

Roll. No.

Question Booklet Number

O.M.R. Serial No.

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M.Sc. (SEM.-III) (NEP) (SUPPLE.) EXAMINATION, 2024-25

CHEMISTRY

(Organotransition Metal Chemistry)

Paper Code							
B	0	2	0	9	0	5	T

(Elective)

Question Booklet
Series

A

Time : 1 : 30 Hours

Max. Marks : 75

Instructions to the Examinee :

1. Do not open the booklet unless you are asked to do so.
2. The booklet contains 100 questions. Examinee is required to answer 75 questions in the OMR Answer-Sheet provided and not in the question booklet. All questions carry equal marks.
3. Examine the Booklet and the OMR Answer-Sheet very carefully before you proceed. Faulty question booklet due to missing or duplicate pages/questions or having any other discrepancy should be got immediately replaced.
4. Four alternative answers are mentioned for each question as - A, B, C & D in the booklet. The candidate has to choose the correct / answer and mark the same in the OMR Answer-Sheet as per the direction :

(Remaining instructions on last page)

परीक्षार्थियों के लिए निर्देश :

1. प्रश्न-पुस्तिका को तब तक न खोलें जब तक आपसे कहा न जाए।
2. प्रश्न-पुस्तिका में 100 प्रश्न हैं। परीक्षार्थी को 75 प्रश्नों को केवल दी गई OMR आन्सर-शीट पर ही हल करना है, प्रश्न-पुस्तिका पर नहीं। सभी प्रश्नों के अंक समान हैं।
3. प्रश्नों के उत्तर अंकित करने से पूर्व प्रश्न-पुस्तिका तथा OMR आन्सर-शीट को सावधानीपूर्वक देख लें। दोषपूर्ण प्रश्न-पुस्तिका जिसमें कुछ भाग छपने से छूट गए हों या प्रश्न एक से अधिक बार छप गए हों या उसमें किसी अन्य प्रकार की कमी हो, उसे तुरन्त बदल लें।
4. प्रश्न-पुस्तिका में प्रत्येक प्रश्न के चार सम्भावित उत्तर- A, B, C एवं D हैं। परीक्षार्थी को उन चारों विकल्पों में से सही उत्तर छानना है। उत्तर को OMR उत्तर-पत्रक में सम्बन्धित प्रश्न संख्या में निम्न प्रकार भरना है :

(शेष निर्देश अन्तिम पृष्ठ पर)

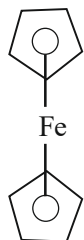
- Which theory best suit for homogenous catalysis?
 - Intermediate
 - Absorption
 - Nucleate
 - Paratoid
- If the catalyst is achiral, then the product of dehydrogenation of practical alkene is :
 - R-enantiomer
 - S-enantiomer
 - Aracenate
 - None of the above
- Wilkinson's catalyst is used as :
 - Homogenous Hydrogenation catalyst for the alkenes
 - Heterogenous hydrogenation catalyst for alkenes
 - Auto hydrogenation catalyst for morphine
 - Enzyme hydrogenation catalyst for alkenes
- Which reaction is carried out by Ziegler Natta catalyst?
 - Carboxylation of methane
 - Polymerisation of ethylene
 - Hydrogenation of alkene
 - None of the above
- Waker's process uses the catalyst :
 - $[\text{PdCl}_4]^{2-}$
 - $[\text{Rh}(\text{CO})_2\text{I}_2]^-$
 - $\text{Pt}[(\text{C}_2\text{H}_4)\text{Cl}_3]$
 - $\text{Cp}_2\text{TiCl}_2 - \text{Al}(\text{C}_2\text{H}_5)_3$
- The complex which do not obey 18-electron rule :
 - $\text{Fe}(\text{CO})_9$
 - $\text{Fe}(\text{CO})_3$
 - $\text{V}(\text{CO})_6$
 - $\text{CO}_2(\text{CO})_8$
- The compound which has 4 m-m bonds:
 - $\text{Fe}_2(\text{CO})_9$
 - $\text{CO}_2(\text{CO})_8$
 - $[\text{Re}_2\text{Cl}_8]^{2-}$
 - $[\text{Ru}_3(\text{CO})_{12}]$
- For the reaction $\text{Trans } [\text{IrCl}(\text{CO})(\text{PPh}_3)_2] + \text{Cl}_2 \rightarrow \text{Trans } [\text{IrCl}_3(\text{CO})(\text{PPh}_3)_2]$, the correct observation :
 - $\nu_{\text{Co}}(\text{Product}) > \nu_{\text{Co}}(\text{Reactant})$
 - $\nu_{\text{Co}}(\text{Product}) < \nu_{\text{Co}}(\text{Reactant})$
 - $\nu_{\text{Co}}(\text{Product}) = \nu_{\text{Co}}(\text{Reactant})$
 - $\nu_{\text{Co}}(\text{Product}) \ll \nu_{\text{Co}}(\text{Reactant})$
- Which one of the following is used as antiknocking agent?
 - $(\text{C}_2\text{H}_5)_4\text{Pb}$
 - $(\text{C}_2\text{H}_5)_4\text{Po}$
 - $(\text{C}_2\text{H}_5)_4\text{Mn}$
 - $(\text{C}_2\text{H}_5)_4\text{Fe}$

