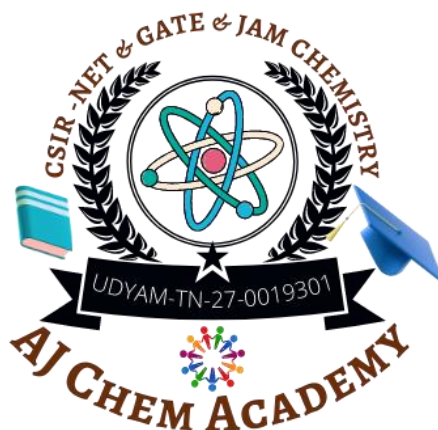


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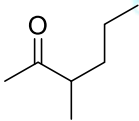
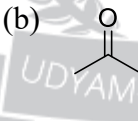
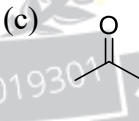
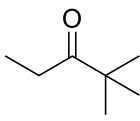
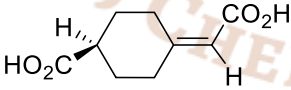
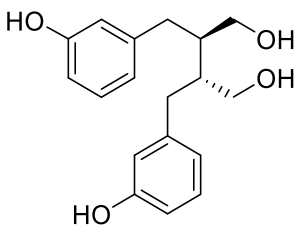


Q.21 – Q.60 MCQ, carry TWO marks each (for each wrong answer: -0.5).

You are required to Answer Maximum 35 Questions.

21. Among the following nuclear reactions of thermal neutrons, the cross section is highest for
- (a) ${}_{92}\text{U}^{235} + {}_0\text{n}^1 \rightarrow {}_{92}\text{U}^{235} + {}_0\text{n}^1$ (b) ${}_{92}\text{U}^{235} + {}_0\text{n}^1 \rightarrow {}_{92}\text{U}^{236}$
 (c) ${}_{92}\text{U}^{235} + {}_0\text{n}^1 \rightarrow {}_{90}\text{Th}^{232} + {}_2\text{He}^4$ (d) ${}_{92}\text{U}^{235} + {}_0\text{n}^1 \rightarrow {}_{36}\text{Kr}^{94} + {}_{56}\text{Ba}^{140} + 2 {}_0\text{n}^1$
22. Spectrophotometric monitoring is not suitable to determine the end point of titration of
- (a) oxalic acid vs potassium permanganate (b) iron(II) vs 1,10-phenanthroline
 (c) cobalt(II) vs eriochrome black T (d) nickel(II) vs dimethylglyoxime
23. The first ionization energy is the lowest for
- (a) Br (b) Se (c) P (d) As
24. Among ClO_3^- , XeO_3 and SO_3 , species with pyramidal shape is/are?
- (a) ClO_3^- and XeO_3 (b) XeO_3 and SO_3 (c) ClO_3^- and SO_3 (d) SO_3
25. The role of BF_3 as an industrial polymerization catalyst is to generate
- (a) carbanion (b) carbocation (c) organic radical (d) cation radical
26. For the following complexes, the increasing order of magnetic moment (spin only value) is
- | | | | |
|--|--|--|--|
| P | Q | R | S |
| $\frac{[\text{TiF}_6]^{3-}}{\text{AJ CHEM ACADEMY}}$ | $\frac{[\text{CrF}_6]^{3-}}{\text{UDYAM-TN-27-0019301}}$ | $\frac{[\text{MnF}_6]^{3-}}{\text{AJ CHEM ACADEMY}}$ | $\frac{[\text{CoF}_6]^{3-}}{\text{AJ CHEM ACADEMY}}$ |
- (a) $\text{S} < \text{P} < \text{Q} < \text{R}$ (b) $\text{R} < \text{P} < \text{S} < \text{Q}$
 (c) $\text{Q} \approx \text{P} < \text{S} < \text{R}$ (d) $\text{P} < \text{Q} < \text{R} \approx \text{S}$
27. The correct statement for cytochrome c is
- (a) It is a non-heme protein
 (b) The coordination number of iron in cytochrome c is five
 (c) It is a redox protein and an electron carrier
 (d) It can store or carry dioxygen
28. Geometries of SNF_3 and XeF_2O_2 , respectively, are
- (a) square planar and square planar (b) tetrahedral and tetrahedral
 (c) square planar and trigonal bipyramidal (d) tetrahedral and trigonal bipyramidal
29. The IR spectrum of $\text{Co}(\text{CO})_4\text{H}$ shows bands at 2121, 2062, 2043 and 1934 cm^{-1} . The $\nu_{\text{Co-D}}$ (in cm^{-1}) expected in the spectrum of $\text{Co}(\text{CO})_4\text{D}$ is

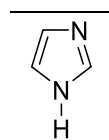
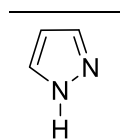
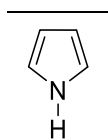


- (a) 2111 (b) 1396 (c) 2053 (d) 1910
30. In trigonal prismatic ligand field, the most stabilized d orbital is
 (a) d_z^2 (b) d_{xy} (c) d_{xz} (d) d_{yz}
31. The most unstable complex on the basis of electro-neutrality principle among the following is
 (a) $[\text{Al}(\text{OH}_2)_6]^{3+}$ (b) $[\text{Al}(\text{NH}_3)_6]^{3+}$ (c) $[\text{AlF}_6]^{3-}$ (d) $[\text{Al}(\text{NCCH}_3)_6]^{3+}$
32. The band in the electronic spectrum of I_2 appearing at 520 nm will undergo maximum blue shift in
 (a) water (b) hexane (c) benzene (d) methanol
33. Mismatch among the following is
 (a) Sharp transition and fluorescence in lanthanides
 (b) Broad bands and d-d transitions
 (c) Very high spin-orbit coupling and transition elements
 (d) Charge transfer and molar absorptivity of the order of $10^4 \text{ L mol}^{-1} \text{ cm}^{-1}$
34. Among the following, the compound that gives base peak at $m/z = 72$ in the EI mass spectrum is
 (a)  (b)  (c)  (d) 
35. The following molecule has
 (a) plane of symmetry
 (b) R configuration
 (c) S configuration
 (d) centre of symmetry
36. The following natural product Enterodiol is a
 (a) terpene
 (b) steroid
 (c) lignan
 (d) alkaloid
37. The correct order of basicity for the following heterocycles is

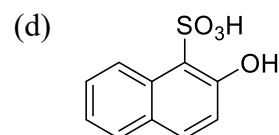
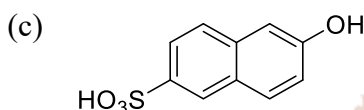
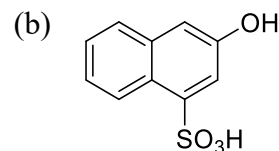
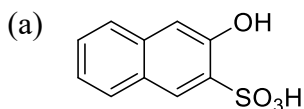
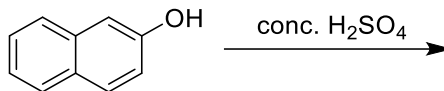
P	Q	R	
_____	_____	_____	

 (a) $P > R > Q$
 (b) $R > P > Q$
 (c) $R > Q > P$

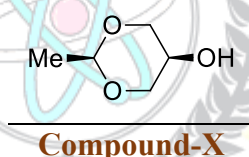


(d) $Q > P > R$

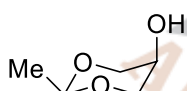
38. The kinetic product formed in the following reaction is



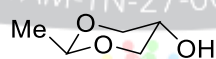
39. Among the structures given below, the one that corresponds to the most stable conformation of compound-X is



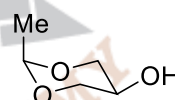
(a)



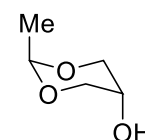
(b)



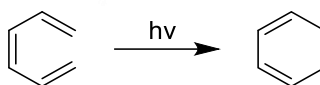
(c)



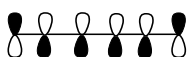
(d)



