PHYSICAL / INORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 8

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.9	(3 marks, 3 min.)	[27, 27]
Comprehension ('–1' negative marking) Q.10 to Q.12	(3 marks, 3 min.)	[9, 9]

1. It is experimentally found that the compound $K_3[Ni(CN)_5]$ shows an decrease in its weight when placed in a magnetic balance and four metal–ligand bond lengths are equal but the rest is different. Then, which of the following set of informations is correct :

(i) The transition metal is sp^3d hybridised

(ii) The net dipole moment of complex is $\neq$ zero

(iii) The transition metal is dsp^3 hybridised

(iv) The net dipole moment of the complex is zero

(v) The complex ion is trigonal bipyramidal

(vi) The complex ion is square pyramidal

(A) (i),(ii),(v) (B) (ii),(iii),(vi) (C) (iii),(iv),(v) (D) none of these

2. It is an experiment fact that : DMG + Ni(II)salt + $NH_4OH \longrightarrow$ Red ppt.

Which of the following is wrong about this red ppt :

(A) It is a non–ionic complex (B) It involves intra molecular H–bonding

(C) Ni(II) is sp^3 hybridised (D) It is a diamagnetic complex

3. All the following complex ions are found to be paramagnetic :

P : $[FeF_6]^{3-}$; Q : $[CoF_6]^{3-}$

R : $[V(H_2O)_6]^{3+}$; S : $[Ti(H_2O)_6]^{3+}$

The correct order of their paramagnetic moment (spin only) is :

(A) P > Q > R > S (B) P < Q < R < S (C) P = Q = R = S (D) P > R > Q > S

4. When the complex K_6 $[(CN)_5$ Co–O–O–Co$(CN)_5]$ is oxidised by bromine into $K_5[(CN)_5$ Co–O–O–Co$(CN)_5]$. Then which of the following statements will be true about this change:

(In both complex Co have t_{2g}^6, $e_g^{0,0}$ configuration) :

(A) Co(II) is oxidised in Co(III) (B) The O–O bond length will increase

(C) The O–O bond length will decrease (D) 'A' & 'B' both are correct

5. The molecules having the same hybridization, shape and number of lone pairs of electrons :

(A) SeF_4, XeO_2F_2 (B) SF_4, XeF_2 (C) $XeOF_4$, TeF_4 (D) $SeCl_4$, XeF_4

6. **(a)** The crystal field-splitting for Cr^{3+} ion in octahedral field increases for ligands I^-, H_2O, NH_3 , CN^- and the order is:

(A) $I^- < H_2O < NH_3 < CN^-$ (B) $CN^- < I^- < H_2O < NH_3$

(C) $CN^- < NH_3 < H_2O < I^-$ (D) $NH_3 < H_2O < I^- < CN^-$

(b) In which of the following configurations will there be the possibility of both para and diamagnestism, depending on the nature of the ligands?

(A) d^7 (B) d^3 (C) d^6 (D) d^5

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7. **(a)** The complex for which the calculation of crystal field splitting can be most easily done, by knowing its absorption spectrum, will be :

(A) $[TiCl_6]^{2-}$ (B) $[Fe(H_2O)_6]^{2+}$ (C) $[Ti(CN)_6]^{3-}$ (D) $[CoF_6]^{3-}$

(b) In which of the following complex ion, the metal ion will have t_{2g}^6, e_g^0 configuration according to CFT:

(A) $[FeF_6]^{3-}$ (B) $[Fe(CN)_6]^{3-}$ (C) $[Fe(CN)_6]^{4-}$ (D) None of these

8. The correct order for the CFSE (numerical value) for the following complexes is

Complex	P	Q	R	S
Formula	$[CoF_6]^{3-}$	$[Co(CN)_6]^{3-}$	$[Co(NH_3)_6]^{3+}$	$[Co(H_2O)_6]^{3+}$

(A) P > Q > R > S (B) Q > R > S > P (C) S > R > P > Q (D) R > Q > P > S

9. In the reaction : $[Ag(CN)_2]^- + Zn \longrightarrow$ the complex formed will be :

(A) Tetrahedral (B) square planar (C) octahedral (D) triangal bipyramidal

Comprehension # (Q.10 to Q.12)

Werner performed two experiments :

Expt-1 : He prepared a compound X by reacting KCl with $PtCl_4$. The compound X didn't give any ppt. with $AgNO_3$ but gave electrical conductance corresponding to 3 ions.