10. Which of the following neutral complex obeying 18-electron rule ?
 (A) $(\eta^5 - C_5H_5)Fe(CO)_2$
 (B) $(\eta^5 - C_5H_5)2Me(CO)_3$
 (C) $(\eta^5 - C_5H_5)_2Co$
 (D) $(\eta^5 - C_5H_5)2Re(\eta^6 - C_6H_6)$
11. The type of hapticity for ethene in Ziese's salt is :
 (A) η^1
 (B) η^2
 (C) η^3
 (D) η^5
12. $[Fe(CO)_5]$ is isolable with :
 (A) CH_3
 (B) H_2O
 (C) C_4
 (D) NH_2
13. Regarding the cycle of hydrogenation of alkenes involving $RhCl[PPh_3]_3$ as the catalyst, the correct statement :
 (A) Only 18 electron Rh complex is involved.
 (B) 14, 16 and 18 electron Rh complex are involved.
 (C) 14 and 16 electron Rh complex are involved.
 (D) 16 and 18 electron Rh complex are involved.
14. The total number of valence electron in $W(\eta_3 - C_p)(\eta_5 - C_p)(CO)_2$ (W At No= 74) :
 (A) 16 (B) 14
 (C) 18 (D) 20
15. According to Polyhedral electron count rule, the structure of $Rh_6(CO)_{16}$ is :
 (A) Closo
 (B) Nido
 (C) Arachno
 (D) Hypho
16. The catalyst and co-catalyst used in Wacker's process, respectively :
 (A) $PdCl_2$ and Cu
 (B) $[PdCl_4]^{2-}$ and $CuCl_2$
 (C) $CuCl_2$ and $[PdCl_4]^{2-}$
 (D) Pd and $CuCl_2$
17. Which of the following statement are true about the following alkene ?

$$K \left[\begin{array}{c} Cl \\ | \\ Cl - Pt \rightleftharpoons \begin{array}{c} CH_2 \\ || \\ CH_2 \end{array} \\ | \\ Cl \end{array} \right]$$

 (A) Above alkene complex is known as Zeise's salt
 (B) The all Pt—Cl bond length are same
 (C) Free ethylene the C-C bond is lengthened slightly
 (D) Substituents in ethylene causes vary the M-C bond length

18. Which of the following statement about Ferrocene is false?



- (A) It obeys the 18 electron rule
(B) It is diamagnetic
(C) It is an orange solid
(D) It resists electrophilic substitution
19. The arrangement of 18 electron rule is :
(A) ns, np, (n-1) d
(B) np, ns, (n-1) d
(C) (n-1)d, ns, np
(D) (n-1) d, np, ns
20. Labile complexes are :
(A) Stable complexes
(B) Unstable complexes
(C) Fast ligand replacing complexes
(D) None of the above
21. The Hapticity of cyclohepta-1, 3, 5 triene in $[(C_7H_7) Fe(CO)_3]$ is :
(A) 2 (B) 4
(C) 6 (D) 7
22. The hapticity of nitrosyl in $[Mo(\eta^1-alkyl)_3(\eta^3-Allyl)_2 NO]$ is :
(A) 1 (B) 2
(C) 3 (D) 0

23. The complex $\left[\begin{array}{c} \text{Co} \\ \diagup \quad \diagdown \\ \text{Ru} - PPh_3 \\ \diagdown \quad \diagup \\ PPh_3 \end{array} \right]^+$

follows :

