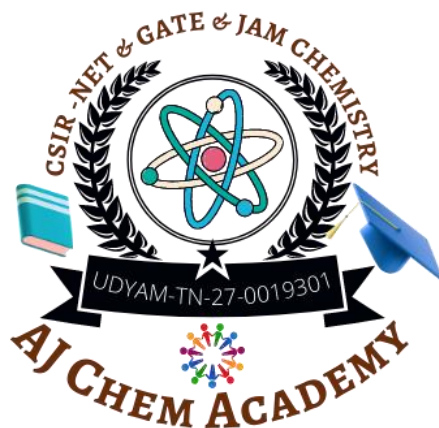


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Q.21 – Q.60 MCQ, carry TWO marks each (for each wrong answer: -0.5).

You are required to Answer Maximum 35 Questions.

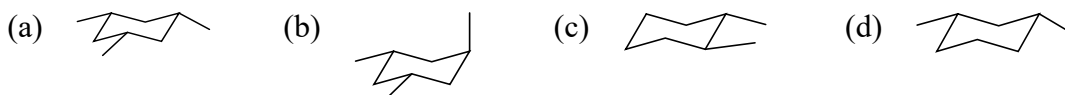
21. ^{212}Bi decays with the emission of an α particle. The resulting nuclide emits a β particle to give an element
 (a) Tl (b) Pb (c) Po (d) At
22. The red colour of the gem, ruby is predominantly due to
 (a) O^{2-} to Al^{3+} charge transfer
 (b) O^{2-} to Cr^{3+} charge transfer
 (c) Red emission (phosphorescence) of Cr^{3+} ions
 (d) Red emission (fluorescence) of Al^{3+} ions
23. Marsh test is used to identify traces of the element,
 (a) As (b) Sb (c) Bi (d) Se
24. The rate of hydration of $[\text{Cr}^{\text{III}}(\text{H}_2\text{O})_5\text{X}]^{n+}$, ($\text{X} = \text{N}_3^-, \text{F}^-, \text{CN}^-$ and NH_3) in neutral aqueous medium remains unaffected in acidic medium at room temperature, if 'X' is
 (a) N_3^- (b) F^- (c) CN^- (d) NH_3
25. The correct statement(s) for oxygen from the following
[P] The ground state for the O atom is $^3\text{P}_1$
[Q] Both the atom and the diatomic molecule are paramagnetic with two Unpaired electrons
[R] The most readily accessible singlet excited state for dioxygen has an empty π^* orbital
- Choose the correct answer from the options given below:
 (a) P and Q only (b) Q and R only (c) P and R only (d) Q only
26. The correct statement for peroxydisulfuric and dithionic acids from the following is:
 (a) Each of these has two O-H bonds
 (b) Peroxydisulfuric has one O-H bond and dithionic acid has two O-H bonds
 (c) Peroxydisulfuric has two O-H bonds and dithionic acid has one O-H bond
 (d) Each of these has only one O-H bond
27. Match List-I with List-II

	Metalloprotein		Metal		P	Q	R	S
P	Carboxypeptidase-A	i	Mn	(a)	iii	; i	; ii	; iv
Q	Oxygen-evolving complex	ii	Fe	(b)	iv	; i	; ii	; iii

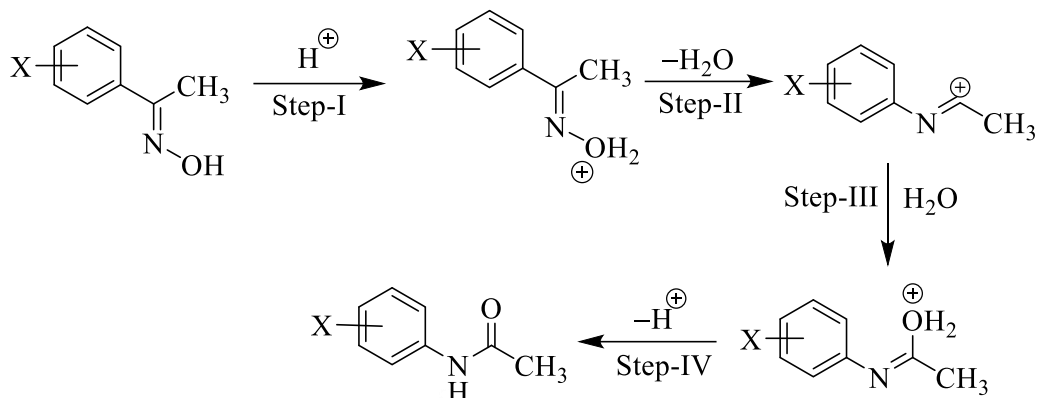


R	Hemerythrin	iii	Ni	(c) ii ; iii ; iv ; i
S	Coenzyme F-430	iv	Zn	(d) iv ; iii ; i ; ii

28. The **first ionization energy** of the metals follows the order:
- (a) Zn > Cd > Hg (b) Hg > Zn > Cd
(c) Hg > Cd > Zn (d) Cd > Zn > Hg
29. Among the following divalent metal ions which forms **polymeric compound**, when ligand used is $C_5H_5^-$ only
- (a) V (b) Ni (c) Mn (d) Co
30. The **correct pair** among the following, in which each species shows **orbital contribution to its magnetic moment** is
- (a) $[CoCl_4]^{2-}$ and $[Ni(H_2O)_6]^{2+}$ (b) $[NiCl_4]^{2-}$ and $[CoF_6]^{2-}$
(c) $[Co(H_2O)_6]^{2+}$ and $[Cr(H_2O)_6]^{3+}$ (d) $[Ni(NH_3)_6]^{2+}$ and $[CrCl_4]^{2-}$
31. In a sample of charcoal, the remaining fraction ^{14}C is 2×10^{-2} , its age (in years) is closest to $[t_{1/2}$ of $^{14}C = 5730$ years]
- (a) 3.2×10^4 (b) 3.0×10^4 (c) 2.8×10^4 (d) 3.4×10^4
32. The correct statement for the CO and N_2 ligands in the complexes **trans-[IrCl(CO)(PPh₃)₂]** and **trans-[IrCl(N₂)(PPh₃)₂]** is:
- (a) N_2 is both better σ -donor and better π -acceptor ligand than CO
(b) CO is a better π -acceptor, but poor σ -donor ligand than N_2
(c) CO is a better σ -donor, but poor π -acceptor ligand than N_2
(d) CO is both better σ -donor and better π -acceptor ligand than N_2
33. Consider the following statements with respect to **Jacobsen's catalyst** used for epoxidation reaction. It is/has
- [P] Manganese(III) complex [Q] Salen type ligand
[R] Cobalt(III) bromide complex [S] 1-nitroso-2-naphthol type ligand
[T] Square pyramid geometry [U] Square planar geometry
- Choose the correct answer from the options given below:
- (a) R, S and T only (b) P, Q and T only (c) P, S and T only (d) Q, R and U only
34. The compound that will show **six signals** in the proton-decoupled ^{13}C -NMR spectrum is