Expt-2 : He took 0.319 g of $CrCl_3.6H_2O$ and passed through a cation exchange resin & the acid coming out required 28.5 ml of 0.125 M NaOH.

Hence,

10. The formula of the compound X is :

(A) $[KPtCl]Cl_2$ (B) $K_2[PtCl_4]$ (C) $K_2[PtCl_6]$ (D) $K[PtCl_4]$

11. The hybridization in $K_2[PtCl_6]$ is :

(A) sp^3 (B) d^2sp^3 (C) sp^3d^2 (D) dsp^3

12. The complex $CrCl_3.6H_2O$ can be rightly represented as :

(A) $[Cr(H_2O)_4Cl_2]Cl$ (B) $[Cr(H_2O)_6]Cl_3$

(C) $[Cr(H_2O)_3Cl_3]3H_2O$ (D) $[Cr(H_2O)_5Cl]Cl_2$

Answer Key

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1.	B		**2.**	C		**3.**	A		**4.**	C		**5.**	A	
6.	(a) A	(b) C	**7.**	(a) C	(b) C	**8.**	B		**9.**	A		**10.**	C	
11.	B		**12.**	B										

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Hints & Solutions

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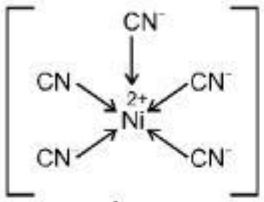
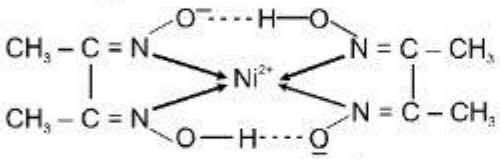
1. According to the question, $k_3[Ni(CN)_5]$ is diamagnetic and square pyramidal with non-zero dipole moment.



dsp^3 & $\mu \neq 0$
square pyramidal

2. The complex is



square planar (dsp^2)

3. **(A)** On the basis of number of electrons the correct order is P > Q > R > S.

	Complex	**No. of unpaired electrons.**
(P)	$[FeF_6]^{3-}$	5
(Q)	$[CoF_6]^{3-}$	4
(R)	$[V(H_2O)_6]^{3+}$	2
(S)	$[Ti(H_2O)_6]^{3+}$	1.

4. **(C)** In the first complex, ligand is O_2^{2-} which is oxidised into O_2^{1-} hence, O – O bond length decreases.

5. SeF_4 and XeO_2F_2 are both sp^3d hybridized, trigonal bipyramidal and see-saw shaped with 1 lone pair of electrons each.

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SF_4 has 1 lone pair, XeF_2 has 3 lone pairs. $XeOF_4$ is square pyramidal with 1 lone pair, TeF_4 is see-saw shaped with 1 lone pair, $SeCl_4$ has see-saw shape with 1 lone pair, XeF_4 has planar shape with 2 lone pairs.

6. **(a)** Increase Order of ligands Strength $I^- < H_2O < NH_3 < CN^-$

(b) SFL $d^6 = t_{2g}^{2,2,2} eg^{0,0}$ – diamagnetic

WFL $d^6 = t_{2g}^{2,1,1} eg^{1,1}$ – Paramagnetic.

7. **(a)** Since this is a d^1 system.

(b) In $[Fe(CN)_6]^{4-}$; Fe(II) is t_{2g}^6 , e_g^0 due to strong ligands.

8. CFSE depends on the strength of ligands which follows order

$CN^- > NH_3 > H_2O > F^-$.

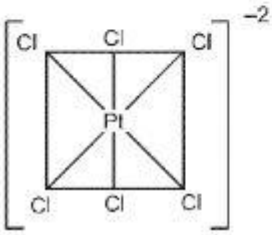
On the basis of nature of ligands the correct order is Q > R > S > P.

9. $2[Ag(CN)_2]^- + Zn \longrightarrow 2Ag + [Zn(CN)_4]^{2-}$.

$Zn^{2+} \longrightarrow 3d^{10}$, Shape of $[Zn(CN)_4]^{2-}$ is tetrahedral.

10. $2KCl + PtCl_4 \longrightarrow K_2[PtCl_6]$

11.



d^2sp^3

12. Meq. of complex = Meq. of base

$$\frac{0.319}{268.5} \times 1000 \times V.F. = 0.125 \times 28.5 \times 1$$

$V.F. \approx 3$

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