- (A) 18 electron rule and stable
(B) 16 electron rule and unstable
(C) 18 electron rule and unstable
(D) 16 electron rule and stable
24. Identify the complex which does not obey the 18 electron rule :
(A) $[Fe(H_2O)_6]^{2+}$
(B) $[Ru(\eta^6-C_6H_6)(\eta^6-C_6H_6)]$
(C) $Na[Co(CO)_3(PPh_3)_2]$
(D) $[Mn(CO)_5]^-$
25. White Phosphorus P_4 belongs to :
(A) Closo (B) Nido
(C) Arachno (D) Hypo
26. According to polyhedral electron count rule the structure of $[Pb_2Sb_2]^{2-}$ is :
(A) Closo (B) Nido
(C) Arachno (D) Hypo
27. The compound that undergo oxidative addition reaction in presence of H_2 is :
(A) $[Mn(CO)_5]^-$
(B) $[(\eta^5-C_5H_5)Mo(CO)_3]$
(C) $[IrCl(CO)(PPh_3)_2]$
(D) $[(\eta^5-C_5H_5)_2 ReH]$

28. What are oxidation states of metal ion in following complexes ?
 (I) PdCl_2
 (II) $\text{Pd}(\text{PPh}_3)_4$
 (III) $\text{Pd}(\text{OAc})_2$
 (IV) ArPdBr
Code :
 (A) 2, 4, 2, 2
 (B) 2, 0, 2
 (C) 2, 0, 2, 2
 (D) 0, 0, 0, 2
29. Which of the following complex has a highest oxidation state of metal?
 (A) $(\eta^6 - \text{C}_6\text{H}_6)_2 \text{Cr}$
 (B) $\text{M}_n(\text{CO})_5 \text{Cl}$
 (C) $\text{Na}_2[\text{Fe}(\text{CO})_4]$
 (D) $\text{K}[\text{Mn}(\text{CO})_5]$
30. Which of the following complex is in which organic Ligand is having only bond with metal?
 (A) $\text{W}(\text{CH}_3)_6$
 (B) $\text{K}[\text{PtCl}_3 \text{C}_2\text{H}_4]$
 (C) $(\eta^5 - \text{C}_5\text{H}_5)_2 \text{Fe}$
 (D) $(\eta^5 - \text{C}_6\text{H}_6)_2 \text{Ru}$
31. What is the oxidation state molybdenum in $[(\eta \text{ tropylium})\text{Mo}(\text{CO})_3]$:
 (A) +2 (B) +1
 (C) 0 (D) -1
32. If complex $[\text{W}(\text{Cp})_2(\text{CO})_2]$ follows 18e - rule. What is Hapticity of Cp ?
 (A) 5 and 5
 (B) 3 and 5
 (C) 3 and 3
 (D) 1 and 5
33. Which of the following complexes show slow oxidation?
 (A) $(\eta^5 - \text{C}_5\text{H}_5)_2 \text{Fe}$
 (B) $(\eta^5 - \text{C}_5\text{H}_5)_2 \text{Re}$
 (C) $(\eta^5 - \text{C}_5\text{H}_5)_2 \text{Co}$
 (D) $(\eta^5 - \text{C}_5\text{H}_5)_2 \text{Mo}$
34. How many M-M bonds are present in $[\text{SpMo}(\text{CO})_3]_2$?
 (A) 1 (B) 2
 (C) 0 (D) 4
35. Which of the following statement is not true about terrocene?
 (A) Cyclopentadienyl rings in ferrocene are almost eclipsed.
 (B) Decamethyl ferrocene is staggered in solid state
 (C) Cyclopentadienyl ring in ferrocene are staggered
 (D) Ferrocene can be nitrated by reaction with HNO_3
36. Ferrocene cannot undergo which of the following reaction :
 (A) Friedal craft acylation
 (B) Diels-Alder reaction
 (C) Oxidation by Ag^+ ions
 (D) Electrophilic substitution

