

COORDINATION COMPOUNDS & ORGANOMETALLICS

Q.1 The oxidation state of Fe in brown ring complex $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}] \text{SO}_4$ is-

- (A) + 1 (B) + 2 (C) + 3 (D) + 4

Q.2 Amongst $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$ and $[\text{NiCl}_4]^{2-}$

- (A) $[\text{Ni}(\text{CO})_4]$ and $[\text{NiCl}_4]^{2-}$ are diamagnetic and $[\text{Ni}(\text{CN})_4]^{2-}$ is paramagnetic
(B) $[\text{NiCl}_4]^{2-}$ and $[\text{Ni}(\text{CN})_4]^{2-}$ are diamagnetic and $[\text{Ni}(\text{CO})_4]$ is paramagnetic
(C) $[\text{Ni}(\text{CO})_4]$ and $[\text{Ni}(\text{CN})_4]^{2-}$ are diamagnetic and $[\text{NiCl}_4]^{2-}$ is paramagnetic
(D) $[\text{Ni}(\text{CO})_4]$ is diamagnetic and $[\text{NiCl}_4]^{2-}$ and $[\text{Ni}(\text{CN})_2]^{2-}$ paramagnetic

Q.3 The compound which does not show paramagnetism is-

- (A) $[\text{Cu}(\text{NH}_3)_4]\text{Cl}_2$ (B) $[\text{Ag}(\text{NH}_3)_2]\text{Cl}$
(C) NO (D) NO_2

Q.4 The number of d-electrons in $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ [At. no. of Cr = 24] is-

- (A) 2 (B) 3 (C) 4 (D) 5

Q.5 Amongst the following ions which one has the highest paramagnetism-

- (A) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ (B) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
(C) $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ (D) $[\text{Zn}(\text{H}_2\text{O})_6]^{2+}$

Q.6 Which of the following is an organometallic compound ?

- (A) Lithium methoxide (B) Lithium acetate
(C) Lithium dimethylamide (D) Methyl lithium

- Q.7** In nitroprusside ion, the iron and NO exist as Fe^{II} and NO^+ rather than Fe^{III} and NO. These forms can be differentiated by-
- (A) Estimating the concentration of iron
 (B) Measuring the concentration of CN^-
 (C) Measuring the solid state magnetic moment
 (D) Thermally decomposing the compound
- Q.8** The geometry of $\text{Ni}(\text{CO})_4$ and $\text{Ni}(\text{PPh}_3)_2\text{Cl}_2$ are-
- (A) Both square planar
 (B) Tetrahedral and square planar
 (C) Both tetrahedral
 (D) Square planar and tetrahedral
- Q.9** The complex ion which has no 'd' electrons in the central metal atom is (At. No. Cr = 24, Mn = 25, Fe = 26, Co = 27)
- (A) $[\text{MnO}_4]^-$
 (B) $[\text{Co}(\text{NH}_3)_6]^{3+}$
 (C) $[\text{Fe}(\text{CN})_6]^{3-}$
 (D) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$
- Q.10** The correct order of hybridisation of the central atom in the following species NH_3 , $[\text{PtCl}_4]^{2-}$, PCl_5 and BCl_3 is (At. NO. Pt = 78)-
- (A) dsp^2 , dsp^3 , sp^2 and sp^3
 (B) sp^3 , dsp^2 , dsp^3 , sp^2
 (C) dsp^2 , sp^2 , sp^3 , dsp^3
 (D) dsp^2 , sp^3 , sp^2 , dsp^3

ANSWER KEY

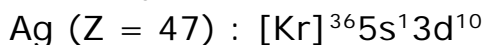
Q.No.	1	2	3	4	5	6	7	8	9	10
Ans.	A	C	B	B	B	D	C	C	A	B

SOLUTIONS (COORDINATION COMPOUNDS & ORGANOMETALLICS)

Ans.1 O.S. of Fe in $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]\text{SO}_4$ is +1.

Ans.2 $[\text{Ni}(\text{CO})_4]$ and $[\text{Ni}(\text{CN})_4]^{2-}$ are both diamagnetic with no unpaired electrons $[\text{NiCl}_4]^{2-}$ is paramagnetic with two unpaired electrons.

Ans.3 $[\text{Cu}(\text{NH}_3)_4]\text{Cl}_2$ is paramagnetic with one unpaired electron.



Hybridisation is sp and complex is linear and diamagnetic (hence not paramagnetic). NO has 15 (7 + 8) electrons. Due to the presence of unpaired electron it is paramagnetic. NO_2 has 23 (7 + 8 + 8) electrons. Due to the presence of unpaired electron it is paramagnetic.

Ans.4 Cr (Z = 24) : $[\text{Ar}]^{18} 4s^1 3d^5$



Hybridisation is $d^2 sp^3$. Complex is paramagnetic with three unpaired electrons in d-subshell.

Ans.5	Complex ion	No. of unpaired electron
	$[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$	3
	$[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$	4
	$[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$	1
	$[\text{Zn}(\text{H}_2\text{O})_6]^{2+}$	Zero

Thus, $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ is expected to be most paramagnetic, due to maximum number of unpaired electrons.

Ans.6	$\text{Li}-\text{O}-\text{CH}_3$	$\text{CH}_3-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{Li}$	$\text{Li}-\text{CH}_3$
	Lithium methoxide	Lithium acetate	Methyl lithium

There is no organometallic compound with name lithium dimethylamide.

Only methyl lithium is an organometallic compound.

Ans.7 Oxidation state of iron (+2 or +3) can be checked by measuring solid state magnetic moment.

Ans.8 Both $[\text{Ni}(\text{CO})_4]$ and $[\text{Ni}(\text{PPh}_3)_2\text{Cl}_2]$ are tetrahedral.

Ni ($Z = 28$) $[\text{Ar}]^{18} 4s^2 3d^8$

$\text{Ni}(\text{CO})_4$: Two 4s-electrons pairs up with 3d-electrons followed by sp^3 hybridisation to give a tetrahedral complex.

$[\text{Ni}(\text{PPh}_3)_2\text{Cl}_2]$: It has Ni^{2+} ion with Outer configuration of $3d^8$. Ni^{2+} undergoes sp^3 hybridisation (PPh_3 or Cl^- can not force the d-electrons to pair up) and complex is tetrahedral.

Ans.9 In $[\text{MnO}_4]^-$, Mn^{7+} has no d-electron.

Ans.10 In NH_3 , N is sp^3 -hybridised

In $[\text{PtCl}_4]^{2-}$, Pt^{2+} is dsp^2 -hybridised.

In PCl_5 , P is dsp^3 -hybridised.

In BCl_3 , B is sp^2 -hybridised.