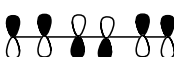
40. According to Frontier Molecular Orbital (FMO) Theory, the Highest Occupied Molecular Orbital (HOMO) of hexatriene in the following reaction is



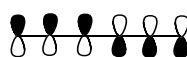
(a)



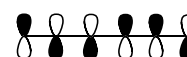
(b)



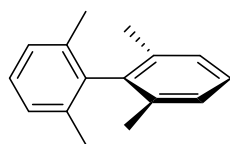
(c)



(d)



41. The number of signals observed in the proton decoupled $^{13}\text{C-NMR}$ spectrum of the following compound is



(a) five

(b) six

(c) ten

(d) thirteen

42. The correct order of stability of the following carbocations is

P

Q

R

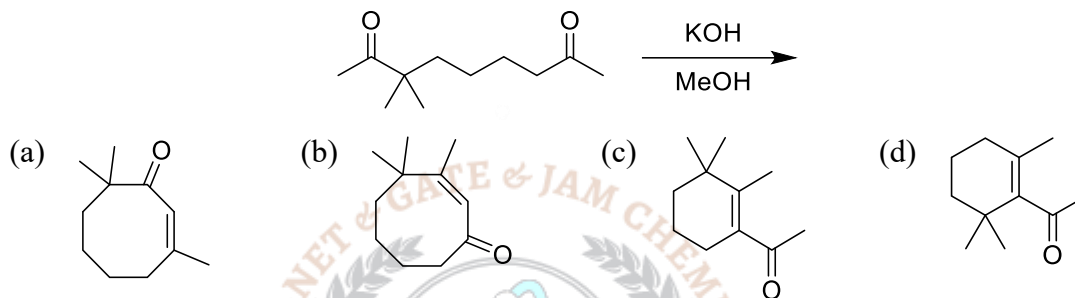
(a) $P > R > Q$



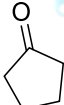
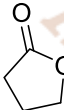
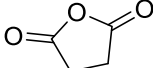
43. An optically pure organic compound has specific rotation of $+40^\circ$. The optical purity of the sample that exhibits specific rotation of $+32^\circ$ is

(a) 8% (b) 12% (c) 20% (d) 80%

44. The major product formed in the following reaction is

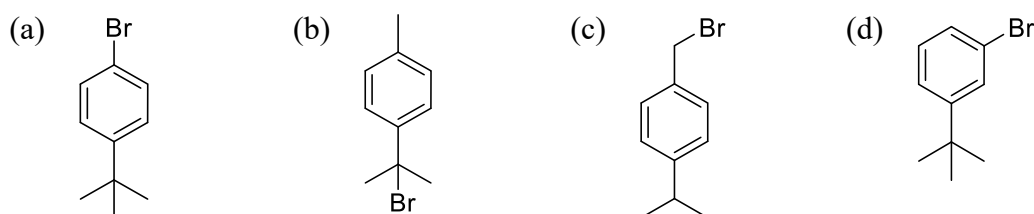


45. Correct match of the compounds in Column-I with the IR stretching frequencies (cm^{-1}) in Column-II is

	Column-I	Column-II (cm^{-1})	P	Q	R
P.	 i.	1865	(a) ii ; iii ; i		
Q.	 ii.	1770	(b) iii ; i ; ii		
R.	 iii.	1745	(c) iii ; ii ; i		
			(d) i ; iii ; ii		

46. The organic compound that displays following data is

$^1\text{H-NMR}$: δ 7.38(d), 7.25(d), 1.29(s) ppm



47. The molecule with a C_2 axis of symmetry among the following is

(a) BH_2Cl (b) CH_3Cl (c) NH_2Cl (d) HOCl

48. The molecule that will show Raman spectrum, but not IR spectrum, among the following is

- (a) H_2 (b) HCl (c) $BrCl$ (d) CS_2
49. Boron in BCl_3 has
 (a) sp hybridization (b) sp^2 hybridization (c) sp^3 hybridization (d) no hybridization
50. The number of degenerate spatial orbitals of a hydrogen-like atom with principal quantum number $n = 6$ is
 (a) 12 (b) 6 (c) 72 (d) 36
51. If $[\hat{A}, \hat{B}] = 0$ and $[\hat{A}, \hat{C}] = 0$, then which of the following necessarily holds:
 $[\hat{A}, \hat{B}$ and $\hat{C}$, are operators]
 (a) $[\hat{B}, \hat{C}] = 0$ (b) $[\hat{A}, \hat{BC}] = 0$ (c) $[\hat{B}, \hat{AC}] = 0$ (d) $[\hat{C}, \hat{AB}] = 0$
52. The correct statement among the following is ($\hat{A}$ is a Hermitian operator)
 (a) The eigenvalues of $\hat{A}^2$ can be negative
 (b) The eigenvalues of $\hat{A}^2$ are always positive
 (c) No eigenfunction of $\hat{A}$ is an eigenfunction of $\hat{A}^2$
 (d) The eigenvalues of $\hat{A}^2$ can be complex
53. If the atoms/ions in the crystal are taken to be hard spheres touching each other in the unit cell, then the fraction of volume occupied in the body centered cubic structure is
 (a) $\sqrt{3}\pi$ (b) $\frac{\sqrt{2}\pi}{6}$ (c) $\frac{\pi}{6}$ (d) $\frac{\sqrt{3}\pi}{8}$
54. Repeated measurements of Pb in a lake water sample gave 3.2, 5.2 and 7.2 ppb of Pb. Standard deviation in the measurement of Pb is
 (a) 2 ppb (b) 4 ppb (c) 0 ppb (d) $2\sqrt{2}$ ppb
55. The stability of lyophobic colloids is a consequence of the
 (a) electrical double layer at the surface of the particles
 (b) vander Waals force between the particles
 (c) small particle size
 (d) shape of the particles
56. The equivalent conductance at infinite dilution of a strong electrolyte (Λ_0) can be obtained from the plot of
 (a) Λ vs. C (b) Λ vs. $\sqrt{C}$ (c) Λ vs. C^2 (d) Λ vs. $1/C$
57. The number-average molar mass ($\bar{M}_n$) for a monodisperse polymer is related to the weight-average molar mass ($\bar{M}_w$) by the relation



(a) $\bar{M}_n = \frac{\bar{M}_w}{3}$

(b) $\bar{M}_n = \frac{\bar{M}_w}{4}$

(c) $\bar{M}_n = 2\bar{M}_w$

(d) $\bar{M}_n = \bar{M}_w$

58. For a sequence of **consecutive reactions**,



the concentration of **I** would be, by **steady state approximation**

(a) $k_1[A]$

(b) $(k_1 + k_2)[A]$

(c) $k_1k_2[A]$

(d) $\frac{k_1}{k_2}[A]$

59. **Enthalpy is equal to**

(a) $TS + PV + \sum \mu_i n_i$

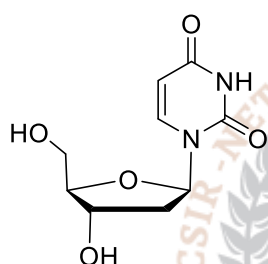
(b) $TS + \sum \mu_i n_i$

(c) $\sum \mu_i n_i$

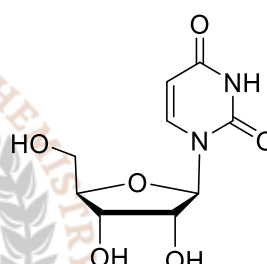
(d) $PV + \sum \mu_i n_i$

60. The structure of **ribonucleoside uridine** is

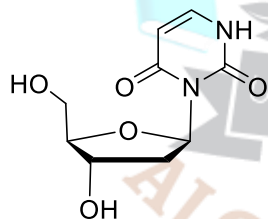
(a)



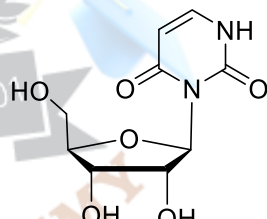
(b)



(c)



(d)



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

You are required to Answer Maximum 25 Questions.

