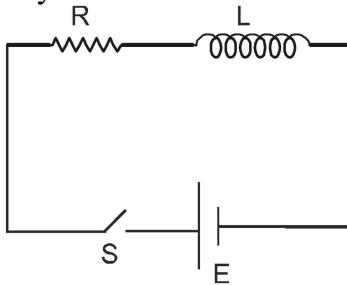
a) $2 \mu\text{C}$

b) $1 \mu\text{C}$

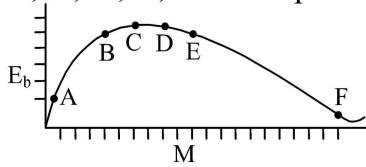
c) $1.33 \mu\text{C}$

d) zero

Q15 In an L-R circuit connected to a battery of constant e.m.f. E switch S is closed at time $t = 0$. If e denotes the induced e.m.f. across inductor and i the current in the circuit at any time t . Then which of the following graphs shows the variation of e with i ?



- Q16** The below is a plot of binding energy per nucleon E_b , against the nuclear mass M; A, B, C, D, E, F correspond to different nuclei. Consider four reactions.

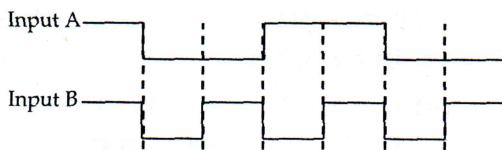
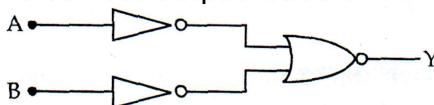


- (i) $A + B \rightarrow C + \varepsilon$ (ii) $C \rightarrow A + B + \varepsilon$
 (iii) $D + E \rightarrow F + \varepsilon$ and (iv) $F \rightarrow D + E + \varepsilon$

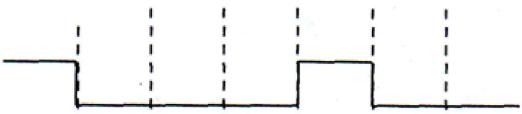
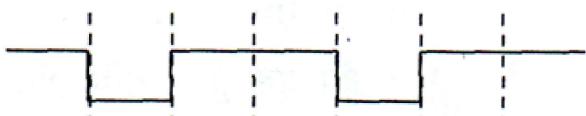
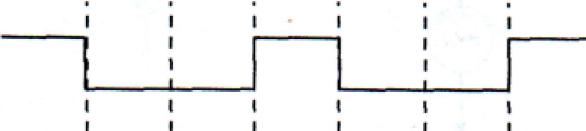
Where ε is the energy released? In which reactions is ε positive -

- a) (i) and (iv) b) (i) and (iii) c) (ii) and (iv) d) (ii) and (iii)

- Q17** The logic circuit shown below has the input waveforms ‘A’ and ‘B’ as shown. Pick out the correct output waveform.



Output is :

- a) 
 b) 
 c) 
 d) 

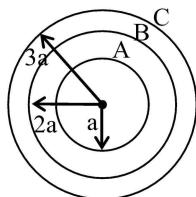
- Q18** The ratio of maximum and minimum intensities of two sources is 4 : 1. The ratio of their amplitudes is –

- a) 1 : 3 b) 3 : 1 c) 1 : 9 d) 1 : 1

- Q19** A straight section PQ of a circuit lies along the x-axis from $x = -(a/2)$ to $x = +(a/2)$ and carries a steady current I. The magnetic field due to the section PQ at a point $x = +a$ will be -

- a) proportional to a b) proportional to a^2
 c) proportional to $(1/a)$ d) equal to zero