37. Structurally nickelocene is similar to ferrocene but how Nickelocene attains stability ?
- (A) Due to formation of monocation
(B) Due to formation of dication
(C) Due to formation of monoanion
(D) Due to formation of dianion
38. Which of the following is/are true about ferrocene?
- (I) Ferrocene is diamagnetic
(II) Dipole moment is zero
(III) Kealy and Pauson Synthesizes ferrocene from C_5H_5 and freshly reduced Fe at $300^\circ C$
(IV) Kealy and Pauson synthesizes ferrocene from C_5H_5MgBr and $FeCl_3$
- (A) (III) and (IV)
(B) (I), (II) and (III) only
(C) (I), (II) and (IV) only
(D) (II), (III) and (IV) only
39. Which type of boranes are B_5H_5 and B_4H_{10} respectively?
- (A) Nido and Arachnaboranes
(B) Nido and closo boranes
(C) Closo and Arachno boranes
(D) Both are Nido
40. $M(CO)_5$ is isolable with which of the following compound :
- (A) CH_4 (B) CH_3
(C) CH_2 (D) CH
41. Which of the following pair is not isolobal ?
- (A) $Mn(CO)_5CH_3$
(B) $[Fe(CO)_4]O$
(C) $Mn(CO)_5Cl$
(D) $Mn(CO)_5O$
42. According to Wade's Rule $[C_2B_{10}H_{12}]$ adopts which type of structure :
- (A) Closo structure
(B) Nido structure
(C) Arachano structure
(D) Hypo structure
43. Which property is the same for isolobal molecules?
- (A) e^- capture
(B) Boiling point
(C) Melting point
(D) Solubility
44. Which of the following is not considered as organometallic compound?
- (A) Ferrocene
(B) Cis-platin
(C) Ziese's salt
(D) Grignard reagent

45. Which one of the following statement is true for $[ML_n(CR)_2]$ complex, in which, M = transition metal, L= ligand, CR_2 = Fisher carbene?
- (A) L is non π - acceptor type
 (B) R group is non π - donor type
 (C) Carbon center is electrophilic in its reactivity
 (D) Metal atom is in its high formal oxidation states
46. For the metal olefin complexes : (i) $[PtCl_3(C_2H_4)]^-$ and (ii) $[PtCl_3(C_2F_4)]^-$, the correct statement is that :
- (A) Carbon-carbon bond length is same both in (i) and (ii)
 (B) Carbon-carbon bond length in (i) is smaller compared to that of (ii)
 (C) Carbon-carbon bond length in (i) is larger compared to that of (ii)
 (D) A metallacycle is formed in each complex
47. In metal-olefin interaction, the extent of increase in metal $\rightarrow$ olefin π -back donation would :
- (A) Lead to decrease in C=C bond length
 (B) Change the formal oxidation state of metal
 (C) Change the hybridisation of the olefin carbon from Sp^2 to Sp^3
 (D) Lead to increase in C=C bond length
48. Identify the order representing increasing π -acidity of the following ligands : C_2F_4 , NEt_3 , Co and C_2H_4
- (A) $Co < C_2F_4 < C_2H_4 < NEt_3$
 (B) $C_2H_4 < C_2F_4 < NEt_3 < Co$
 (C) $C_2H_4 < NEt_3 < Co < C_2F_4$
 (D) $NEt_3 < C_2H_4 < C_2F_4 < Co$
49. Which one of the following molecules exists as a monomer under the ambient conditions?
- (A) Trimethyl aluminium
 (B) Triethyl aluminium
 (C) Triphenyl aluminium
 (D) Trimesuminium
50. The molecule $(OC)_5M = \begin{matrix} OCH_3 \\ \diagup \\ C \\ \diagdown \\ Ph \end{matrix}$ obeys 18 electron rule, The two 'm' satisfying the conditions are :
- (A) Cr, Re^+ (B) Mo, V
 (C) V, Re^- (D) Cr, V
51. Complex in which organic ligand is having only σ -bond with metal is :
- (A) $W(CH_3)_6$
 (B) $(\eta^5-C_5H_5)_2Fe$
 (C) $K[PtCl_3(C_2H_4)]$
 (D) $(\eta^6-C_6H_6)_2Ru$

52. The greater the stability of $[(CH_3)_3C-CH_2]_4 Ti$ (a) Compared to that of $[(CH_3)_2CH-CH_2]_4 Ti$ (b) is due to :
- (A) Hyperconjugation present in complex (A)
 (B) β -hydride elimination is not possible in complex (A)
 (C) Steric protection of titanium from reactive species in complex (A)
 (D) The stronger nature of Ti-C in complex (A)
53. The stable cyclopentadienyl complex of beryllium is :
- (A) $[Be(\eta^5-C_5H_5)_2]$
 (B) $[Be(\eta^5-C_5H_5)(\eta^3-C_5H_5)]$
 (C) $[Be(\eta^1-C_5H_5)(\eta^3-C_5H_5)]$
 (D) $[Be(\eta^1-C_5H_5)(\eta^5-C_5H_5)]$
54. The ligand/ligands that is/are fluxional in the complex:
 $[Fe(\eta^5-C_5H_5)(\eta^1-C_5H_5)(CO)_2]$
- (A) $\eta^5-C_5H_5$
 (B) $\eta^1-C_5H_5$
 (C) $\eta^1-C_5H_5$ and Co
 (D) $\eta^5-C_5H_5$ and Co
55. The bonding of cyclopentadienyl in $Ti(Cp)_4$ is such that :
- (A) All Cp rings are pentahepto
 (B) One Cp ring is pentahepto and the other three rings are monohapto
 (C) Two Cp rings are monohapto and the other two rings are pentahepto
 (D) All Cp rings are monohapto
56. The Sandwich complex $\eta-Cp Co C_n H_n$ is on 18 electron series, when 'n' is :
- (A) 6 (B) 4
 (C) 3 (D) 5
57. Oxidation occurs very easily in case of :
- (A) $[(\eta^5-C_5H_5)_2]Fe$
 (B) $[(\eta^5-C_5H_5)_2]Co$
 (C) $[(\eta^5-C_5H_5)_2]Ru$
 (D) $[(\eta^5-C_5H_5)_2]Co^+$
58. Among the following the unstable carbonyl species is :
- (A) $Mn(CO)_5Cl$
 (B) $[Mn(CO)_5]^-$
 (C) $[Mn(CO)_5]^+$
 (D) $MnCO_5$