61. The peak area of **differential thermal analysis** curve is proportional to one or more of the following:

P

mass loss

Q

mass of the sample

R

heat of decomposition/phase change

The correct answer is

(a) P only

(b) Q only

(c) P and R

(d) Q and R

62. To determine the bond parameters at **25 °C**, **electron diffraction** is generally unsuitable for both

(a) O_3 and NO_2

(b) Sulfur and dry ice

(c) NO_2 and sulphur(d) O_3 and dry ice

63. Match lanthanides in **Column-I** with their properties in **Column-II**

(P)	Lu	(i)	Reagent in oxidation state IV		P	Q	R	S			
(Q)	Eu	(ii)	MI ₂ of metallic lustre	(a)	iii	;	ii	;	i	;	iv
(R)	Ce	(iii)	Diamagnetic M(III)	(b)	ii	;	iii	;	iv	;	i
				(c)	iv	;	ii	;	i	;	iii
(S)	Tb	(iv)	Pink in oxidation state III	(d)	iii	;	ii	;	iv	;	i

64. Among the following, species **isolobal to CH_2** are

P	Q	R	S	T
CpCr(CO)_2	CpCu	Ni(CO)_2	Cr(CO)_4	Fe(CO)_4
(a) P, R and T	(b) Q, R and S	(c) Q, R and T	(d) P, Q and S	

65. Choose the **incorrect statement** for the **phosphomolybdate anion**, $[\text{PMo}_{12}\text{O}_{40}]^{3-}$

- (a) It has a Keggin structure
- (b) Phosphorus is in +5 oxidation state
- (c) It is extremely basic
- (d) It forms crystalline precipitates with $[\text{R}_4\text{N}]^+$ (R = bulky alkyl or aryl group)

66. Consider the following statement(s) for actinides (An):

- [P] Oxidation states greater than +3 are more frequent in An compared to lanthanides (Ln)
- [Q] Some An(III) ions show d-d transitions
- [R] UO_2^{2+} and PuO_2^{2+} are stable
- [S] Some of actinides do not have radioactive isotopes

The correct answer is

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

67. According to **Bent's rule**, for p-block elements, the correct combination of geometry around the central atom and position of more electronegative substituent is

- (a) Trigonal bipyramidal and axial
- (b) Trigonal bipyramidal and equatorial
- (c) Square pyramidal and axial
- (d) Square pyramidal and basal

68. **Allred-Rochow electronegativity** of an element is

- [P] directly proportional to the effective nuclear charge
- [Q] directly proportional to the covalent radius
- [R] inversely proportional to the square of the covalent radius
- [S] directly proportional to the square of the effective nuclear charge

The correct answer is

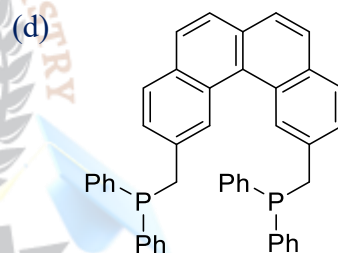
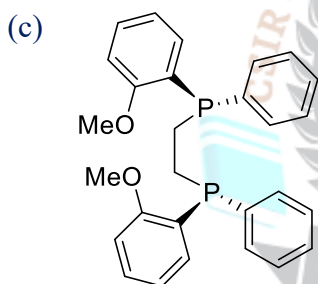
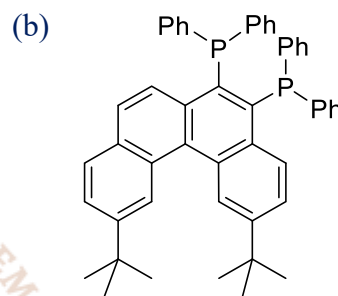
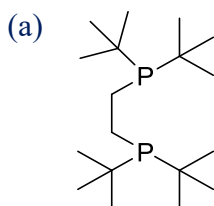


- (a) P and Q (b) P and R (c) Q and R (d) P and S

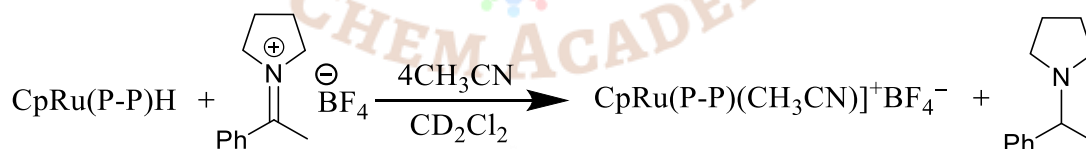
69. Br_2 with propanone forms a charge transfer complex and I_2 forms triiodide anion with I^- . This implies that

- (a) both Br_2 and I_2 act as bases (b) both Br_2 and I_2 act as acids
(c) Br_2 acts as an acid and I_2 acts as a base (d) Br_2 acts as a base and I_2 acts as an acid

70. In the complex $[\text{Pd}(\text{L-L})(\text{Me})(\text{Ph})]$, the bisphosphine (L-L) that does not allow reductive elimination of PhMe , is



71. In the reaction given below, the bisphosphine (P-P) that is ineffective for transfer-hydrogenation reaction is



- (a) Diphenylphosphinomethane (b) 1,2-Diphenylphosphinoethane
(c) 1,3-Diphenylphosphinopropane (d) 1,4-Diphenylphosphinobutane

72. For high spin and low spin d^6 octahedral complexes (ML_6), the generally observed spin allowed transitions, respectively, are

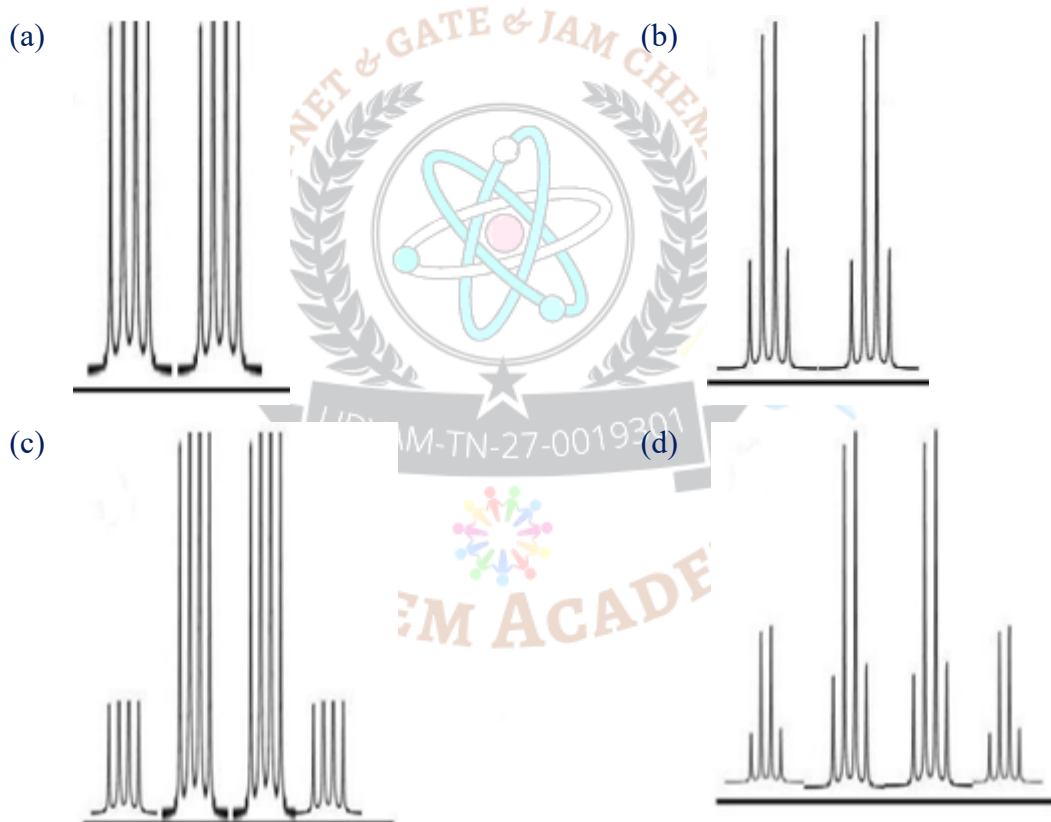
- (a) two and one (b) one and two (c) zero and one (d) two and two