- Q20** Three concentric spherical shells A, B and C having uniformly distributed total charges $+Q$, $-2Q$ and $+Q$ respectively are placed as shown. The potential at the centre will be -



a) $\frac{-Q}{4\pi\epsilon_0 a}$

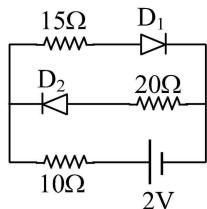
b) $\frac{-Q}{12\pi\epsilon_0 a}$

c) $\frac{Q}{12\pi\epsilon_0 a}$

d) zero

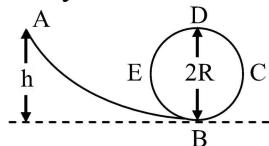
Numerical

- Q21** The current I (in mA) through 10Ω resistor in the circuit given below is –

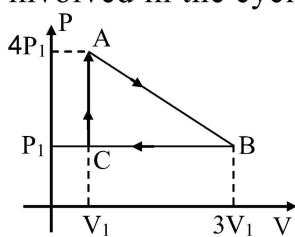


- Q22** An e.m.f. of 2 volt is produced in a coil when the current changed at a steady rate from 3 to 2 amperes in 1 milli-second. The value of self-inductance (in mH) is –

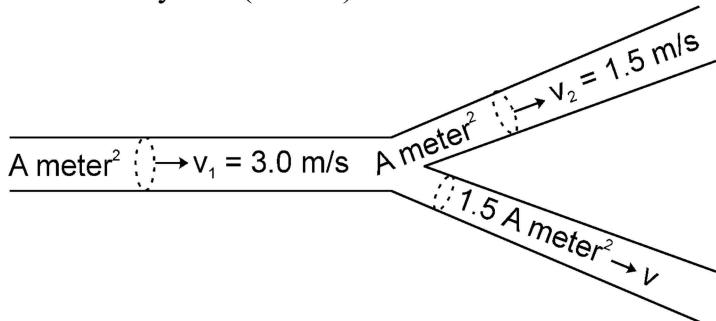
- Q23** A frictionless track ABCDE ends in a circular loop of radius R. A body slides down the track from point A which is at a height $h = 5$ cm. Maximum value of R (in cm) for the body to successfully complete the loop is :



- Q24** An ideal gas of 2 mole is taken through series of changes ABCA. The amount of work involved in the cycle is $n RT_0$ then find the value of n (temperature at C is T_0)



- Q25** An incompressible liquid flows through a horizontal tube as shown in the figure. Then the velocity 'v' (in m/s) of the fluid is :

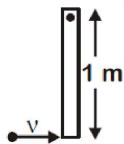


- Q26** The rate of radiation of a black body at $0\text{ }^{\circ}\text{C}$ is E watt. Then the rate of radiation of this black body at $273\text{ }^{\circ}\text{C}$ will be nE then find the value of n :

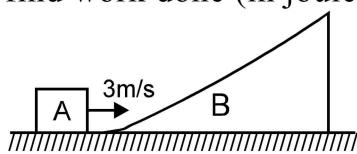
- Q27** Two concentric circular coils, C_1 and C_2 are placed in the XY plane. C_1 has 500 turns, and a radius of 1 cm. C_2 has 200 turns and radius of 20 cm. C_2 carries a time dependent current $I(t) = (5t^2 - 2t + 3)$ A where t is in s. The emf induced in C_1 (in mV), at the instant $t = 1$ s is $\frac{4}{x}$. The value of x is ____.

- Q28** A particle of mass $200\text{ MeV}/c^2$ collides with a hydrogen atom at rest. Soon after the collision the particle comes to rest, and the atom recoils and goes to its first excited state. The initial kinetic energy of the particle (in eV) is $\frac{N}{4}$. The value of N is (Given the mass of the hydrogen atom to be $1\text{ GeV}/c^2$) ____.

- Q29** A thin rod of mass 0.9 kg and length 1 m is suspended, at rest, from one end so that it can freely oscillate in the vertical plane. A particle of mass 0.1 kg moving in a straight line with velocity 80 m/s hits the rod at its bottom most point and sticks to it (see figure). The angular speed (in rad/s) of the rod immediately after the collision will be ____.