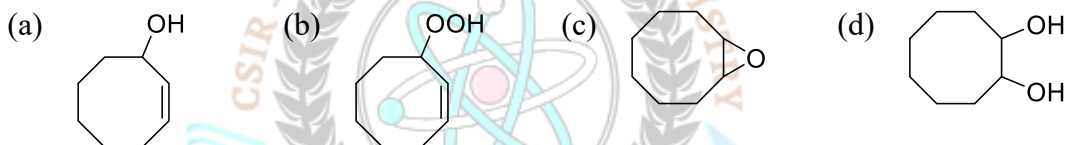


35. The Hammett ρ -value for the following reaction is -2.0 . the rate-determining step (RDS) is:

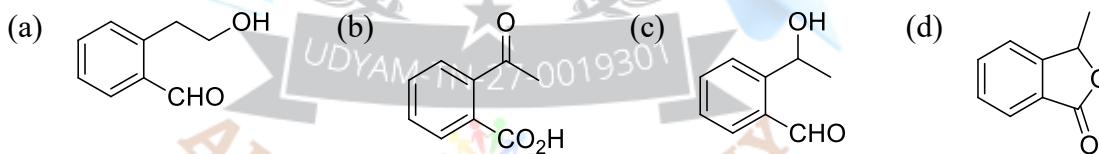


- (a) Step-I (b) Step-II (c) Step-III (d) Step-IV

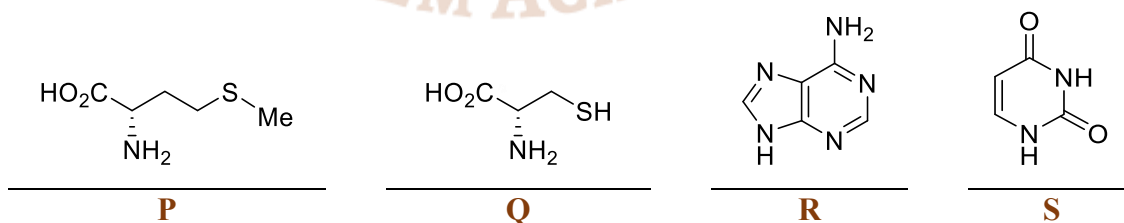
36. The major product formed in the photochemical reaction of cyclooctene in the presence of oxygen and a photosensitizer is



37. The compound that answers both, haloform and Tollen's tests is



38. Components of S-adenosyl methionine are



Choose the correct answer from the options given below:

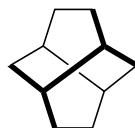
- (a) P and R only (b) P and S only (c) Q and R only (d) Q and S only
39. The correct order of basicity for following compounds is



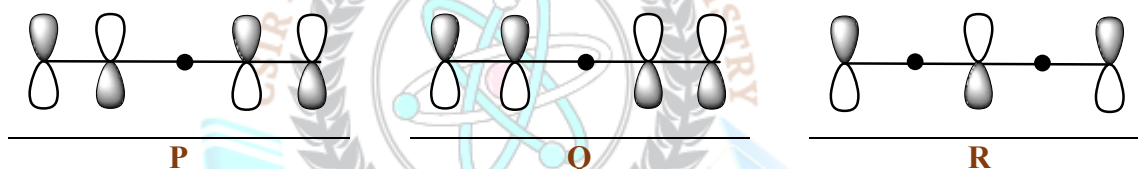
42. Given in the options are compounds with the molecular weight 125. The one that will show the given EI mass spectral data is:

125 ($[M]^+$, 55%), 126 ($[M + 1]^+$, 3.65%), 127 ($[M + 2]^+$, 2.35%)

- (a) C_6H_7NS (b) $C_6H_7NO_2$ (c) C_7H_8FN (d) $C_8H_{15}N$
43. The following hydrocarbon, twistane, is

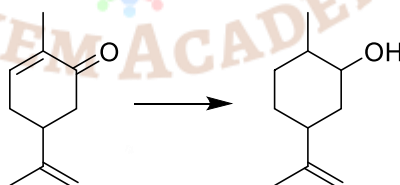


- (a) achiral due to the presence of centre of symmetry
 (b) achiral due to the presence of plane of symmetry
 (c) chiral with no elements of symmetry
 (d) chiral with C_2 axes of symmetry
44. The correct order of energy for the following molecular orbitals is

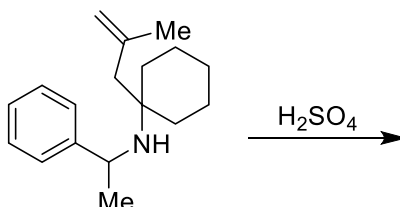


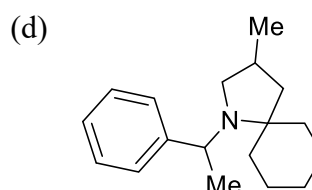
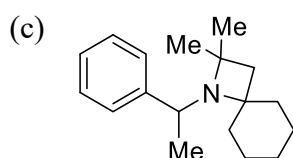
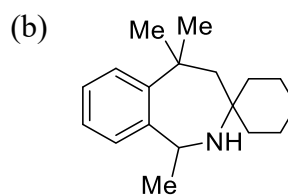
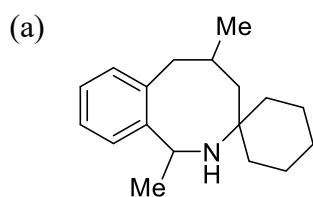
Choose the correct answer from the options given below

- (a) $R > P > Q$ (b) $R > Q > P$
 (c) $P > R > Q$ (d) $Q > P > R$
45. The most suitable reagent to effect the following conversion is



- (a) $BH_3 \cdot SMe_2$ (b) $Na, EtOH$ (c) $NaBH_4, CeCl_3$ (d) $H_2, Pd/C$
46. The major product formed in the following reaction is





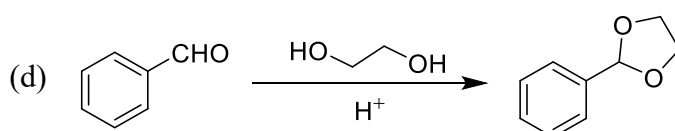
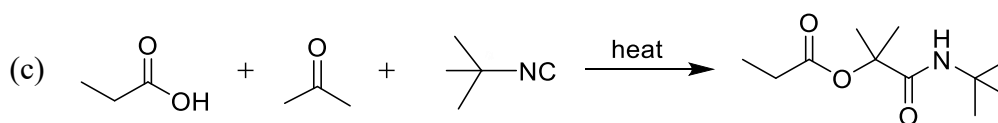
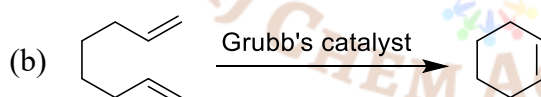
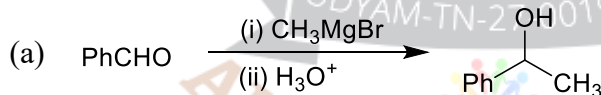
47. The units of a rate constant for the reaction $nA \rightarrow \text{Products}$, is $\text{L mol}^{-1}\text{min}^{-1}$. If the half life is 300 min when $[A_0] = 0.05 \text{ M}$, its half-life (in min), when $[A_0] = 0.1 \text{ M}$ is closest to