59. Oxidation number of Fe in $[\text{Fe}(\text{NO})(\text{CN})_5]^{2-}$ is :
 (A) 1 (B) 2
 (C) 3 (D) 0
60. The correct order of energy level of d-orbital in ferrocene is :
 (A) $dx^2 - y^2, dxy < dxz, dyz < dz^2$
 (B) $dx^2 - y^2, dxy < dx^2, dxy, dyz$
 (C) $dz^3 < dx^2, dyz < dx^2 - y^2, dxy$
 (D) $dyz, dxz, < dz^2, dx^2 - y^2$
61. To satisfy the 18-electron rule in the complex [Cycloheptatriene, Mo(CO)₃], the hapticity of the coordinated cycloheptatriene ligand must be :
 (A) 6 (B) 5
 (C) 4 (D) 2
62. The oxidation state of Fe in the complex $[\text{Cp}\{\text{Fe}(\text{CO})_2\}]_2$ is :
 (A) +2 (B) +1
 (C) 0 (D) -1
63. The hapticity of nitrosyl in $[\text{Mo}(\eta^1\text{allyl})_3(\eta^3\text{allyl})_2\text{NO}]$ is :
 (A) 1 (B) 2
 (C) 3 (D) 0
64. Intense bond at 15000 cm^{-1} in the UV-visible spectrum of $[\text{Bu}_4\text{N}]_2\text{Re}_2\text{Cl}_8$ is due to the transition :
 (A) $\pi - \pi^*$ (B) $\delta - \delta^*$
 (C) $\delta - \pi^*$ (D) $\pi - \delta^*$
65. The number of metal-metal bond in $[\text{W}_2(\text{OPh})_6]^-$:
 (A) 1
 (B) 2
 (C) 3
 (D) 4
66. Among the following the correct statement is :
 (A) CH is isolobal to Co(CO)₃
 (B) CH₂ is isolobal to Ni(CO)₂
 (C) CH is isolobal to Fe(CO)₄
 (D) CH₂ is isolobal to Mn(CO)₄
67. The correct statement regarding the terminal/bridging CO groups in solid Co₄(CO)₁₂ and Tr₄(CO)₁₂ is :
 (A) Both have equal number of bridging Co group
 (B) Number of bridging CO group in Co₄(CO)₁₂ is 4
 (C) The number of terminal CO group in Co₄(CO)₁₂ is 8
 (D) The number of bridging CO groups in Ir₄(CO)₁₂ is zero
68. Which of the following metal fragments $d^9 - \text{ML}_n$ is isolobal with CH?
 (A) $d^7 - \text{ML}_5$
 (B) $d^8 - \text{ML}_4$
 (C) $d^4 - \text{ML}_3$
 (D) $d^5 - \text{ML}_6$