- Q30** In the figure shown A is of mass 1 kg and B is mass 2 kg. A moves with velocity 3 m/s and rises on B. All the surfaces are smooth. Assume no loss of kinetic energy of (A + B) due to collision between A and B. By the time A reaches the highest point on B, find work done (in joules) by A on B.



Chemistry**Single Choice Question**

Q31 The value of spin only magnetic moment for one of the following configurations is 2.84 B.M.

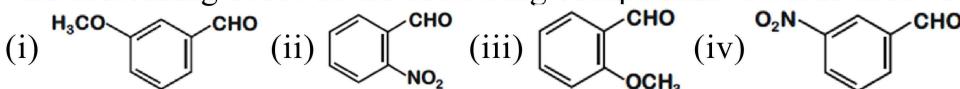
Which of the following is correct ?

- a) d^4 (in strong field ligand)
- b) d^2 (in weak field ligand)
- c) d^3 (in weak as well as in strong field ligand)
- d) d^5 (in strong field ligand)

Q32 What is the correct order of 2nd ionisation energy ?

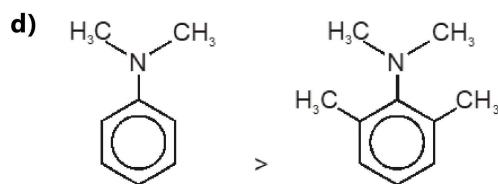
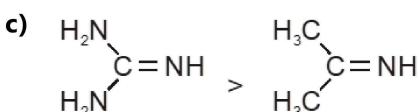
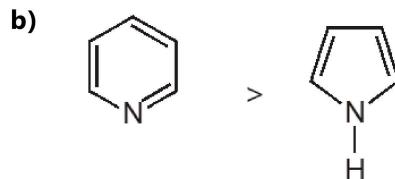
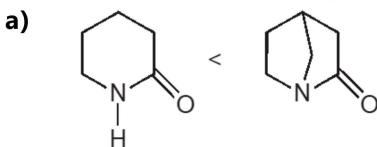
- a) F < N < C < O
- b) N < C < F < O
- c) C < N < F < O
- d) O < C < F < N

Q33 The increasing order of the following compounds towards HCN addition is



- a) (iii) < (iv) < (ii) < (i)
- b) (iii) < (i) < (iv) < (ii)
- c) (iii) < (iv) < (i) < (ii)
- d) (i) < (iii) < (iv) < (ii)

Q34 Which of the following order of basicity is incorrect?



Q35 Decomposition of nitrogen pentoxide is known to be a first order reaction 75 percent of the oxide had decomposed in the first 24 minutes. At the end of an hour, after the start of the reaction, the amount of oxide left will be

- a) Nil
- b) About 1%
- c) About 2%
- d) About 3%

Q36 In a sample of hydrogen atoms all electrons are in a particular excited state n , when all electrons returned to ground state, photons with 6 different wavelengths are emitted. Which of the following is correct ?

- a) Out of 6 different photons only 2 photons have speed equal to that of visible light.
- b) If highest energy photon emitted from above sample is incident on the metal plate having work function 8 eV, K.E. of liberated photo-electron may be equal to or less than 4.75 eV.
- c) Total number of radial nodes in all the orbital of n^{th} shell is 14.
- d) Total number of angular nodes in all the orbital in $(n - 1)^{\text{th}}$ shell is 13.