- (a) 450 (b) 300 (c) 150 (d) 75

48. A metallic lattice exhibits peaks corresponding to Miller indices (110), (111), (210) and (211) in its powder XRD pattern. The metal is crystallised in the Bravais lattice

- (a) bcc (b) fcc (c) side centered cubic (d) primitive cubic

49. The most efficient reaction in terms of atom economy, among the following, is



50. The quantity that is an exact differential of a state function is (following the convention that heat flowing in and work done on the system are positive)

- (a) dq (b) $TdS - PdV$ (c) $TdS - VdP$ (d) $VdP + SdT$

51. The reaction whose rate constant is least dependent on the dielectric constant of the medium is: $[P = \text{Product(s)}]$

- (a) $\text{S}_2\text{O}_8^{2-} + \text{I}^- \rightarrow \text{P}$ (b) $\text{CH}_3\text{COOC}_2\text{H}_5 + \text{OH}^- \rightarrow \text{P}$





52. Assuming that the **enthalpy of mixing is zero**, the mixture with the **largest Gibbs free energy**, at the same temperature, among the following, is
- (a) 0.1 moles of benzene and 0.9 moles of toluene
 (b) 0.25 moles of benzene and 0.75 moles of toluene
 (c) 0.6 moles of benzene and 0.4 moles of toluene
 (d) 0.8 moles of benzene and 0.2 moles of toluene
53. The angle between the **z-axis** and the **intrinsic spin angular momentum** for $m_s = \pm \frac{1}{2}$ is
- (a) $\cos^{-1}(1/\sqrt{2})$ (b) $\cos^{-1}(\sqrt{3}/2)$ (c) $\cos^{-1}(1/2)$ (d) $\cos^{-1}(1/\sqrt{3})$
54. The permitted values of the **total angular momentum quantum number 'j'**, for an electron occupying an **f orbital** are
- (a) 7/2 and 5/2 (b) 1/2 and -1/2 (c) 9/2 and 7/2 (d) 3/2 and 1/2
55. The resistance of a **0.1 M KCl** solution in a cell is **300 ohms** and specific conductance is 1.5 S cm^{-1} . If the resistance of a **0.05 M NaCl** in the same cell is **750 ohms**, then the **molar conductance ($\text{S cm}^2 \text{ mol}^{-1}$) of the NaCl** is:
- (a) 6,000 (b) 8,000 (c) 12,000 (d) 3,000
56. A **diatomic molecule** undergoing **simple harmonic motion** has a **displacement(q)** of $4.9 \times 10^{-12} \text{ m}$. Its **force constant** is 1610 N m^{-1} . The **potential energy** of the molecule is (in Joules)
- (a) 1.93×10^{22} (b) 1.93×10^{-23} (c) 3.86×10^{-20} (d) 1.93×10^{-20}
57. The **spin density** in **propenyl radical** is predominantly localized on
- (a) atoms 1 and 2 (b) atoms 2 and 3
 (c) atoms 1 and 3 (d) equally on all the atoms
58. In the **electric double layer model**, the difference in potential between the fixed part of the double layer and bulk solution is called:
- (a) Zeta potential (b) Double layer potential
 (c) Sedimentation potential (d) Chemical potential
59. The **point groups** of **cis- and trans-1, 2-dichloroethylene** are respectively
- (a) C_{2v} and C_{2v} (b) C_{2v} and C_{2h} (c) C_{2h} and C_{2v} (d) C_{2h} and C_{2h}
60. The correct expression for the **internal energy of a system** following **Boltzmann distribution of energy** is



(Q - partition function, T - Temperature, k_B - Boltzmann constant, N - number of molecules and V - volume)

- (a) $k_B T \left(\frac{\partial \ln Q}{\partial T} \right)_{N,V}$ (b) $k_B T^2 \left(\frac{\partial \ln Q}{\partial T} \right)_{N,V}$ (c) $k_B T \left(\frac{\partial \ln Q}{\partial \beta} \right)_{N,V}$ (d) $k_B T^2 \left(\frac{\partial \ln Q}{\partial \beta} \right)_{N,V}$

Q.61 – Q.120 MCQ, carry FOUR marks each (for each wrong answer: -1).

You are required to Answer Maximum 25 Questions.

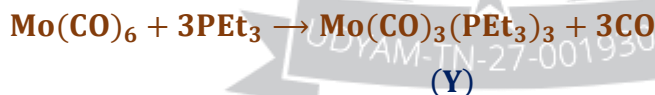
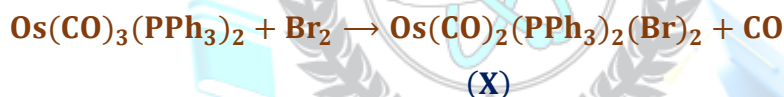
61. Consider the following with regard to **gas chromatography (GC)**.

- [P] Electron capture [Q] Deemter equation
[R] Partition coefficient [S] Critical temperature of gas

Of the above, which are relevant to GC?

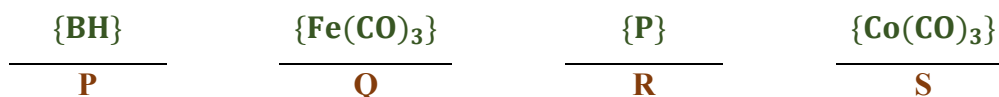
Choose the correct answer from the options given below:

- (a) P, Q and S only (b) P, R and S only (c) Q, R and S only (d) P, Q and R only
62. The possible terms arising from a **P^1d^1** configuration are
(a) 1F and 2D (b) 3F and 3D (c) 3F and 1D (d) 3F and 1F
63. Consider the following reactions:



The correct **stereochemical dispositions** of the Br ligands in X and the CO ligands in Y, respectively, are

- (a) trans and fac (b) trans and mer (c) cis and fac (d) cis and mer
64. In solution, **Vaska's complex** is known to bind O_2 reversibly. In the product, **oxidation state of the metal ion center, coordination geometry and mode of binding of O_2** , respectively are
- (a) +3, octahedron and side-on (b) +3, square pyramid and end-on
(c) +1, octahedron and side-on (d) +1, trigonal bipyramid and end-on
65. **Isolobal pairs from the fragments (P-S) is/are**



Choose the correct answer from the options given below:

- (a) P and S; Q and R (b) P and Q; R and S (c) P and Q only (d) P and R; Q and S
66. The **ground state term symbol and the g_j value for Pr^{3+} ion**, respectively are



- (a) 3H_4 and 6/7 (b) 3H_6 and 4/5 (c) 3H_6 and 6/7 (d) 3H_4 and 4/5

67. Considering spin-orbit coupling, the multiplet width $[W_{SO} = \lambda S(2L + 1)]$ for Eu^{3+} ion is

- (a) 14λ (b) 21λ (c) 7λ (d) 28λ

68. Consider the following statements for haemoglobin(Hb) and myoglobin(Mb).

[P] Oxy-Hb is formed in lungs, whereas oxy-Mb is formed in tissues

[Q] Mb has greater affinity for dioxygen than Hb

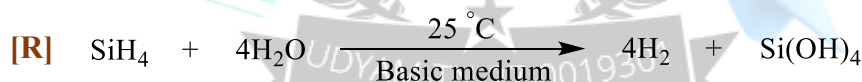
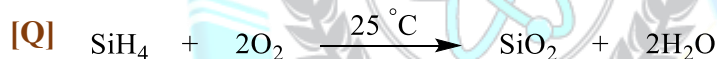
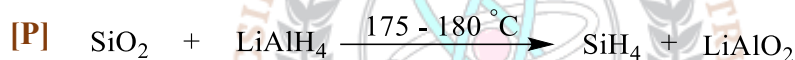
[R] The equilibrium constant for the formation of the oxy-Mb is $K_{Mb} = \frac{[MbO_2]}{[Mb][O_2]}$

[S] The equilibrium constant for the formation of the oxy-Hb is $K_{Hb} = \frac{[Hb(O_2)_4]}{[Mb][O_2]^4}$

Choose the correct answer from the options given below:

- (a) P, Q and R only (b) P, R and S only (c) Q, R and S only (d) P, Q and S only

69. Among the following feasible reaction(s) is/are?



Choose the correct answer from the options given below:

- (a) P only (b) R only (c) Q and R only (d) P, Q and R only

70. Based on Wade's rules, the correct structure types for $[B_4H_{10}]$, $[B_8H_8]^{2-}$, $[B_{10}H_{14}]$ and $[Mn(CO)_4B_3H_8]$ respectively are

- (a) arachno , closo , arachno and hypho
 (b) nido , nido , arachno and hypho
 (c) arachno , closo , nido and arachno
 (d) nido , closo , nido and hypho

71. For octahedral geometry the triad with no net gain in CFSE, when the ligand field changes from weak to strong is,

- (a) Fe^{2+} , Co^{3+} , Mn^{3+} (b) Ni^{2+} , Pt^{2+} , Cr^{3+} (c) Mn^{2+} , Fe^{3+} , Ni^{3+} (d) Co^{2+} , Os^{3+} , Rh^{3+}

72. Among the following statements, select those which best describe plastocyanine

[P] Coordination geometry of Cu^{II} -ion is distorted tetrahedron

[Q] The geometry around Cu^{II} changes to square-planar on reduction



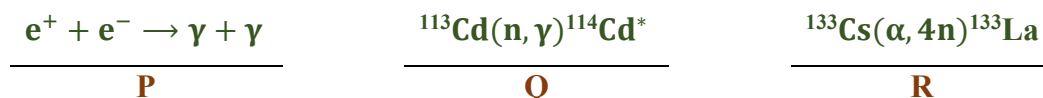
[R] In EPR spectrum, the A_{H} values are smaller in plastocyanine than in CuCl_4^{2-}

[S] The active site contains the amino acids histidine and cysteine only

Choose the correct answer from the options given below:

- (a) P and R only (b) P and S only (c) P, Q and S only (d) Q, R and S only

73. The reaction(s)/event(s) used to prove the existence of neutrinos is/are



Choose the correct answer from the options given below:

- (a) P and R only (b) P and Q only (c) Q and R only (d) Q only

74. Consider the ^{31}P -NMR (decoupled from ^1H and ^{195}Pt) spectra for the isomers of 'X' = $[\text{PtBrCl}(\text{PMe}_3)_2]$ and 'Y' = $[\text{IrCl}_3(\text{PMe}_3)_3]$, separately. The number of ^{31}P -NMR signals for the different isomers of the complexes are given in the table below. The correct answer is ,

No. of ^{31}P resonance signal(s)			
Complex X		Complex Y	
Isomer 1	Isomer 2	Isomer 1	Isomer 2
(a) one	one	one	one
(b) one	two	one	two
(c) two	two	one	two
(d) one	two	two	two

75. Consider following statements regarding the magnetic moment of the 3d transition metal complexes:

[P] Octahedral complexes of Mn^{II} (high spin) and Fe^{III} (high spin) have μ_{eff} approximately equal to their μ_{spin} values

[Q] Tetrahedral complexes of Ni^{II} and octahedral complexes Co^{II} have orbital contribution added to their magnetic moments

[R] Orbital contribution is quenched for metal ions having A or E ground state

[S] Octahedral complexes of Cu^{II} have $\mu_{\text{eff}} > \mu_{\text{spin}}$ value at 300 K due to orbital contribution added to their magnetic moments

Choose the correct answer from the options given below:

- (a) P, Q and S only (b) Q, R and S only (c) P, Q and R only (d) P, R and S only

76. The number of Ge-Ge, Te-Te and Pb-Pb bonds in Ge_4^{4-} , Te_4^{2+} , Pb_5^{2-} respectively are



- (a) 6, 4 and 8 (b) 4, 6 and 9 (c) 6, 4 and 9 (d) 4, 6 and 8

77. For CO, the contour plot of the molecular orbital which best represents the HOMO is



78. Among the following combinations of metal carbonyl clusters and their skeletal structures, identify the correct ones.

- P. $[\text{Co}_6(\text{CO})_{14}]^{4-}$; capped trigonal bipyramid
 Q. $[\text{Ni}_6(\text{CO})_{12}]^{2-}$; trigonal antiprism
 R. $[\text{Rh}_6\text{C}(\text{CO})_{15}]^{2-}$; trigonal prism
 S. $[\text{Os}_6(\text{CO})_{18}]$; octahedron

Choose the correct answer from the options given below:

- (a) P, R and S only (b) Q and R only (c) Q and S only (d) R and S only

79. The $[(\eta^5\text{-C}_5\text{H}_5)\text{Fe}(\text{CO})_2]_2$ molecule exists in solution as a 1 : 1 mixture of cis- and trans-isomers. At 28 °C, $^1\text{H-NMR}$ spectrum of the molecule shows

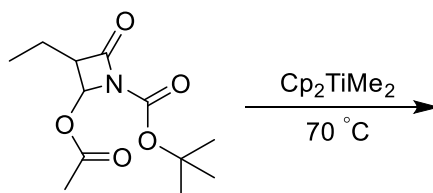
- (a) one singlet (b) two singlet (c) four singlet (d) three singlet