69. The correct statement regarding the terminal/bridging CO groups in solid $\text{Fe}_3(\text{CO})_{12}$ and $\text{Os}_3(\text{CO})_{12}$ is :
- (A) Both have equal number of bridging CO groups
 (B) Number of bridging CO groups in $\text{Fe}_3(\text{CO})_{12}$ is 4
 (C) The number of terminal CO groups in $\text{Fe}_3(\text{CO})_{12}$ is 8
 (D) The number of bridging CO groups in $\text{Fe}_3(\text{CO})_{12}$ is 2 and in $\text{Os}_3(\text{CO})_{12}$ is zero
70. The cluster having arachno type structure is :
- (A) $[\text{Os}_5(\text{CO})_{16}]$
 (B) $[\text{Os}_3(\text{CO})_{12}]$
 (C) $[\text{Ir}_4(\text{CO})_{12}]$
 (D) $[\text{Rh}_6(\text{CO})_{16}]$
71. Total number of M-M bonds in the given complexes $\text{Fe}_3(\text{CO})_{12}$, $\text{Co}_4(\text{CO})_{12}$ and $[\eta^5\text{CpMo}(\text{CO})_2]_2$ are respectively :
- (A) 3, 4, 5 (B) 3, 4, 2
 (C) 4, 3, 2 (D) 3, 6, 3
72. The cluster $\text{Rh}_6(\text{CO})_{16}\text{Os}_5(\text{CO})_{15}$ and $[\text{Fe}_4(\text{CO})_{12}\text{C}]^{2-}$ has structure respectively :
- (A) Closo, nido arachno
 (B) Nido, closo, arachno
 (C) Closo, arachno, nido
 (D) Arachno, closo, nido
73. Predict the number of Fe-Fe bonds in $[(\eta^5-\text{C}_5\text{H}_5)\text{Fe}(\text{CO})_{12}]_2$ molecules using 18 electron rule :
- (A) One (B) Two
 (C) Three (D) Four
74. $[\text{CO}(\text{CO})_4]$ is isolabal with :
- (A) CH_4 (B) CH_3
 (C) CH_2 (D) CH
75. Metal metal quadrupole bonds are well known for the metal :
- (A) Ni (B) Co
 (C) Fe (D) Re
76. The total number of metal-metal bonds in $\text{Ru}_3(\text{CO})_{12}$ and $\text{Co}_4(\text{CO})_{12}$ respectively is :
- (A) 3 and 6
 (B) 4 and 5
 (C) Zero and 4
 (D) 3 and 4
77. The number of M-M bonds in $\text{Ir}_4(\text{CO})_{12}$ are :
- (A) Four (B) Six
 (C) Eight (D) Zero
78. The number of M-M bonds in donors $[\text{CpFe}(\text{CO})(\text{NO})]_2$ and $[\text{CpMo}(\text{CO})_3]_2$ are :
- (A) Two and two
 (B) Two and three
 (C) One and two
 (D) Zero and one

79. The W–W bond order in $\left[\text{W}(\eta^5\text{-C}_5\text{H}_5)(\eta\text{-Cl})(\text{CO}_2) \right]_2$ is:
 (A) 3 (B) 2
 (C) 1 (D) 0
80. The reaction:
 $\left[(\text{CO})_5\text{Mn}(\text{Me}) \right] + \text{Co} \rightarrow \left[(\text{CO})_5\text{Mn}(\text{CO})\text{Me} \right]$
 is an example for :
 (A) Oxidative addition
 (B) Electrophilic substitution
 (C) Nucleophilic substitution
 (D) Migratory insertion
81. The final products of the reaction of carbonyl metalates $\left[\text{V}(\text{CO})_6 \right]^-$ and $\left[\text{Co}(\text{CO})_4 \right]^-$ with H_3PO_4 , respectively are :
 (A) $\text{V}(\text{CO})_6$ and $\text{HCo}(\text{CO})_4$
 (B) $\text{HV}(\text{CO})_6$ and $\text{CO}_2(\text{CO})_8$
 (C) $\left[\text{H}_2\text{V}(\text{CO})_6 \right]^+$ and $\text{HCo}(\text{CO})_4$
 (D) $\text{V}(\text{CO})_6$ and $\text{Co}(\text{CO})_8$
82. The following reaction :
 $\left[\text{RhT}_3(\text{CO})_2\text{CH}_3 \right]^- \rightarrow \left[\text{RhI}_3(\text{Solvent})(\text{COCH}_3) \right]^-$ is :
 (A) Oxidative Addition
 (B) Reductive elimination
 (C) Migratory Insertion
 (D) Addition
83. The following reaction :
 $\text{Mn}_2(\text{CO})_{10} + \text{Br}_2 \rightarrow 2\text{MnBr}(\text{CO})_5$
 is :
 (A) Reductive Elimination
 (B) Addition
 (C) Insertion
 (D) Oxidative Addition
84. The following reaction :
 $\text{CO}_2(\text{CO})_8 + \text{H}_2 \rightarrow 2\left[\text{Co}(\text{H})(\text{CO})_4 \right]$
 is :
 (A) Oxidative addition
 (B) Reductive elimination
 (C) Insertion
 (D) Addition
85. The oxidative addition and reductive elimination steps are favoured by :
 (A) Electron rich metal centres
 (B) Electron deficient metal centres
 (C) Electron deficient and electron rich metal centres
 (D) Electron rich and electron deficient metal centres
86. Oxidative addition of O_2 to $\text{Tr}(\text{CO})\text{Cl}(\text{PPh}_3)_2$ the oxidation state and coordination number of Ir changes respectively by :
 (A) 1 and 3
 (B) 2 and 2
 (C) 3 and 1
 (D) 2 and 3