73. The reactions given below, are examples of



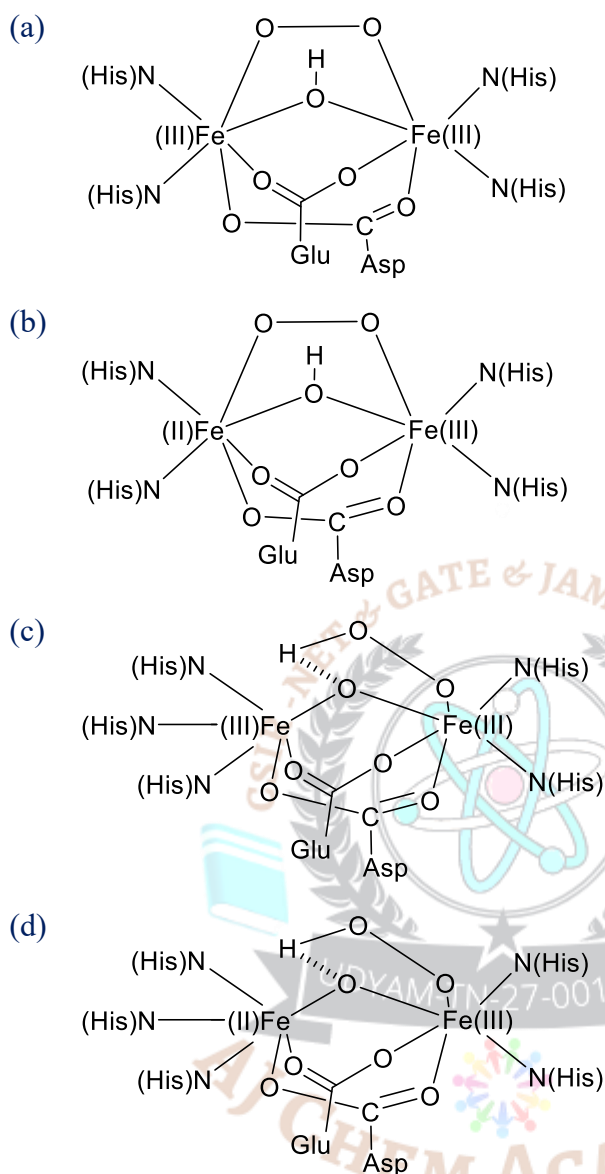
- (a) disproportionation only
(b) disproportionation (I) and solvation (II)

- (c) solvation (I) and disproportionation (II)
 (d) solvolysis as well as disproportionation
74. According to **Wade's rules**, the **cluster type** and **geometry** of $[\text{Sn}_9]^{4-}$ respectively, are
- (a) closo and tricapped trigonal prismatic
 (b) nido and monocapped square-antiprismatic
 (c) arachno and heptagonal bipyramidal
 (d) closo and monocapped square antiprismatic
75. Assuming $^1J_{\text{PH}} > ^1J_{\text{PB}}$ the expected ^{31}P -NMR spectrum of $\text{H}_3\text{P} \cdot ^{11}\text{BCl}_3$ is
 [for ^{11}B , $I = 3/2$]



76. The **geometry** around **Cu** and its **spin state** for K_3CuF_6 and KCuL_2 , respectively are:
 [$\text{H}_2\text{L} = \text{H}_2\text{NCONHCONH}_2$]
- (a) (Octahedral, high-spin) and (square planar, low-spin)
 (b) (octahedral, low-spin) and (square planar, low-spin)
 (c) (trigonal prismatic, high-spin) and (tetrahedral, high-spin)
 (d) (trigonal prismatic, low-spin) and (tetrahedral, high-spin)
77. The **active site structure** for **oxy-hemerythrin** is:





78. Consider the following statements with respect to the base hydrolysis of $[\text{CoCl}(\text{NH}_3)_5]^{2+}$ to $[\text{Co}(\text{NH}_3)_5(\text{OH})]^{2+}$.