80. Mossbauer spectrum of $\text{Fe}(\text{CO})_5$ at liquid nitrogen temperature in the presence of a field gradient and taking into effect quadrupole interaction shows a

[For ^{57}Fe , $I = 1/2$ for the ground state and $I = 3/2$ for the first excited state],

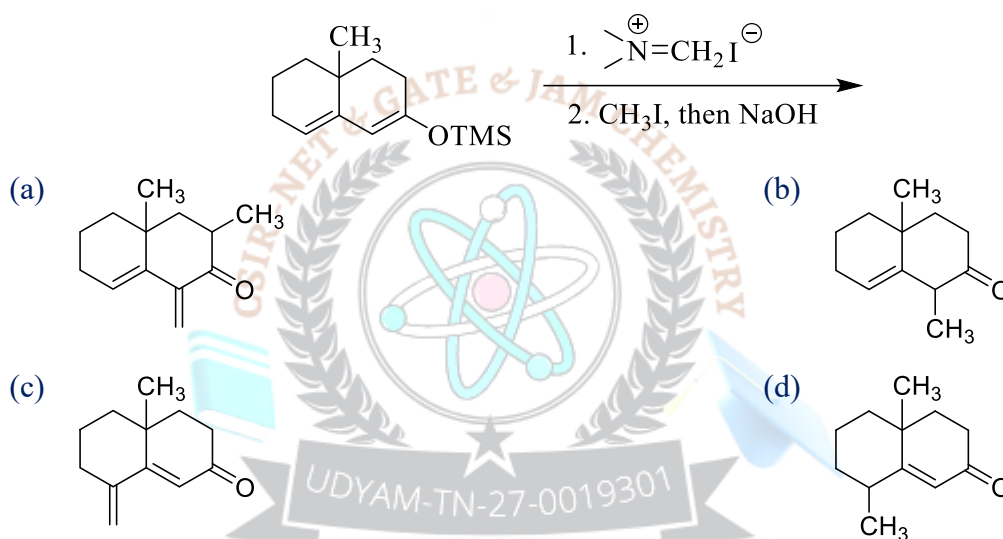
- (a) quintet (b) triplet (c) doublet (d) singlet

81. The major product formed in the following reaction is





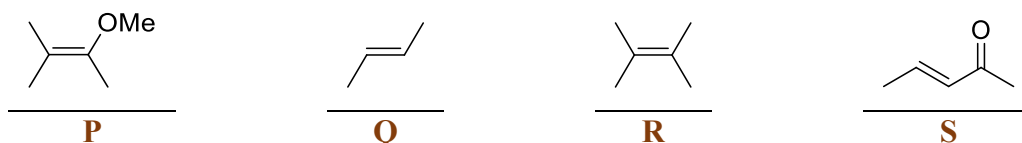
82. The major product formed in the following reaction sequence is



83. Match List-I (Functional groups) and List-II (symmetric and asymmetric stretching frequencies)

	List I	List I	P	Q	R
P	N-H bonds of R-NH ₂	i. 1790 and 1810	(a) ii ; i ; iii		
Q	N-O bonds of R-NO ₂	ii. 3300 and 3400	(b) iii ; i ; ii		
R	C=O bonds of anhydride	iii. 1350 and 1550	(c) iii ; ii ; i		
			(d) ii ; iii ; i		

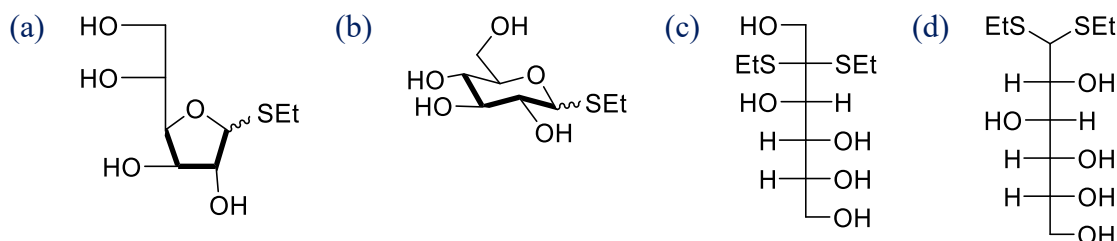
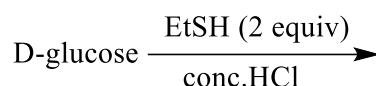
84. The correct order of reactivity of the following olefins towards ozone is



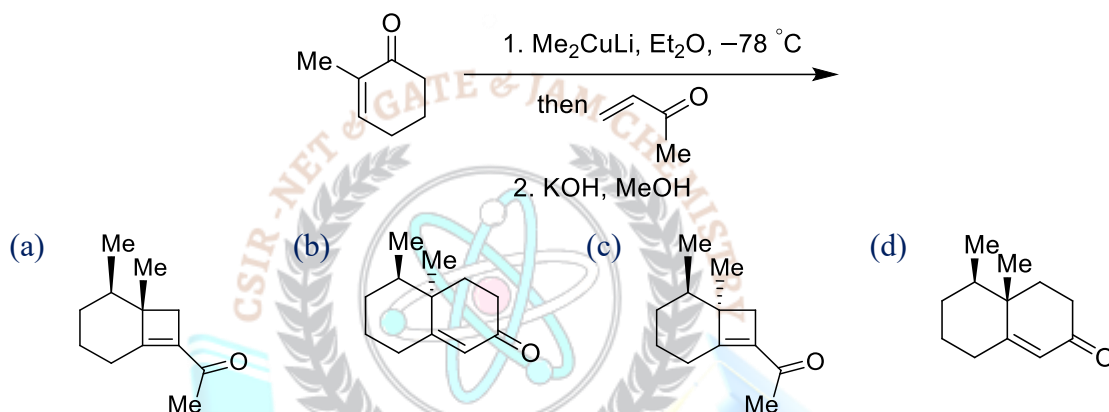
- (a) P > R > Q > S (b) P > Q > S > R
- (c) Q > R > P > S (d) R > P > S > Q



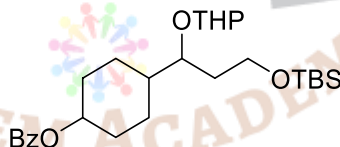
85. The major product formed in the following reaction is



86. The major product formed in the following reaction sequence is

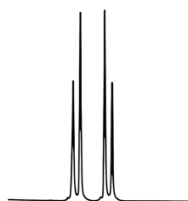


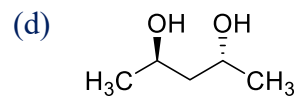
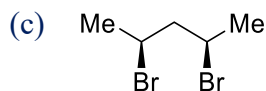
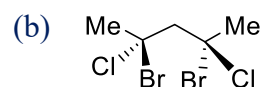
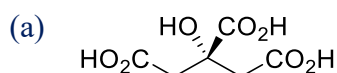
87. The correct match of reagents in Column-I for the selective cleavage of the protecting group in Column-II for the following substrate is