87. In Ziegler-Natta catalysis the commonly used catalyst system is :
- (A) $\text{TiCl}_4, \text{Al}(\text{C}_2\text{H}_5)_3$
- (B) $(\eta^5 - \text{Cp})_2 \text{TiCl}_2, \text{Al}(\text{OEt})_3$
- (C) $\text{VO}(\text{acac})_2, \text{Al}_2(\text{CH}_3)_6$
- (D) $\text{TiCl}_4, \text{BF}_3$
88. An intermediate formed during the hydroformylation of olefin using $\text{CO}_2(\text{CO})_8$ as catalyst in :
- (A) $\text{HCo}(\text{CO})_8$
- (B) $\text{H}_4\text{Co}(\text{CO})_3$
- (C) $\text{H}_2\text{Co}(\text{CO})_4$
- (D) $\text{HCo}(\text{CO})_4$
89. In Monsanto acetic acid process shown below :
- $$\text{CH}_3\text{OH} + \text{CO} \xrightarrow[180^\circ\text{C}, 30 \text{ bar}]{\text{Rh(I) Catalyst / HI}} \text{CH}_3\text{CO}_2\text{H}$$
- the role of HI is :
- (A) To convert CH_3OH to a stronger nucleophile CH_3O^-
- (B) To reduce the Rh(I) catalyst to Rh (0) species
- (C) To reduce a Rh(III) active species to a Rh(I) species in the catalytic cycle
- (D) To convert CH_3OH to CH_3I
90. The catalyst used in the conversion of ethylene to acetaldehyde using Wacker's process :
- (A) $\text{HCo}(\text{CO})_4$
- (B) $[\text{PdCl}_4]^{2-}$
- (C) V_2O_5
- (D) TiCl_4 in the presence of $\text{Al}(\text{C}_2\text{H}_5)_3$
91. Among the complexes (i) $(\text{C}_6\text{H}_5)_2\text{Cr}$ (ii) $[\text{HMn}(\text{CO})_5]$, (iii) $[(\text{CH}_3\text{CO})\text{Rh}(\text{CO})\text{I}_3]^-$ and (iv) $\text{CpFe}(\text{CO})_2(\text{CH}_3)$, the 18 electron rule is not followed in :
- (A) (iii) only
- (B) (ii) and (iii)
- (C) (i) and (iv)
- (D) (ii) only
92. The oxidation states of manganese in $\text{NaMn}(\text{CO})_5, \text{BrMn}(\text{CO})_5$ and $\text{Mn}_2(\text{CO})_{10}$ are :
- (A) 1, -1, 0
- (B) -1, 1, 0
- (C) 0, 1, -1
- (D) -1, 0, 1
93. Co Bond order is lowest in :
- (A) Un coordinated CO
- (B) CO bond to one metal
- (C) CO bridging to two metal
- (D) Co bridging to three metal

94. The final product in the reaction $[\text{Mn}(\text{CO})_6]^+ + \text{MeLi} \rightarrow$ is :
- (A) $[\text{Mn}(\text{CO})_6]^{-\text{Me}}$
 (B) $[\text{Mn}(\text{CO})_5 \text{Me}]$
 (C) $[\text{Mn}(\text{CO})_6]$
 (D) $[(\text{Me CO})\text{Mn}(\text{CO})_5]$
95. Though cyclobutadiene (C_4H_4) is highly unstable and readily polymerizes in its free state, its transition metal complexes could be isolated because :
- (A) It engages in long range interaction with transition metal.
 (B) It gains stability due to formation of $\text{C}_4\text{H}_4^{2-}$ on binding to transition metal.
 (C) Its polymerisation ability reduces in presence of transition metal
 (D) It becomes stable in presence of transition metals due to formation of $\text{C}_4\text{H}_4^{2+}$
96. Schrock carbenes are :
- (A) Triplets and nucleophilic
 (B) Triplets and electrophilic
 (C) Singlets and nucleophilic
 (D) Singlets and electrophilic
97. The incorrect statement regarding the Fischer type metal carbene complexes is that :
- (A) Carbene acts as a σ -donor and π -acceptor
 (B) All atoms directly connected to carbene C atom are coplanar
 (C) The bond between the metal and the carbene C atom has partial double bond character
 (D) The carbene C atom is nucleophilic
98. The oxidation state of ion in $[\text{Fe}(\eta^5\text{-Cp})]_2 [\text{BF}_4]$ is :
- (A) +1
 (B) +2
 (C) +3
 (D) +4
99. The bond order of the metal-metal bond in the dimeric complex $[\text{Re}_2\text{Cl}_4(\text{PMe}_2\text{Ph})_4]^+$ is :
- (A) 4.0
 (B) 3.5
 (C) 3.0
 (D) 2.5
100. Hydroformylation reactions are catalysed by :
- (A) TiCl_4 and AlEt_3
 (B) CaCl_2 and MeOEt
 (C) $\text{Ni}(\text{CO})_4$
 (D) $\text{Co}_2(\text{CO})_8$