[P] One of the ammonia ligands acts as a Bronsted acid

[Q] The entering group is water

[R] A heptacoordinated Co^{3+} species is an intermediate

The correct statement(s) is/are

(a) P and Q

(b) P and R

(c) Q and R

(d) R only

79. The number of inorganic sulfides in cubane like ferredoxin and their removal method, respectively, are

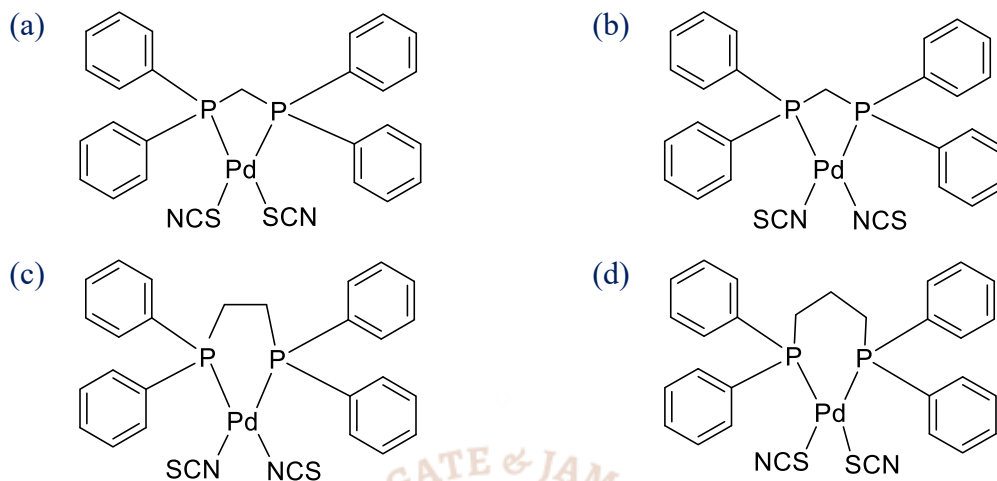
(a) eight and washing with an acid

(b) four and washing with a base

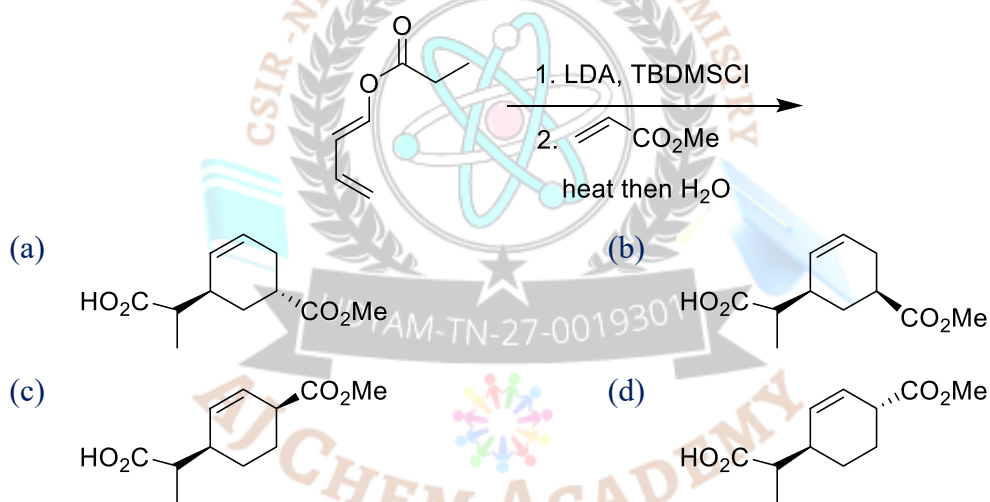
(c) eight and washing with a base

(d) four and washing with an acid

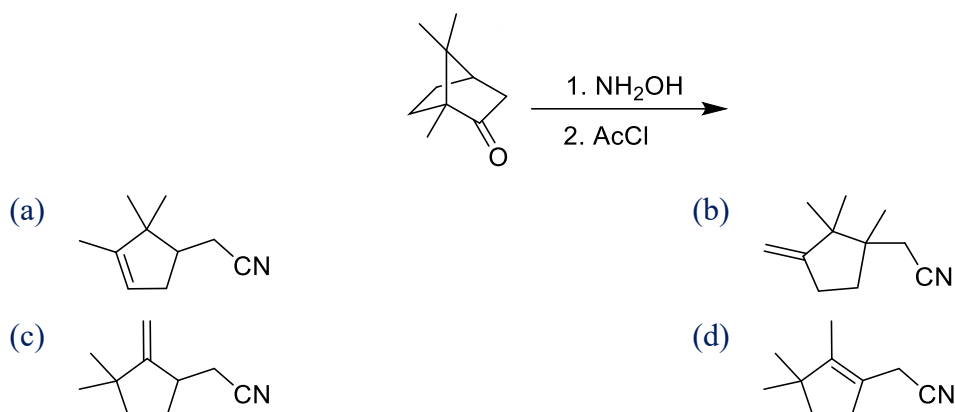
80. Considering the ambidentate behaviour of thiocyanate ion, the most stable structure among the following is



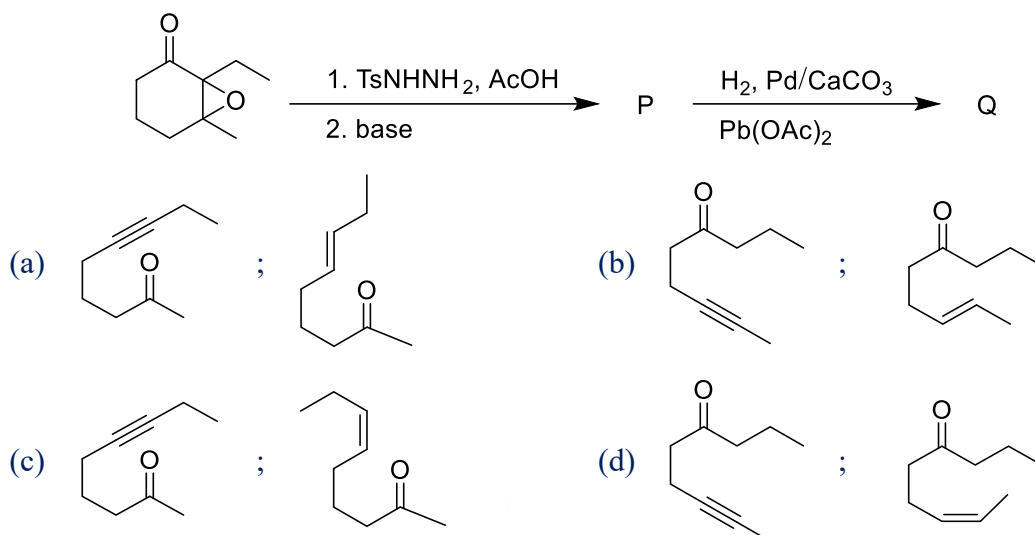
81. Major product of the following reaction is



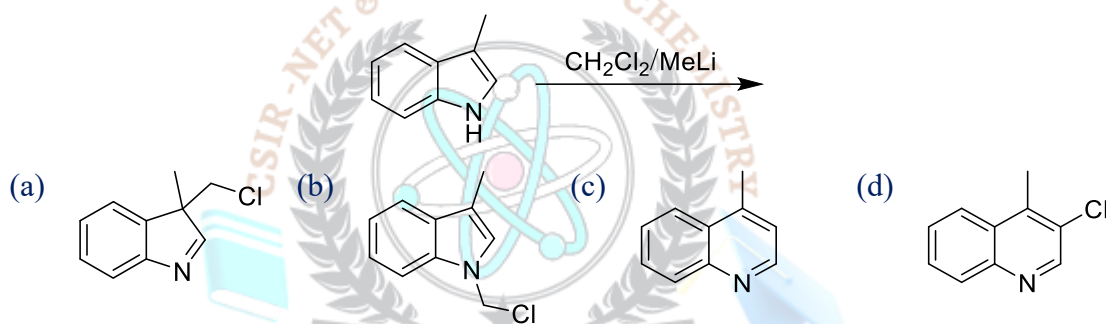
82. Major product in the following reaction is



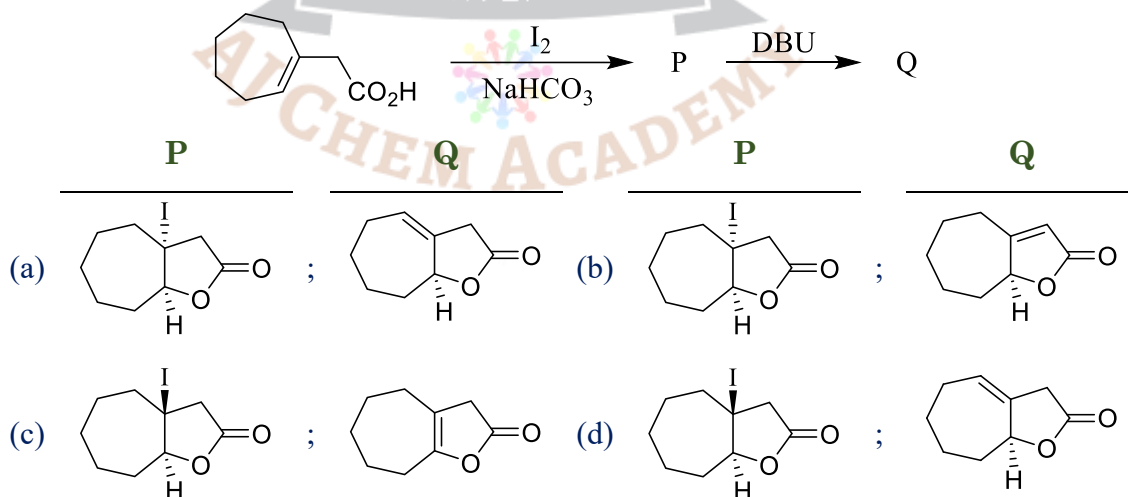
83. Major products P and Q of the following reaction sequence are



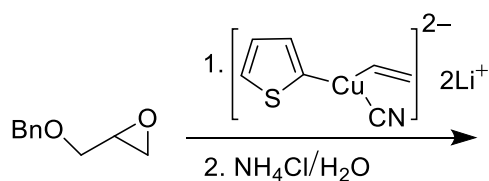
84. The major product formed in the following reaction is

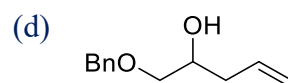
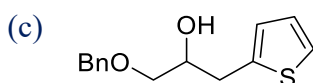
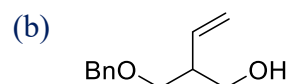
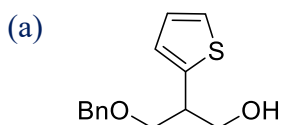


85. Major products P and Q of the following reaction sequence are

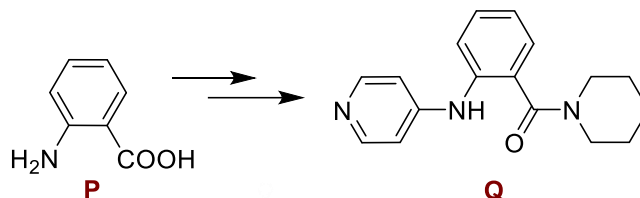


86. The major product formed in the following reaction is





87. Correct sequence of reagents (i)-(iii) required for the conversion of **P** to **Q** is



(i)

Thionyl chloride

(ii)

4-Chloropyridine

(iii)

Piperidine

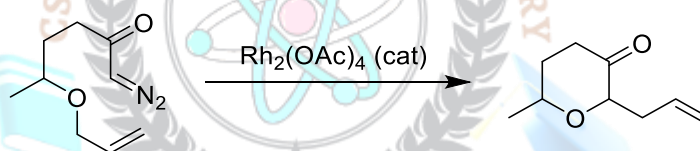
(a) (i), (ii) and (iii)