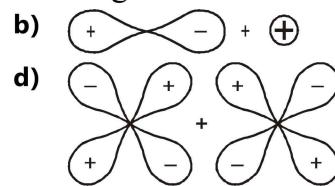
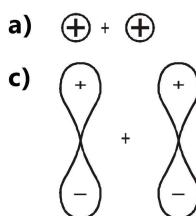
Q37 10 litre of a non linear polyatomic ideal gas at 127°C and 2 atm pressure is suddenly released to 1 atm pressure and the gas expanded adiabatically against constant external pressure, the final temperature and volume of the gas respectively are :

- a) $T = 350\text{K}; V = 17.5 \text{ L}$
- b) $T = 300\text{K}; V = 15\text{L}$
- c) $T = 250 \text{ K}; V = 12.5 \text{ L}$
- d) None of these

Q38 Which of the following species have bond order less than two

- a) CO^+
- b) N_2^+
- c) NO
- d) O_3

Q39 Which of the following orbital overlap will result in gerade molecular orbital



Q40 Isobutene can be prepared from tert-butanol by

S1 : Heating it in the presence of conc. H_2SO_4 .

S2 : Treating it with anhydrous ZnCl_2 /Conc. HCl followed by reaction with alc. KOH/ Δ .

S3 : Treating it with p-tosylchloride followed by reaction with $t\text{Bu}\ddot{\text{O}}\text{K}/\Delta$.

S4 : Heating it with Al_2O_3 .

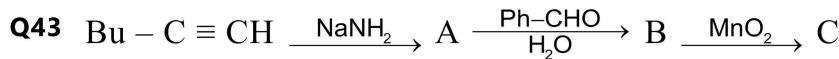
- a) TTTT
- b) TFTT
- c) FTFT
- d) TTFF

Q41 $\xrightarrow[\text{H}_2\text{O}_2/\text{OH}]{\text{BD}_3/\text{THF}}$. Product A, A is

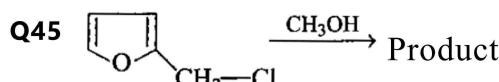
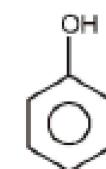
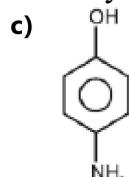
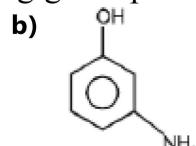
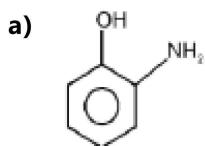
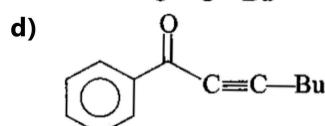
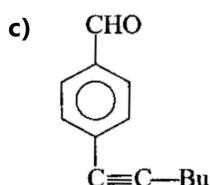
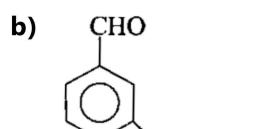
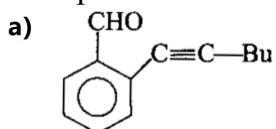
- a)
- b)
- c)
- d)

Q42 Which of the following sets consists only of essential amino acids ?

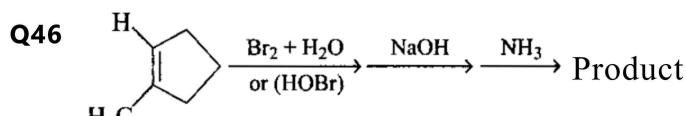
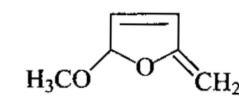
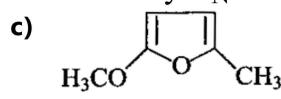
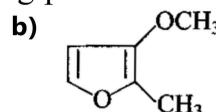
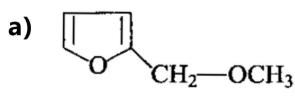
- a) Alanine, tyrosine, cysteine
- b) Leucine, lysine, tryptophan
- c) Alanine, glutamine, lysine
- d) Leucine, proline, glycines



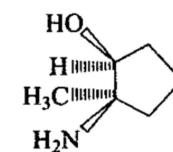
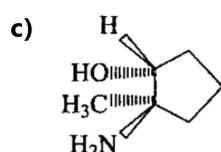
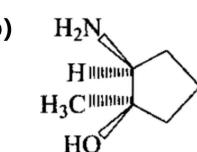
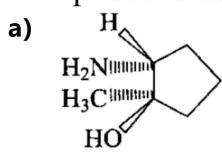
Compound C of the reaction is



Which of the following products cannot be obtained by S_N1 reaction?