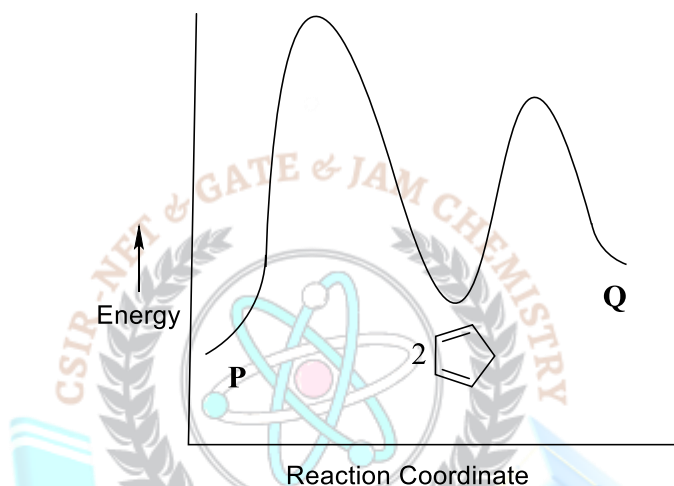
	Column-I		Column-II		P	Q	R
P.	TBAF, THF	i.	THP	(a)	iii	i	ii
Q.	AcOH, H ₂ O, THF	ii.	Bz	(b)	iii	ii	i
R.	LiOH, H ₂ O, THF	iii.	TBS	(c)	ii	iii	i
				(d)	i	iii	ii

88. The compound that will show the following characteristic splitting pattern in the ¹H-NMR spectrum is



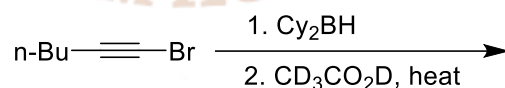


89. **P** and **Q** are isomers of cyclopentadiene dimer. A representative energy profile diagram of the dimerization is given below. The correct statement about the reaction under ambient conditions is

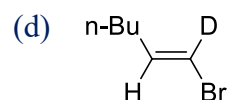
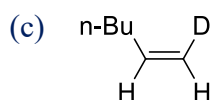
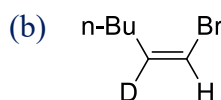
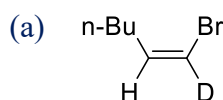


- (a) P is the major product as it is more stable
 (b) Q is the major product as it is more stable
 (c) P is the major product as it is formed faster
 (d) Q is the major product as it is formed faster

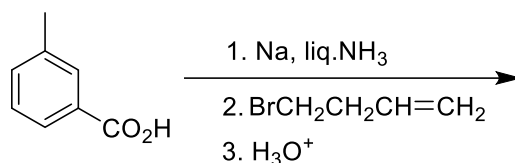
90. The major product formed in the following reaction sequence is



(Cy₂BH = dicyclohexylborane)

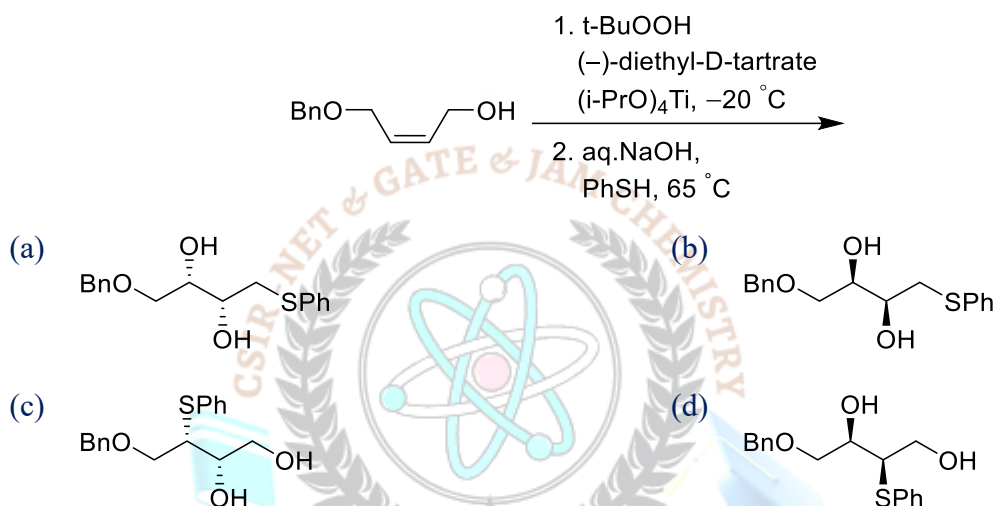


91. The major product formed in the following reaction is

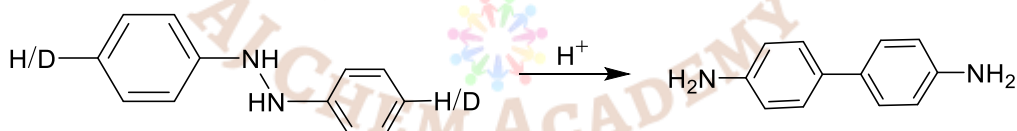




92. The major product formed in the following reaction sequence is

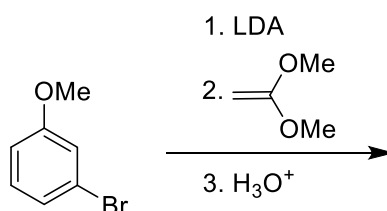


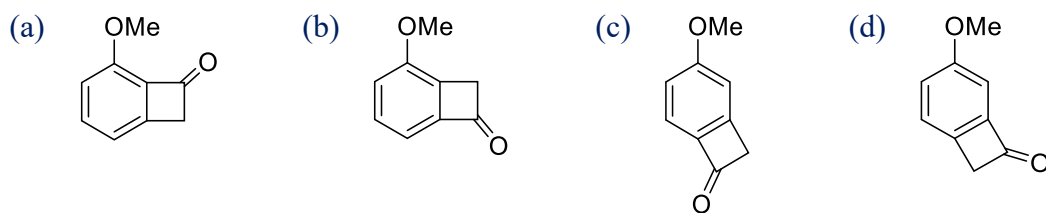
93. For the given reaction, isotopic substitution (H to D) at the indicated position will lead to the observation of



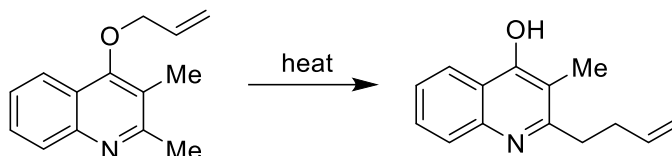
- (a) Primary kinetic isotope effect
(b) Secondary kinetic isotope effect with $k_H > k_D$
(c) Secondary kinetic isotope effect with $k_D > k_H$
(d) no kinetic isotope effect, $k_H = k_D$