(b) (i), (iii) and (ii)

(c) (ii), (i) and (iii)

(d) (iii), (i) and (ii)

88. The following reaction involves



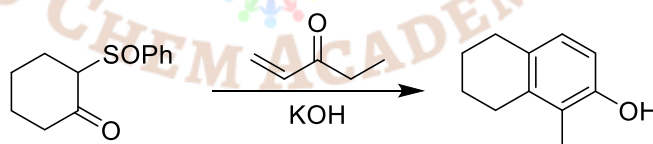
(a) [1,2]sigmatropic rearrangement

(b) [2,3] sigmatropic rearrangement

(c) [3,3] sigmatropic rearrangement

(d) C-H insertion reaction

89. Correct sequence of steps involved in the following transformation is



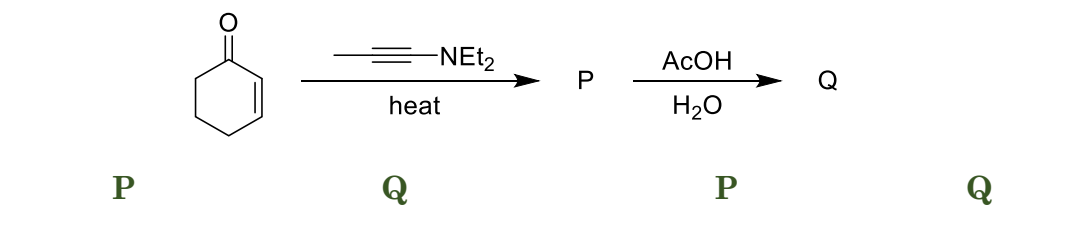
(a) Michael addition, aldol condensation, syn-elimination, keto-enol tautomerism

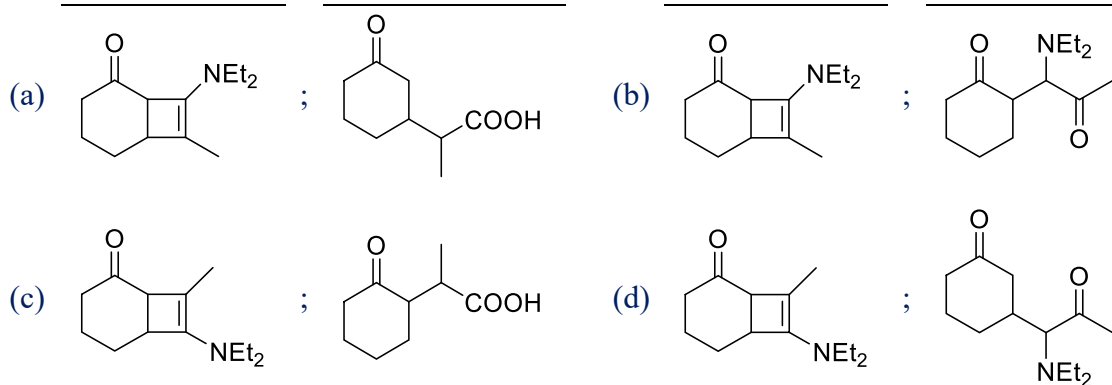
(b) Aldol condensation, electrocyclic ring closing, syn-elimination, dehydrogenation

(c) Michael addition, Claisen condensation, anti-elimination, keto-enol tautomerism

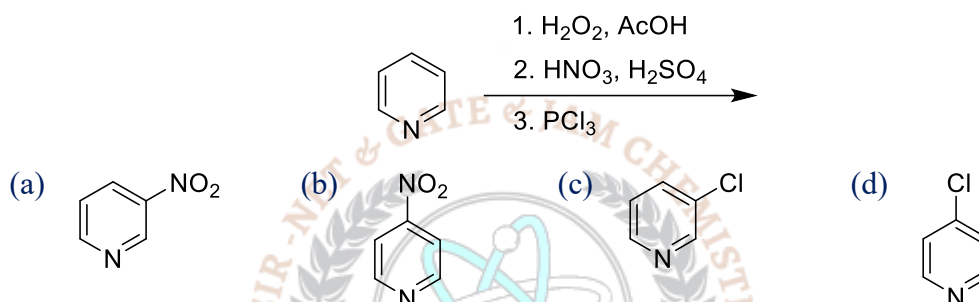
(d) Robinson annulation, dehydrogenation, anti-elimination

90. The major products **P** and **Q** in the following reaction sequence are





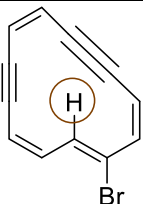
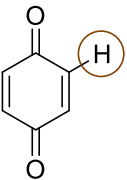
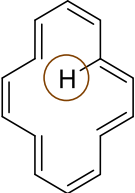
91. The major product formed in the following reaction sequence is



92. The number of optically active stereoisomers possible for $\text{CH}_3\text{-CH(OH)-CH(OH)-CH(OH)-CH}_3$ is

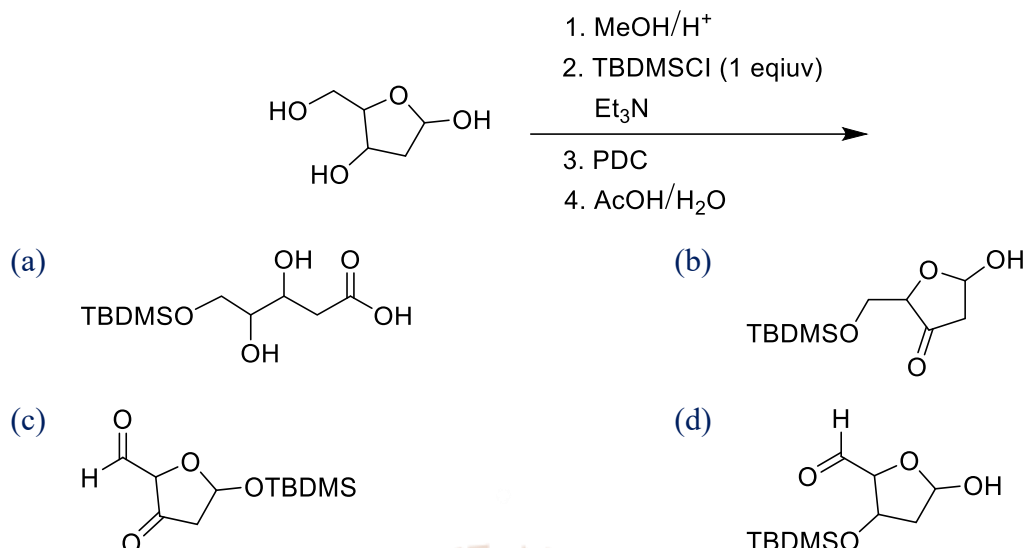
- (a) two (b) four (c) six (d) eight

93. The correct match of the circled protons in Column-P with the $^1\text{H-NMR}$ chemical shift (δ ppm) in Column Q is

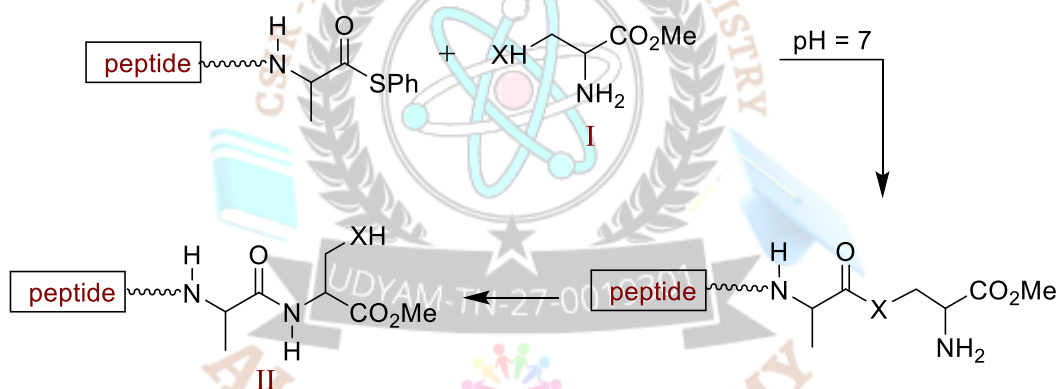
	Column-P		Column-Q
I		P	6.72
II		Q	16.4
III		R	-0.61