The product is:



Q47 The reason for double helical structure of DNA is operation of :

- a) Van der Waals' forces
- b) Dipole-dipole interaction
- c) Hydrogen bonding
- d) Electrostatic attractions

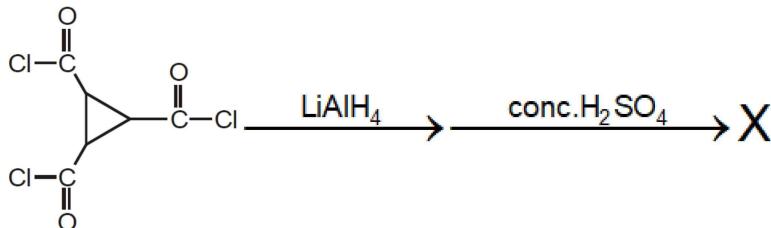
Q48 Al_4C_3 is an ionic carbide, named as :

- a) Acetylide
- b) Methanide
- c) Allylide
- d) Alloy

- Q49** First IE of 5d series elements are generally higher than those of 3d and 4d series elements. This is due to :
- Bigger size of atoms of 5d-series elements than 3d-series elements.
 - Greater effective nuclear charge is experienced by valence electrons because of the weak shielding of the nucleus by 4f-electrons in 5d series.
 - (A) and (B) both.
 - None of these.
- Q50** Which one is correct group reagent for group cations?
- $Mn^{2+} Co^{2+} Zn^{2+} Ni^{2+}$; $HCl + H_2S$
 - $Mn^{2+} Co^{2+} Zn^{2+} Ni^{2+}$; dil. HCl
 - $Mn^{2+} Co^{2+} Zn^{2+} Ni^{2+}$; $NH_4Cl + NH_4OH$
 - $Mn^{2+} Co^{2+} Zn^{2+} Ni^{2+}$; $NH_4Cl + NH_4OH + H_2S$

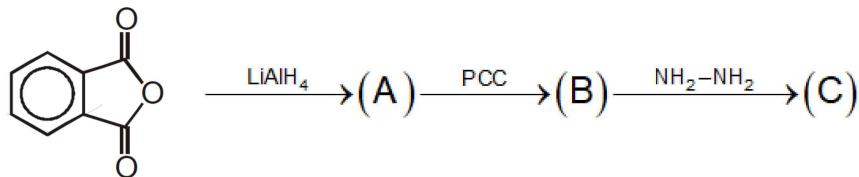
Numerical

- Q51** Among the following find out the number of molecule which are electrophiles?
 $\overset{\oplus}{NH}_4$, $\overset{\oplus}{PH}_4$, $SiCl_4$, $\overset{\oplus}{CH}_3$: CCl_2 (singlet), SO_3
- Q52** The number of Cl = O bonds in perchloric acid is, “_____”.
- Q53** The elevation of boiling point of 0.10 m aqueous $CrCl_3 \cdot xNH_3$ solution is two times that of 0.05 m aqueous $CaCl_2$ solution. The value of x is _____. [Assume 100% ionisation of the complex and $CaCl_2$, coordination number of Cr as 6, and that all NH_3 molecules are present inside the coordination sphere]

Q54

Product X is a cyclic compound. If molecular formula of product X is C_xH_y and number of π bonds in product X is equal to w then $\frac{x+y}{w}$ is:

- Q55** In an estimation of bromine by Carius method, 3.2 g of an organic compound gave 1.88 g of $AgBr$. The mass percentage of bromine in the compound is _____. (Atomic mass, Ag=108, Br=80 g mol⁻¹)
- Q56** A 1.84 mg sample of polyhydric alcoholic compound 'X' of molar mass 92.0 g/mol gave 1.344 mL of H_2 gas at STP. The number of alcoholic hydrogens present in compound 'X' is _____.
- Q57** If the solubility product of AB_2 is $25.6 \times 10^{-11} M^3$, then the solubility of AB_2 in pure water is ____ $\times 10^{-4} \text{ mol L}^{-1}$. [Assuming that neither kind of ion reacts with water]

Q58

What is numbers of π bond (s) in the product (3) ?