Rough Work / रफ कार्य

Example :

Question :

Q.1 (A) ● (C) (D)

Q.2 (A) (B) ● (D)

Q.3 (A) ● (C) (D)

5. Each question carries equal marks. Marks will be awarded according to the number of correct answers you have.
6. All answers are to be given on OMR Answer Sheet only. Answers given anywhere other than the place specified in the answer sheet will not be considered valid.
7. Before writing anything on the OMR Answer Sheet, all the instructions given in it should be read carefully.
8. After the completion of the examination, candidates should leave the examination hall only after providing their OMR Answer Sheet to the invigilator. Candidate can carry their Question Booklet.
9. There will be no negative marking.
10. Rough work, if any, should be done on the blank pages provided for the purpose in the booklet.
11. To bring and use of log-book, calculator, pager & cellular phone in examination hall is prohibited.
12. In case of any difference found in English and Hindi version of the question, the English version of the question will be held authentic.

Impt. On opening the question booklet, first check that all the pages of the question booklet are printed properly. If there is any discrepancy in the question Booklet, then after showing it to the invigilator, get another question Booklet of the same series.

उदाहरण :

प्रश्न :

प्रश्न 1 (A) ● (C) (D)

प्रश्न 2 (A) (B) ● (D)

प्रश्न 3 (A) ● (C) (D)

5. प्रत्येक प्रश्न के अंक समान हैं। आपके जितने उत्तर सही होंगे, उन्हीं के अनुसार अंक प्रदान किये जायेंगे।
6. सभी उत्तर केवल ओ०एम०आर० उत्तर-पत्रक (OMR Answer Sheet) पर ही दिये जाने हैं। उत्तर-पत्रक में निर्धारित स्थान के अलावा अन्यत्र कहीं पर दिया गया उत्तर मान्य नहीं होगा।
7. ओ०एम०आर० उत्तर-पत्रक (OMR Answer Sheet) पर कुछ भी लिखने से पूर्व उसमें दिये गये सभी अनुदेशों को सावधानीपूर्वक पढ़ लिया जाये।
8. परीक्षा समाप्ति के उपरान्त परीक्षार्थी कक्ष निरीक्षक को अपनी OMR Answer Sheet उपलब्ध कराने के बाद ही परीक्षा कक्ष से प्रस्थान करें। परीक्षार्थी अपने साथ प्रश्न-पुस्तिका ले जा सकते हैं।
9. निगेटिव मार्किंग नहीं है।
10. कोई भी रफ कार्य, प्रश्न-पुस्तिका में, रफ-कार्य के लिए दिए खाली पेज पर ही किया जाना चाहिए।
11. परीक्षा-कक्ष में लॉग-बुक, कैल्कुलेटर, पेजर तथा सेल्युलर फोन ले जाना तथा उसका उपयोग करना वर्जित है।
12. प्रश्न के हिन्दी एवं अंग्रेजी रूपान्तरण में भिन्नता होने की दशा में प्रश्न का अंग्रेजी रूपान्तरण ही मान्य होगा।

महत्वपूर्ण: प्रश्नपुस्तिका खोलने पर प्रथमतः जाँच कर देख लें कि प्रश्नपुस्तिका के सभी पृष्ठ भलीभाँति छपे हुए हैं। यदि प्रश्नपुस्तिका में कोई कमी हो, तो कक्षनिरीक्षक को दिखाकर उसी सिरिज की दूसरी प्रश्नपुस्तिका प्राप्त कर लें।