	I	II	III
(a)	P ; Q ; R		
(b)	Q ; P ; R		
(c)	Q ; R ; P		
(d)	R ; Q ; P		

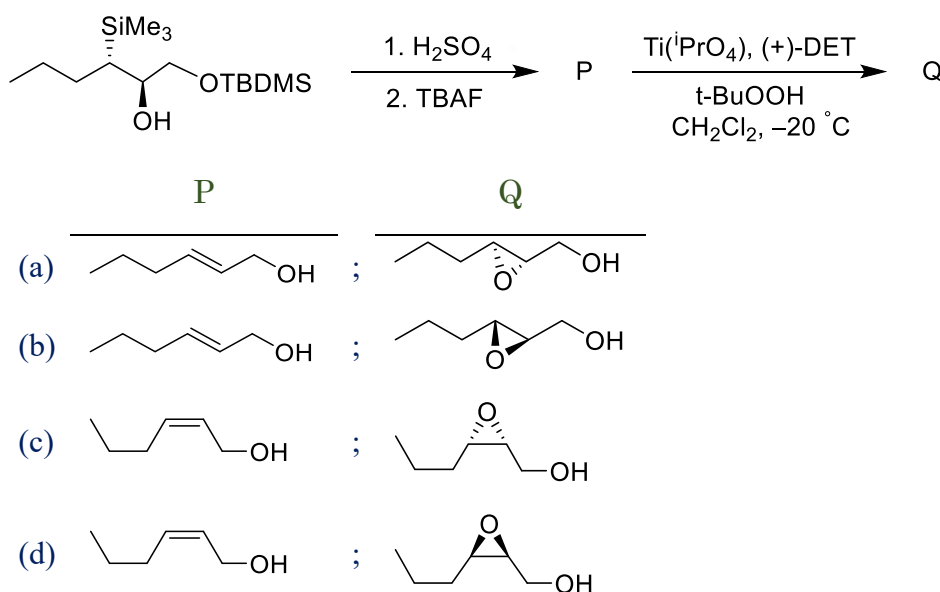
94. The major product formed in the following reaction sequence is



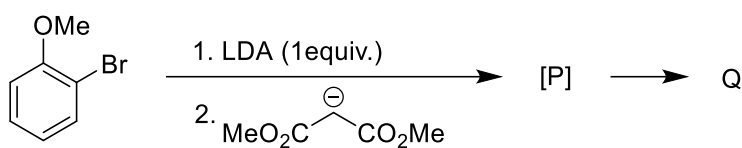
95. For the successful synthesis of peptide linkage leading to the product-I, the side chain of the amino acid-II should have



- (a) XH = -OH (b) XH = -(CH₂)₄NH (c) XH = -p-(C₆H₄)OH (d) XH = -SH
96. The major products P and Q in the following reaction sequence are

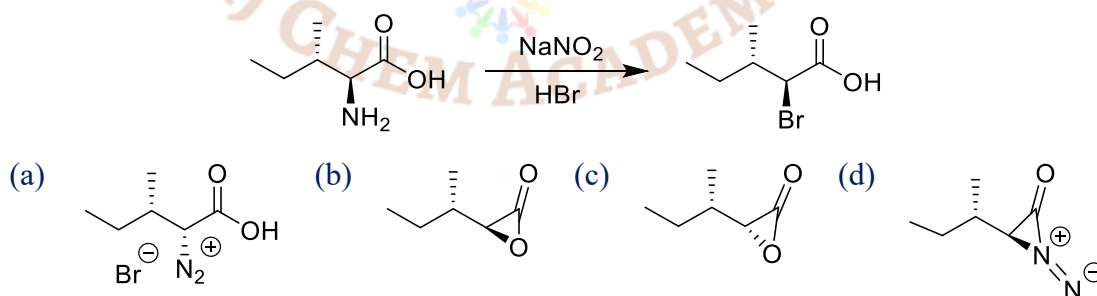


97. The **intermediate-P** and the **major product-Q** in the following reaction are

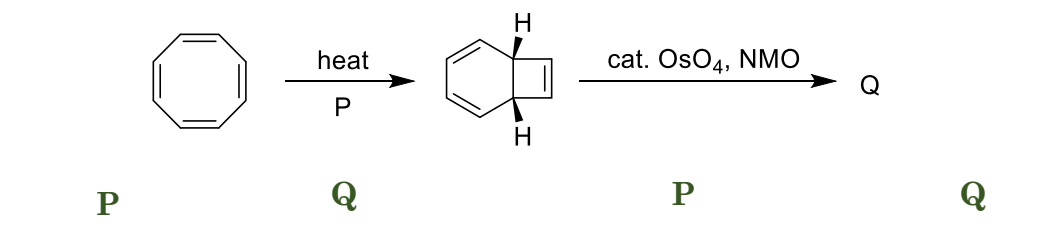


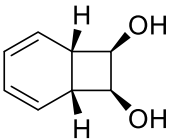
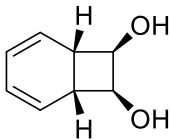
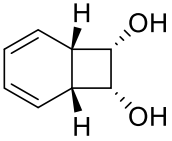
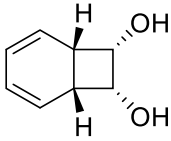
- (a) ;
- (b) ;
- (c) ;
- (d) ;

98. The **correct intermediate** which leads to the product in the following reaction is

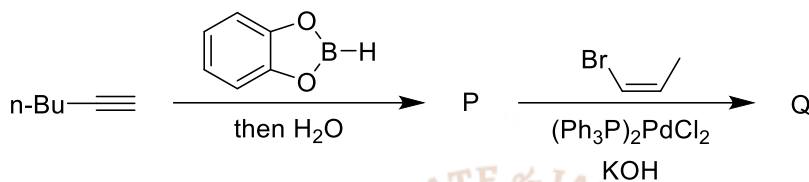


99. In the following transformation, the mode of **electrocyclization P** and the **major product Q** are



- (a) $(4n) e^-$, dis ; 
- (b) $(4n + 2) e^-$, dis ; 
- (c) $(4n) e^-$, con ; 
- (d) $(4n + 2) e^-$, con ; 

100. The major products **P** and **Q** in the following reaction sequence are



- (a) **P**: $n\text{-Bu-CH=CH-B(OH)}_2$; **Q**: $n\text{-Bu-CH=CH-CH=CH-CH=CH-CH=CH}_2$
- (b) **P**: $n\text{-Bu-CH=CH-B(OH)}_2$; **Q**: $n\text{-Bu-CH=CH-CH=CH-CH=CH-CH=CH}_2$
- (c) **P**: $n\text{-Bu-CH=CH-B(OH)}_2$; **Q**: $n\text{-Bu-CH=CH-CH=CH-CH=CH-CH=CH}_2$
- (d) **P**: $n\text{-Bu-CH=CH-B(OH)}_2$; **Q**: $n\text{-Bu-CH=CH-CH=CH-CH=CH-CH=CH}_2$

101. The correct statement about the symmetry of the eigenfunctions of a quantum of 1-D harmonic oscillator is

- (a) All the eigenfunctions are only even functions, because the potential is an even function
- (b) All the eigenfunctions are only odd functions, although the potential is an even function
- (c) The eigenfunctions have no odd-even symmetry
- (d) All the eigenfunctions are either odd or even functions, because the potential is an even function

102. The correct statement about the difference of second and first excited state energies (ΔE) of a particle in 1-D, 2-D square and 3-D cubic boxes with same length for each, is