- Q59** Solid ammonium carbamate ($\text{NH}_2\text{COONH}_4$) is heated to a temperature of $2T$ Kelvin in a closed container initially containing NH_3 at a pressure of 0.005 atm and temperature T Kelvin, when dissociation equilibrium reaches, the pressure of reaction mixture becomes 0.04 atm. The equilibrium constant (K_p) for the carbamate at $2T$ Kelvin is $X \times 10^{-6}$ atm 3 . What is the value of 'X' ?
- Q60** I_2 (s) | I^- (1.0M) half cell is connected to $\text{H}_{(aq)}^+ | \text{H}_2$ (1 atm), Pt half cell and its cell potential is found to be 0.7714 V. If standard reduction potential of $\text{I}_{2(s)} | \text{I}^-$ is 0.535 V the pH of $\text{H}_{(aq)}^+ | \text{H}_2$ half cell will be

Mathematics**Single Choice Question**

- Q61** Let α, β, γ be the three roots of the equation $x^3 + bx + c = 0$. If $\beta\gamma = 1 = -\alpha$, then $b^3 + 2c^3 - 3\alpha^3 - 6\beta^3 - 8\gamma^3$ is equal to-
- a) 21 b) $\frac{169}{8}$ c) 19 d) $\frac{155}{8}$
- Q62** $\int \frac{dx^3}{x^3(x^n+1)}$ equals:
- a) $\frac{3}{n} \ln \left(\frac{x^n}{x^n+1} \right)$ b) $\frac{1}{n} \ln \left(\frac{x^n}{x^n+1} \right)$ c) $\frac{3}{n} \ln \left(\frac{x^n+1}{x^n} \right)$ d) $3n \ln \left(\frac{x^n+1}{x^n} \right)$
- Q63** Let $f(x) = 3 \sin^4 x + 10 \sin^3 x + 6 \sin^2 x - 3$, $x \in \left[-\frac{\pi}{6}, \frac{\pi}{2}\right]$. Then, f is :-
- a) increasing in $\left(-\frac{\pi}{6}, \frac{\pi}{2}\right)$ b) decreasing in $\left(0, \frac{\pi}{2}\right)$
 c) increasing in $\left(-\frac{\pi}{6}, 0\right)$ d) decreasing in $\left(-\frac{\pi}{6}, 0\right)$
- Q64** There are m men and two women participating in a chess tournament. Each participant plays two games with every other participant. If the number of games played by the men between themselves exceeds the number of games played between the men and the women by 84, then the value of m is
- a) 9 b) 7 c) 11 d) 12
- Q65** If the area (in sq. units) bounded by the parabola $y^2 = 4\lambda x$ and the line $y = \lambda x$, $\lambda > 0$, is $\frac{1}{9}$, then λ is equal to :
- a) 48 b) 24 c) $4\sqrt{3}$ d) $2\sqrt{6}$
- Q66** The derivative of $\cos\left(2\tan^{-1}\left(\sqrt{\frac{1-x}{1+x}}\right)\right) - 2 \cos^{-1}\left(\sqrt{\frac{1-x}{2}}\right)$ w. r. to x is:
- a) $1 - \frac{1}{\sqrt{1-x^2}}$ b) $1 - \frac{1}{\sqrt{1+x^2}}$ c) $2 - \frac{1}{\sqrt{1-x^2}}$ d) $2 - \frac{1}{\sqrt{1+x^2}}$
- Q67** Let $y = y(x)$ be the solution of the differential equation $\sin x \frac{dy}{dx} + y \cos x = 4x$, $x \in (0, \pi)$. If $y\left(\frac{\pi}{2}\right) = 0$, then $y\left(\frac{\pi}{6}\right)$ is equal to
- a) $-\frac{8}{9}\pi^2$ b) $-\frac{4}{9}\pi^2$ c) $\frac{4}{9\sqrt{3}}\pi^2$ d) $\frac{-8}{9\sqrt{3}}\pi^2$
- Q68** $\lim_{x \rightarrow \frac{\pi}{2}^-} [1 + (\cos x)^{\cos x}]^2$ is equal to
- a) Does not exist b) 1 c) e d) 4

