PHYSICAL / INORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 12

Total Marks : 36

Max. Time : 36 min.

Topic : Coordination Compounds

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.5 to Q.6	(4 marks, 4 min.)	[8, 8]
Integer Answer Type		
Subjective Questions ('–1' negative marking) Q.7 to Q.10	(4 marks, 4 min.)	[16 ,16]

1. The IUPAC name of $[Fe(NH_2)(CO)_2I(PPh_3)_2]$ is :
(A) Amidodicarbonyliodidoditriphenylphosphineiron(II)
(B) Amidodicarbonyliodidobis(triphenylphosphine)iron(II)
(C) Aminedicarbonyliodidobis(triphenylphosphine)iron(II)
(D) Amidodicarbonyliodidobis(triphenylphosphine)ferrate(II)

2. EAN rule is followed by the complexes.
(i) $[Fe(\pi\text{-}C_5H_5)_2]$ (ii) $[Mn_2(CO)_{10}]$ (iii) $[V(CO_6)]^-$
(A) only (i) (B) only (ii) (C) only (iii) (D) all

3. Which of the following compound is expected to be coloured :
(A) $Ca_2[Fe(CN)_6]$ (B) $[Cu(CH_3CN)_4]BF_4$ (C) $K_3[Cu(CN)_4]$ (D) $K_4[VO_4]$

4. **S_1 :** The species $[CuCl_4]^{2-}$ exists but $[CuI_4]^{2-}$ does not.
S_2 : $[RhCl(Ph_3P)_3]$ and $[Ni(CO)_4]$ both are tetrahedral and diamagnetic.
S_3 : $N(Me)_3$ and $N(SiMe_3)_3$ are isostructural
(A) T T F (B) T F F (C) F T F (D) F T T

5. For Mn^{+3} pairing energy is 28000 cm^{-1}, Δ_0 for $[Mn(CN)_6]^{3-}$ is 38500 cm^{-1} then which of the following is / are correct.
(A) Complex will be coloured (B) Complex will be low spin complex
(C) Net CFSE = – 33600 cm^{-1} (D) Complex will be colourless

6. Which of the following statement(s) is/are correct?
(A) $[Cr(NH_3)_6]^{3+} > [Mn(CN)_6]^{3-} > [V(CO)_6]$, With respect to magnetic moment (spin values in B.M.)
(B) $[Co(CN)_6]^{3-} > [Co(NH_3)_6]^{3+} > [Co(H_2O)_6]^{3+}$, With respect to Δ_o values.
(C) $[Ni(CO)_4] > [Co(CO)_4]^- > [Fe(CO)_4]^{2-}$, With respect to strength of M – C, π-bond. (M = Ni, Co or Fe)
(D) $[NiCl_4]^{2-} < [CuCl_4]^{2-} < [ZnCl_4]^{2-}$, with respect to stability.

Integer Answer Type

7. Number of complexes that are paramagnetic in nature with number of unpaired electrons ($n \geq 2$) are :
1. $[MnCl_4]^{2-}$ 2. $[Mn_2(CO)_{10}]$ 3. $[V(CO)_6]^-$ 4. $[Ni(H_2O)_6]Cl_2$
5. $[Pt(NH_3)_4Cl_2]$ 6. $[Co(NH_3)_2(H_2O)_4]Cl_2$ 7. $[Ni(CN)_4]^{2-}$ 8. $[Cu(H_2O)_4]^{2+}$
9. $K_3[Cr(CN)_6]$

8. The brown ring complex is formulated as $[Fe(H_2O)_5NO^+]SO_4$. The oxidation number of iron is :

9. How many isomers are possible for the complex $[Ir(CO)Cl(PPh_3)_2]$?

10. In how many of the following complex ions, the central metal ions use (n – 1)d, ns and np orbitals for hybridisation ?
$[Mn(CN)_6]^{4-}$, $[Ni(NH_3)_6]^{2+}$, $[Co(ox)_3]^{3-}$, $[Cu(NO_2)_6]^{4-}$, $[AgF_4]^-$, $[Ni(CN)_4]^{2-}$, $[PdCl_4]^{2-}$, $[Pd(CN)_4]^{2-}$, $[Co(SCN)_4]^{2}$.