- (a) ΔE (1-D box) = ΔE (2-D box) = ΔE (3-D box)
- (b) ΔE (1-D box) > ΔE (2-D box) > ΔE (3-D box)
- (c) ΔE (1-D box) > ΔE (2-D box) = ΔE (3-D box)



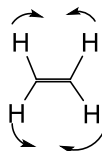
(d) ΔE (1-D box) $<$ ΔE (2-D box) $<$ ΔE (3-D box)

103. A one-dimensional quantum harmonic oscillator is perturbed by a potential λx^3 .

The first order correction to the energy for the ground state ($\Delta E^{(1)}$) is

- (a) $\Delta E^{(1)} > 0$ but < 1 (b) $\Delta E^{(1)} < 0$ (c) $\Delta E^{(1)} = 0$ (d) $\Delta E^{(1)} > 2$

104. The normal mode of ethylene represented, by the figure below, is



- (a) only IR active (b) only Raman active
(c) both IR and Raman active (d) neither IR nor Raman active

105. The pair that contains a spherical top and a symmetric top, among the following, is

- (a) CH_4 , CH_2Cl_2 (b) CH_2Cl_2 , CH_3Cl (c) CH_3Cl , CH_4 (d) CH_4 , $\text{C}(\text{CH}_3)_4$

106. A part of the character table of a point group (of order 4) is given below

	E	X_1	X_2	X_3
Γ_1	1	1	1	1
Γ_2	1	-1	1	-1
Γ_3	1	-1	-1	1
Γ_4	?	?	?	?

The four characters of Γ_4 are, respectively

- (a) 1, 1, -1, -1 (b) 2, 0, 0, 1 (c) 1, i, i, 1 (d) 1, -i, i, -1

107. The electronic transition energy from $\pi_1 \rightarrow \pi_2$ in propenyl radical is 4.8 eV. Within the frame work of Hückel theory, the transitions energy from $\pi_1 \rightarrow \pi_3$ would be

- (a) 2.4 eV (b) 4.8 eV (c) 9.6 eV (d) 14.4 eV

108. The g-factors of ^1H and ^{13}C are 5.6 and 1.4 respectively. For the same value of the magnetic field strength, if the ^1H resonates at 600 MHz, the ^{13}C would resonate at

- (a) 2400 MHz (b) 600 MHz (c) 150 MHz (d) 38 MHz

109. The term symbol for the ground state of a metal ion is $^3\text{P}_2$. The residual entropy of a crystal of a salt of this metal ion at 0 K is

- (a) $k_B \ln 1$ (b) $k_B \ln 3$ (c) $k_B \ln 5$ (d) $k_B \ln 7$

110. In stretching of a rubber band, $dG = Vdp - SdT + fdL$

Which of the following relations is true?

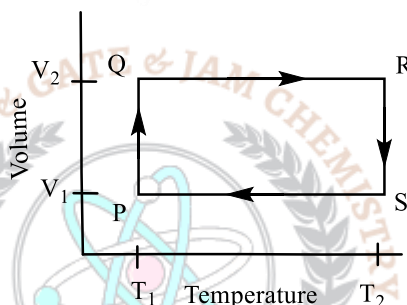


- (a) $\left(\frac{\partial S}{\partial L}\right)_{p,T} = -\left(\frac{\partial f}{\partial T}\right)_{p,L}$ (b) $\left(\frac{\partial S}{\partial L}\right)_{p,T} = -\left(\frac{\partial f}{\partial V}\right)_{p,L}$
 (c) $\left(\frac{\partial S}{\partial L}\right)_{p,T} = -\left(\frac{\partial V}{\partial T}\right)_{p,L}$ (d) $\left(\frac{\partial S}{\partial L}\right)_{p,T} = -\left(\frac{\partial f}{\partial p}\right)_{T,L}$

111. Four distinguishable molecules are distributed in energy levels E_1 and E_2 with degeneracy of 2 and 3, respectively. Number of microstates, with 3 molecules in energy level E_1 and one in energy level E_2 , is

- (a) 4 (b) 12 (c) 96 (d) 192

112. One mole of an ideal gas undergoes a cyclic process (PQRS) starting from point P through 4 reversible steps as shown in the figure. Total work done in the process is



- (a) $RT(T_1 - T_2) \frac{V_2}{V_1}$ (b) $R(T_1 + T_2) \frac{V_2}{V_1}$ (c) $R(T_1 + T_2) \ln \frac{V_2}{V_1}$ (d) $R(T_2 - T_1) \ln \frac{V_2}{V_1}$

113. If the specific conductance of an electrolyte solution is $0.2 \Omega^{-1} \text{cm}^{-1}$ and cell constant is 0.25cm^{-1} , the conductance of the solution is

- (a) $1.25 \Omega^{-1}$ (b) $1.0 \Omega^{-1}$ (c) $0.8 \Omega^{-1}$ (d) $2.0 \Omega^{-1}$

114. The predicted electromotive force (emf) of the given electrochemical cell is



$$(E^0_{\text{Fe}^{2+}/\text{Fe}} = -0.447 \text{ V and } E^0_{\text{Cd}^{2+}/\text{Cd}} = -0.403 \text{ V})$$

- (a) -0.850 V (b) $+0.044 \text{ V}$ (c) $+0.0850 \text{ V}$ (d) -0.044 V

115. A polymer has the following molar mass distribution

Number of molecules	Molar mass (g. mol^{-1})
50	5000
75	6000

The calculated number average molar mass ($\bar{M}_n$) of the polymer is

- (a) 5200 (b) 5600 (c) 5800 (d) 6000

116. The separation of the (123) planes of an orthorhombic unit cell is 3.12 nm. The separation of (246) and (369) planes are, respectively,

- (a) 1.56 nm and 1.04 nm (b) 1.04 nm and 1.56 nm

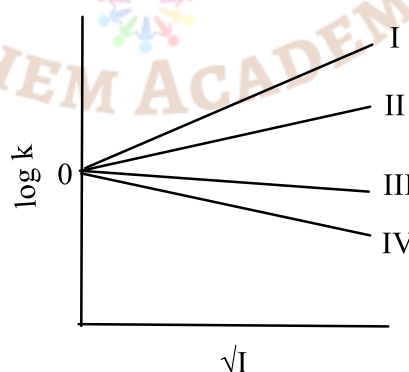


- (c) 3.12 nm and 1.50 nm (d) 1.04 nm and 3.12 nm
117. The slope and intercept obtained from (1/Rate) against (1/substrate concentration) of an enzyme catalysed reaction are 300 and 2×10^5 , respectively. The Michaelis-Menten constant of the enzyme in this reaction is
 (a) 5×10^6 M (b) 5×10^{-6} M (c) 1.5×10^3 M (d) 1.5×10^{-3} M
118. The pressure inside (P_{in}) a spherical cavity with a radius r formed in a liquid with surface tension is related to the external pressure (P_{out}) as
 (a) $P_{in} = P_{out} - \frac{2\gamma}{r}$ (b) $P_{in} = P_{out} + \frac{2\gamma}{r}$ (c) $P_{in} = P_{out} - \frac{\gamma}{r}$ (d) $P_{in} = P_{out} + \frac{\gamma}{r}$
119. Reaction between A and B is carried out for different initial concentrations and the corresponding half-life times are measured. The data are listed in the table:

Entry	[A] ₀ (μ M)	[B] ₀ (μ M)	$t_{1/2}$ (sec)
1	500	10	60
2	500	20	60
3	10	500	60
4	20	500	30

The rate can be represented as

- (a) $k[A][B]$ (b) $k[A]^2$ (c) $k[A]^2[B]$ (d) $k[A][B]^2$
120. The plot of the rate constant vs. ionic strength of the reaction $A^{2+} + B^-$ follows the line (refer to the figure)



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

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Answer Key

PART - B

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

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

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

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

PART - C

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

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

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

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



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72.	b
73.	d
74.	b
75.	c

87.	c
88.	b
89.	a
90.	a

102.	c
103.	c
104.	b
105.	c

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

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