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Q69

Let $\vec{\alpha} = 3\hat{i} + \hat{j}$ and $\vec{\beta} = 2\hat{i} - \hat{j} + 3\hat{k}$. If $\vec{\beta} = \vec{\beta}_1 - \vec{\beta}_2$, where $\vec{\beta}_1$ is parallel to $\vec{\alpha}$ and $\vec{\beta}_2$ is perpendicular to $\vec{\alpha}$, then $\vec{\beta}_1 \times \vec{\beta}_2$ is equal to :

- a) $\frac{1}{2}(3\hat{i} - 9\hat{j} + 5\hat{k})$ b) $\frac{1}{2}(-3\hat{i} + 9\hat{j} + 5\hat{k})$ c) $-3\hat{i} + 9\hat{j} + 5\hat{k}$ d) $3\hat{i} - 9\hat{j} - 5\hat{k}$

Q70 Range of $\sin^{-1} \left(\frac{x^2 + 1}{x^2 + 2} \right)$ is:

- a) $[0, \pi/2]$ b) $(0, \pi/6)$ c) $[\pi/6, \pi/2)$ d) none of these

Q71 Let P be a variable point on the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ with foci S_1 and S_2 . If A be the area of ΔPS_1S_2 , then the maximum value of A:

- a) $ab \sin \theta$ b) abe c) $a \sin \theta$ d) $b \sin \theta$

Q72 Let $[x]$ denote the greatest integer $\leq x$, where $x \in \mathbb{R}$. If the domain of the real valued function $f(x) = \frac{[x]-2}{\sqrt{[x]-3}}$ is $(-\infty, a) \cup [b, c) \cup [4, \infty)$, $a < b < c$, then the value of $a + b + c$ is :

- a) 8 b) 1 c) -2 d) -3

Q73 If a circle $x^2 + y^2 + 2x + 4y - 1 = 0$ and parabola $y^2 = 4x$ cut at the points (x_i, y_i) ; $i = 1, 2, 3, 4$ then $y_1 + y_2 + y_3 + y_4$ is equal to

- a) 0 b) 1 c) -1 d) 24

Q74 $\text{cosec } 18^\circ$ is a root of the equation :

- a) $x^2 + 2x - 4 = 0$ b) $4x^2 + 2x - 1 = 0$
 c) $x^2 - 2x + 4 = 0$ d) $x^2 - 2x - 4 = 0$

Q75 Let $S = \{1, 2, \dots, 20\}$. A subset B of S is said to be "nice", if the sum of the elements of B is 203. Then the probability that a randomly chosen subset of S is "nice" is

- a) $\frac{4}{2^{20}}$ b) $\frac{6}{2^{20}}$ c) $\frac{4}{2^{20}}$ d) $\frac{5}{2^{20}}$

Q76 Let $\theta = \frac{\pi}{5}$ and $A = \begin{bmatrix} \cos \theta & \sin \theta \\ -\sin \theta & \cos \theta \end{bmatrix}$. If $B = A + A^4$, then $\det(B)$:

- a) lies in $(2, 3)$ b) is zero c) is one d) lies in $(1, 2)$

Q77 Let PQ be a focal chord of the parabola $y^2 = 4x$ such that it subtends an angle of $\frac{\pi}{2}$ at the point $(3, 0)$. Let the line segment PQ be also a focal chord of the ellipse E : $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, $a^2 > b^2$. If e is the eccentricity of the ellipse E, then the value of $\frac{1}{e^2}$ is equal to :

- a) $1+\sqrt{2}$ b) $3+2\sqrt{2}$ c) $1+2\sqrt{3}$ d) $4+5\sqrt{3}$

Q78 Let a_1, a_2, \dots, a_{30} be an A.P., $S = \sum_{i=1}^{30} a_i$ and $T = \sum_{i=1}^{15} a_{(2i-1)}$. If $a_5 = 27$ and $S - 2T = 75$, then a_{10} is equal to
a) 47 **b)** 57 **c)** 52 **d)** 42

Q79 If the roots of the equation $\frac{x^2 - bx}{ax - c} = \frac{\lambda - 1}{\lambda + 1}$ are such that $\alpha + \beta = 0$, then the value of λ is-

- a)** $\frac{a-b}{a+b}$ **b)** c **c)** $\frac{1}{c}$ **d)** $\frac{a+b}{a-b}$

Q80 Let $\alpha > 0, \beta > 0$ be such that $\alpha^3 + \beta^2 = 4$. If the maximum value of the term independent of x in the binomial expansion of $\left(\alpha x^{\frac{1}{9}} + \beta x^{-\frac{1}{6}}\right)^{10}$ is $10k$, then k is equal to :
a) 84 **b)** 176 **c)** 336 **d)** 352

Numerical

Q81 A data consists of n observations x_1, x_2, \dots, x_n . If $\sum_{i=1}^n (x_i + 1)^2 = 9n$ and $\sum_{i=1}^n (x_i - 1)^2 = 5n$, then variance of this data is

Q82 Consider the triangles with vertices A(2, 1) B (0, 0) and C ($t, 4$), $t \in [0, 4]$. If the maximum and the minimum perimeters of such triangles are obtained at $t = \alpha$ and $t = \beta$ respectively, then $6\alpha + 21\beta$ is equal to ____.

Q83 The sum of distinct values of λ for which the system of equations
 $(\lambda - 1)x + (3\lambda + 1)y + 2\lambda z = 0$
 $(\lambda - 1)x + (4\lambda - 2)y + (\lambda + 3)z = 0$
 $2x + (3\lambda + 1)y + 3(\lambda - 1)z = 0$,
has non-zero solutions, is ____.

Q84 If (a, b, c) is the image of the point $(1, 2, -3)$ in the line $\frac{x+1}{2} = \frac{y-3}{-2} = \frac{z}{-1}$, then $a + b + c$ is equal to :

Q85 Fractional part of the number $\frac{4^{2022}}{15}$ is equal to k then find the value of $30 \times k$

Q86 Let $f(x) = |x - 2|$ and $g(x) = f(f(x))$, $x \in [0, 4]$. Then $\int_0^3 (g(x) - f(x))dx$ is equal to :

Q87 If a and b are real numbers such that $(2 + \alpha)^4 = a + b\alpha$, where $\alpha = \frac{-1+i\sqrt{3}}{2}$, then $a + b$ is equal to :

Q88 Let $a \in \mathbb{Z}$ and $[t]$ be the greatest integer $\leq t$. Then the number of points, where the function $f(x) = [a + 13 \sin x]$, $x \in (0, \pi)$ is not differentiable, is ____

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Q89 The shortest distance between the lines $\frac{x+2}{1} = \frac{y}{-2} = \frac{z-5}{2}$ and $\frac{x-4}{1} = \frac{y-1}{-2} = \frac{z+3}{0}$ is

Q90 $\int_0^5 \cos\left(\pi\left(x - \left[\frac{x}{2}\right]\right)\right) dx$, Where $[t]$ denotes greatest integer less than or equal to t , is equal to :

Answer Key

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