94. The major product formed in the following reaction is



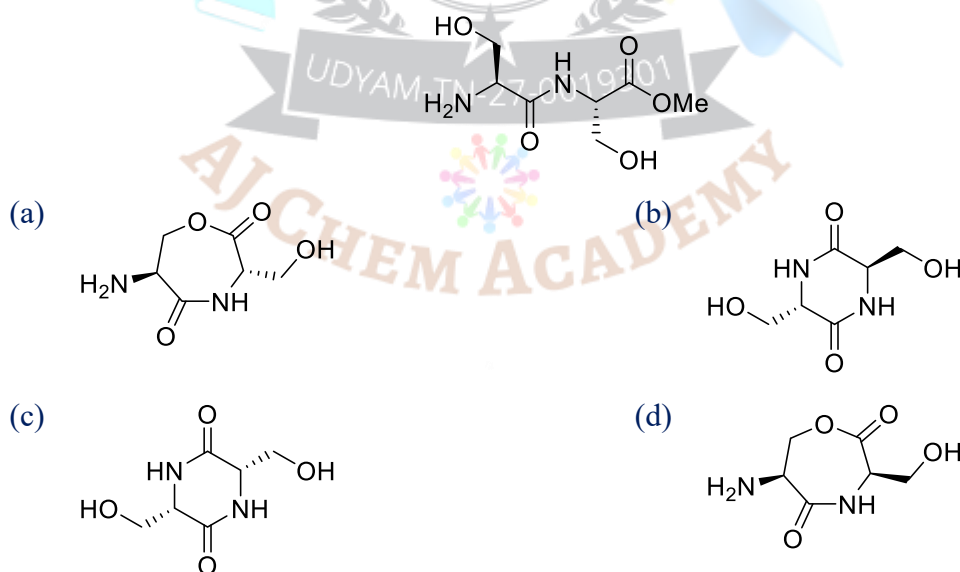


95. The sequence through which the following reaction proceeds is

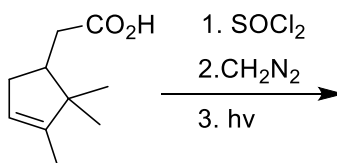


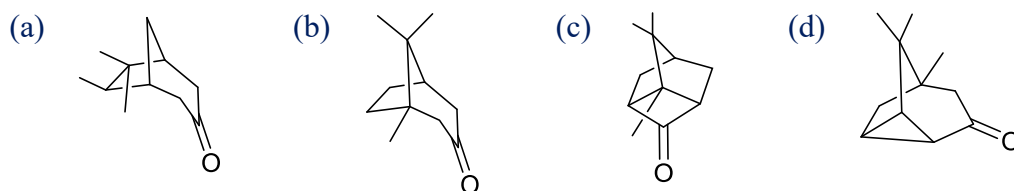
- (a) P. Claisen rearrangement,
Q. Tautomerization and
R. Cope rearrangement
- (b) P. Claisen rearrangement,
Q. aza-Claisen rearrangement and
R. Tautomerization
- (c) P. Cope rearrangement,
Q. Claisen rearrangement and
R. Tautomerization
- (d) P. Claisen rearrangement,
Q. Tautomerization and
R. aza-Claisen rearrangement

96. Cyclization of the following dipeptide under mildly basic conditions gives

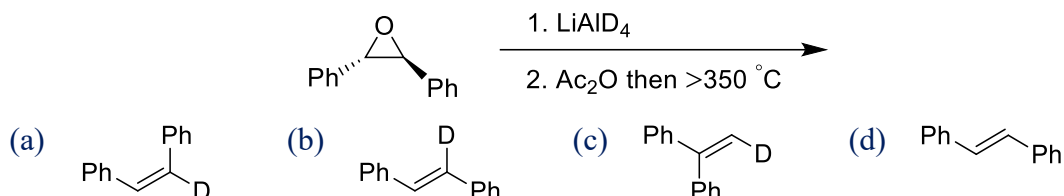


97. The major product formed in the following reaction sequence is

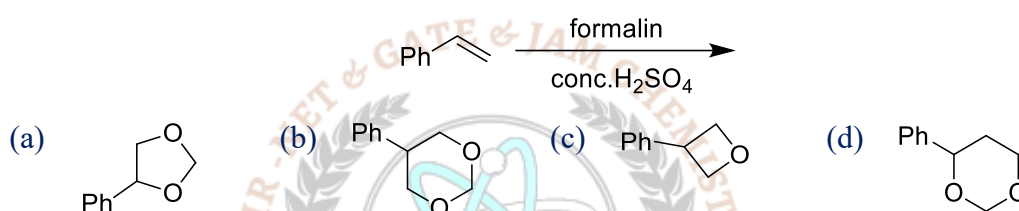




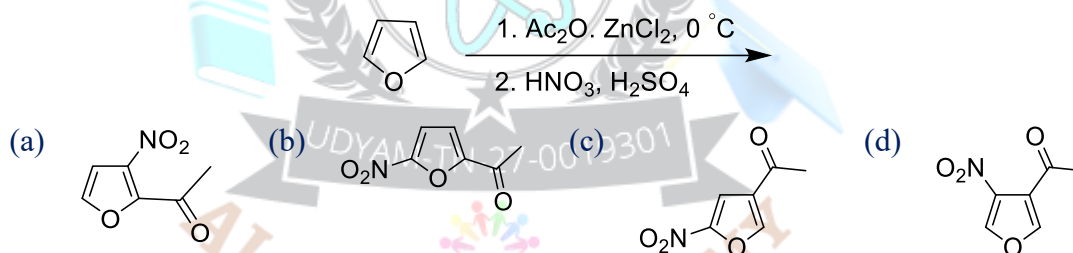
98. The major product formed in the following reaction sequence is



99. The major product formed in the following reaction is



100. The major product formed in the following reaction is



101. Lamb dip spectroscopy can reduce

- (a) Natural line width (b) Doppler line width
(c) Collision induced line width (d) Saturation line width

102. The equilibrium constant for the formation of the complex $[\text{Zn}(\text{NH}_3)_4]^{2+}$ at 25 °C is close to _____ [Given: $E_{\text{Zn}^{+2}/\text{Zn}}^0 = -0.763\text{V}$ and $E_{\text{Zn}(\text{NH}_3)_4^{+2}/\text{Zn}, \text{NH}_3}^0 = -1.03\text{V}$]

- (a) 2×10^8 (b) 5.5×10^{10} (c) 1×10^9 (d) 6.6×10^7

103. The approximate length (in μm) of the extended chain (contour length) of polypropylene of molar mass 420 kg mol^{-1} is close to:

- (a) 1.5 (b) 3 (c) 4.5 (d) 0.5

104. Thermal decomposition of acetaldehyde follows a chain reaction mechanism in which methane gas is produced in the chain propagation step. The rate of methane formation is proportional to:

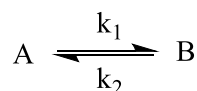
- (a) $[\text{CH}_3\text{CHO}]^{3/2}$ (b) $[\text{CH}_3\text{CHO}]^{1/2}$ (c) $[\text{CH}_3\text{CHO}]^{5/2}$ (d) $[\text{CH}_3\text{CHO}]^2$



105. The depression in the freezing point of four solutions containing one g/L of the solutes P, Q, R, S are 2, 4, 3 and 1 °C respectively. The solute with the largest molecular weight is
 (a) P (b) Q (c) R (d) S
106. The molecule that is better described by single determinantal MO theory rather than the elementary single resonance structure VB theory is
 (a) LiH (b) F₂ (c) H₂ (d) O₂
107. An electron in a hydrogen atom is exposed to a perturbation $V = V_0 \cos \varphi$. The first order correction to the ground-state energy of the electron is
 (a) $-V_0/2$ (b) 0 (c) $V_0/2$ (d) V_0
108. Entropy associated with a die with all its six faces having equal probability of being on top is _____ (k_B : Boltzmann constant)
 (a) $\exp(-k_B/6)$ (b) $\exp(-6k_B)$ (c) $6 \ln k_B$ (d) $k_B \ln 6$
109. The characters of a reducible representation Γ_R under the C_{3h} point group are presented at the end of the character table below. The correct coefficients of the irreducible representations A' and A'' in the Γ_R are
- | C_{3h} | E | $2C_3$ | σ_h | $2S_3$ |
|------------|----|--------|------------|--------|
| A' | 1 | 1 | 1 | 1 |
| E' | 2 | -1 | 2 | -1 |
| A'' | 1 | 1 | -1 | -1 |
| E'' | 2 | -1 | -2 | 1 |
| Γ_R | 21 | 0 | 7 | -2 |
- (a) 3, 3 (b) 4, 3 (c) 3, 4 (d) 4, 4
110. The first two lines in the R-branch of the vibrational spectrum of HCl appear at 2906 and 2926 cm^{-1} respectively. The first line in the R-branch of DCl appears 2102 cm^{-1} . The second line (in cm^{-1}) is expected to appear close to _____
 (a) 2112 (b) 2122 (c) 2152 (d) 2192
111. The equivalent symmetry operations for S_6^4 and S_3^3 are, respectively,
 (a) C_3^2 and C_3 (b) C_6^4 and i (c) C_3^2 and σ_h (d) C_6^4 and E
112. The data obtained from an enzyme catalyzed reaction are plotted as $1/\text{rate}$ against $1/[S]_0$, where $[S]_0$ is the initial substrate concentration. The slope and y-intercept



- obtained from this plot are **50** and **100**, respectively. If the enzyme concentration used in this reaction is **0.5 mM**, then the **turnover number** (in mM^{-1}) of the enzyme is:
- (a) 0.02 (b) 0.04 (c) 0.08 (d) 0.06
113. The system with the **largest internal pressure** is
- (a) a droplet of pure water with 0.1 mm radius
 (b) a droplet of 0.1 M aqueous soap solution with radius of 0.1 mm radius
 (c) a droplet of 0.1 M aqueous NaCl solution with a radius of 0.1 mm radius
 (d) a 0.1 M bulk aqueous sugar solution
114. The molecule that can absorb in the **infra-red** among the following is
- (a) $^{13}\text{N}_2$ (b) $^{13}\text{N}^{16}\text{O}$ (c) $^{16}\text{O}_2$ (d) $^{13}\text{N}^{14}\text{N}$
115. $(\partial T/\partial P)_S =$
- (a) $(\partial S/\partial U)_S$ (b) $(\partial T/\partial P)_V$ (c) $(\partial V/\partial S)_P$ (d) $(\partial U/\partial P)_T$
116. Two angular momenta with quantum numbers $j_1 = 3/2$ and $j_2 = 5/2$ are added. The possible values of **J** for the resultant angular momentum states are
- (a) 4, 3, 2, 1 (b) 4, 1 (c) 4, 3, 2, 1, 0 (d) $\pm 4, \pm 1$
117. A compound consists of **atoms A and B**. **Atoms of B form cubic close packing lattice and atoms of A occupy half of octahedral voids and half of tetrahedral void.** What is the **molecular formula** of the compound?
- (a) AB (b) A_3B_2 (c) A_2B_3 (d) A_2B
118. Radiation from a helium ion He^+ is nearly equal in wavelength to the **H_α line (the first line of the Balmer series)**. The states (values of n) between which the transition in the helium ion occur are
- (a) 6, 2 (b) 3, 1 (c) 3, 2 (d) 6, 4
119. The **equilibrium constant** of a chemical reaction **decreases monotonically with increasing temperature**. From this we may conclude that
- (a) $\Delta H^\circ < 0$ (b) $\Delta G^\circ < 0$ (c) $\Delta S^\circ < 0$ (d) $\Delta U^\circ < 0$
120. Consider



The action, if a , x and x_e are the initial concentration of B at time t and equilibrium concentration of B, respectively for the above reaction, then the $\frac{dx}{dt}$ is:



(a) $\frac{k_1 a}{x_e} (x_e + x)$

(b) $k_1 (x_e - x)$

(c) $\frac{k_1 a}{x_e} (x_e - x)$

(d) $\frac{k_1 x_e}{a} (x_e - x)$

Answer Key**PART - B**

Q.No	Ans
21.	b
22.	c
23.	a
24.	d
25.	b
26.	a
27.	b
28.	b
29.	c
30.	b

Q.No	Ans
31.	a
32.	d
33.	b
34.	b
35.	b
36.	b
37.	c
38.	a
39.	d
40.	a

Q.No	Ans
41.	b
42.	a
43.	d
44.	c
45.	b
46.	b
47.	c
48.	d
49.	c
50.	b

Q.No	Ans
51.	b
52.	a
53.	d
54.	a
55.	c
56.	d
57.	c
58.	a
59.	b
60.	b

PART - C

Q.No	Ans
61.	d
62.	d
63.	c
64.	a
65.	b
66.	d
67.	b
68.	a
69.	d
70.	c

Q.No	Ans
76.	c
77.	b
78.	b
79.	a
80.	c
81.	d
82.	c
83.	d
84.	a
85.	d

Q.No	Ans
91.	b
92.	a
93.	d
94.	a
95.	a
96.	c
97.	c
98.	b
99.	d
100.	b

Q.No	Ans
106.	d
107.	b
108.	d
109.	b
110.	a
111.	c
112.	a
113.	c
114.	b
115.	c



71.	b
72.	a
73.	b
74.	b
75.	c

86.	d
87.	a
88.	a
89.	d
90.	a

101.	b
102.	c
103.	b
104.	a
105.	d

116.	a
117.	b
118.	d
119.	a
120.	c

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