Answer Key

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1.	B	**2.**	B	**3.**	D	**4.**	B	**5.**	BCD
6.	ABD	**7.**	4	**8.**	1	**9.**	2	**10.**	6

Hints & Solutions

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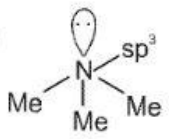
1. According to IUPAC nomenclature.

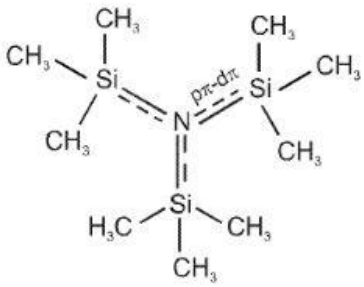
2. For all three EAN = 36

3. In $K_4[VO_4]$ vanadium is d^1 and paramagnetic.

4. **S_1 :** I^- ion is a stronger reducing agent than Cl^- ion. It reduces Cu^{2+} to Cu^+ ion.
S_2 : Both diamagnetic but $[Ni(CO)_4]$ is tetrahedral and $[RhCl(Ph_3P)_3]$ is square planar.

S_3 :





not isostructural

5. $\lambda_{ab} = \frac{1}{38500} = 259 \times 10^{-7}$ cm = 259 nm (U.V. region).
and $t_{2g}^{2,1,1}\, eg^{0,0}$
C.F.S.E = $-1.6\Delta_0 + P = 1.6 \times 38500 + 28000 = -33600$ cm^{-1}

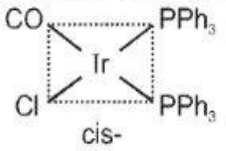
6. (A) Cr^{3+}–$3d^3$ configuration $(t_{2g}^{1,1,1}.e_g^{0,0})$; Mn^{3+} – $3d^4$ configuration $(t_{2g}^{2,1,1}.e_g^{0,0})$; V – $3d^5$ configuration $(t_{2g}^{2,2,1}.e_g^{0,0})$

(B) $\Delta_o \propto$ strength of ligand for same oxidation state of central metal.
(C) In carbonylate anion, the metal has a greater electron density to be dispersed, with the result that M–C, π bonding is enhanced in strength. Hence the correct order is $[Ni(CO)_4] < [Co(CO)_4]^- < [Fe(CO)_4]^{2-}$ for strength of M–C, π bond.
(D) Chelate effect.

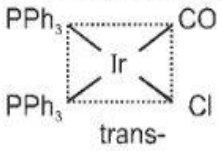
7. $[MnCl_4]^{2-}$, $[Ni(H_2O)_6]Cl_2$, $[Co(NH_3)_2(H_2O)_4]Cl_2$, $K_3[Cr(CN)_6]$.

8. The O.N. of Fe in $[\overset{x}{Fe}(\overset{0}{H_2O})\overset{+1}{NO}]^{2+}SO_4^{2-}$ is x + 0 + 1 = +2 or x = +1

9. In complex, Ir with +1 oxidation state has $5d^8$ configuration. Hence, the complex would be square planar and diamagnetic. It will have two geometrical isomers as given below.



cis-



trans-

10. $[Mn(CN)_6]^{4-}$ - $3d^5$, d^2sp^3; +2 oxidation sate
$[Ni(NH_3)_6]^{2+}$ - $3d^8$, sp^3d^2; +2 oxidation sate
$[Co(ox)_3]^{3-}$ - $3d^6$, d^2sp^3; +3 oxidation sate
$[Cu(NO_2)_6]^{4-}$ - $3d^9$, sp^3d^2; +2 oxidation sate
$[AgF_4]^-$ - $4d^8$, dsp^2; +3 oxidation sate
$[Ni(CN)_4]^{2-}$ - $3d^8$, dsp^2; +2 oxidation sate
$[PdCl_4]^{2-}$ - $4d^8$, dsp^2; +2 oxidation sate
$[Pd(CN)_4]^{2-}$ - $4d^8$, dsp^2; +2 oxidation sate
$[Co(SCN)_4]^{2-}$ - $3d^7$, sp^3; +2 oxidation sate