Q1 - 2024 (01 Feb Shift 1)

Given below are two statements:

Statement (I): A solution of $\left[Ni(H_2O)_6\right]^{2+}$ is green in colour.

Statement (II): A solution of $[Ni(CN)_4]^{2-}$ is colourless.

In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Both Statement I and Statement II are incorrect

(2) Both Statement I and Statement II are correct

(3) Statement I is incorrect but Statement II is correct

(4) Statement I is correct but Statement II is incorrect

Q2 - 2024 (01 Feb Shift 1)

Which of the following complex is homoleptic?

(1) $[Ni(CN)_4]^{2-}$

(2) $\left[Ni(NH_3)_2Cl_2\right]$

(3) $\left[Fe(NH_3)_4Cl_2\right]^{+}$

(4) $\left[Co(NH_3)_4Cl_2\right]^{+}$

Q3 - 2024 (01 Feb Shift 2)

$\left[Co(NH_3)_6\right]^{3+}$ and $[CoF_6]^{3-}$ are respectively known as:

(1) Spin free Complex, Spin paired Complex

(2) Spin paired Complex, Spin free Complex

(3) Outer orbital Complex, Inner orbital Complex

(4) Inner orbital Complex, Spin paired Complex

Q4 - 2024 (01 Feb Shift 2)

Given below are two statements :

Statement (I) : Dimethyl glyoxime forms a sixmembered covalent chelate when treated with $NiCl_2$ solution in

presence of NH_4OH.

Statement (II) : Prussian blue precipitate contains iron both in (+2) and (+3) oxidation states. In the light of the above statements, choose the most appropriate answer from the options given below:

(1) Statement I is false but Statement II is true

(2) Both Statement I and Statement II are true

(3) Both Statement I and Statement II are false

(4) Statement I is true but Statement II is false

Q5 - 2024 (27 Jan Shift 1)

Yellow compound of lead chromate gets dissolved on treatment with hot NaOH solution. The product of lead formed is a :

(1) Tetraanionic complex with coordination number six

(2) Neutral complex with coordination number four

(3) Dianionic complex with coordination number six

(4) Dianionic complex with coordination number four

Q6 - 2024 (27 Jan Shift 2)

Identify from the following species in which d^2sp^3 hybridization is shown by central atom:

(1) $\left[Co(NH_3)_6\right]^{3+}$

(2) BrF_5

(3) $[Pt(Cl)_4]^{2-}$

(4) SF_6

Q7 - 2024 (27 Jan Shift 2)

Identity the incorrect pair from the following:

(1) Photography - AgBr

(2) Polythene preparation - $TiCl_4, Al(CH_3)_3$

(3) Haber process - Iron

(4) Wacker process $-PtCl2$

Q8 - 2024 (27 Jan Shift 2)

The Spin only magnetic moment value of square planar complex $\left[Pt(NH_3)_2Cl\left(NH_2CH_3\right)\right]$ Cl is _____ B.M. (Nearest integer)

(Given atomic number for $Pt = 78$)

Q9 - 2024 (29 Jan Shift 1)

In which one of the following metal carbonyls, CO forms a bridge between metal atoms?

(1) $[Co_2(CO)_8]$

(2) $[Mn_2(CO)_{10}]$

(3) $[Os_3(CO)_{12}]$

(4) $[Ru_3(CO)_{12}]$

Q10 - 2024 (29 Jan Shift 2)

The correct IUPAC name of K_2MnO_4 is

(1) Potassium tetraoxopermanganate (VI)

(2) Potassium tetraoxidomanganate (VI)

(3) Dipotassium tetraoxidomanganate (VII)

(4) Potassium tetraoxidomanganese (VI)

Q11 - 2024 (30 Jan Shift 1)

Aluminium chloride in acidified aqueous solution forms an ion having geometry

(1) Octahedral

(2) Square Planar

(3) Tetrahedral

(4) Trigonal bipyramidal

Q12 - 2024 (30 Jan Shift 1)

Choose the correct Statements from the following:

(A) Ethane-1 2-diamine is a chelating ligand.

(B) Metallic aluminium is produced by elecrtrolysis of aluminium oxide in presence of cryolite.

(C) Cyanide ion is used as ligand for leaching of silver.

(D) Phosphine act as a ligand in Wilkinson catalyst.

(E) The stability constants of Ca^{2+} and Mg^{2+} are similar with EDTA complexes.

Choose the correct answer from the options given below:

(1) (B), (C), (E) only

(2) (C), (D), (E) only

(3) (A), (B), (C) only

(4) (A), (D), (E) only

Q13 - 2024 (30 Jan Shift 2)

The molecule/ion with square pyramidal shape is:

(1) $[Ni(CN)_4]^{2-}$

(2) PCl_5

(3) BrF_5

(4) PF_5

Q14 - 2024 (30 Jan Shift 2)

The coordination geometry around the manganese in decacarbonyldimanganese(0)

(1) Octahedral

(2) Trigonal bipyramidal

(3) Square pyramidal

(4) Square planar

Q15 - 2024 (30 Jan Shift 2)

Number of complexes which show optical isomerism among the following is _____

cis $-[Cr(ox)_2Cl_2]^{3-}$, $[Co(en)_3]^{3+}$,
cis $-[Pt(en)_2Cl_2]^{2+}$, cis $-[Co(en)_2Cl_2]^{+}$,
trans $-[Pt(en)_2Cl_2]^{2+}$, trans $-[Cr(ox)_2Cl_2]^{3-}$

Q16 - 2024 (31 Jan Shift 1)

The correct statements from following are:

A. The strength of anionic ligands can be explained by crystal field theory.

B. Valence bond theory does not give a quantitative interpretation of kinetic stability of coordination compounds.

C. The hybridization involved in formation of $[Ni(CN)_4]^{2-}$ complex is dsp^2.

D. The number of possible isomer(s) of cis- $[PtCl_2(en)_2]^{2+}$ is one

Choose the correct answer from the options given below:

(1) A, D only

(2) A, C only

(3) B, D only

(4) B, C only

Q17 - 2024 (31 Jan Shift 2)

Match List I with List II

	LIST - I		LIST - II
	(Complex ion)		(Electronic Configuration)
A.	$[Cr(H_2O)_6]^{3+}$	I.	$t_{2g}^2e_g^0$
B.	$[Fe(H_2O)_6]^{3+}$	II.	$t_{2g}^3e_g^0$
C.	$[Ni(H_2O)_6]^{2+}$	III.	$t_{2g}^3e^2$
D.	$[V(H_2O)_6]^{3+}$	IV.	$t_{2g}^6e^2$

Choose the correct answer from the options given below :

(1) A-III, B-II, C-IV, D-I

(2) A-IV, B-I, C-II, D-III

(3) A-IV, B-III, C-I, D-II

(4) A-II, B-III, C-IV, D-I

Q18 - 2024 (31 Jan Shift 2)

Select the option with correct property -

(1) $[Ni(CO)_4]$ and $[NiCl_4]^{2-}$ both diamagnetic

(2) $[Ni(CO)_4]$ and $[NiCl_4]^{2-}$ both paramagnetic

(3) $[NiCl_4]^{2-}$ diamagnetic, $[Ni(CO)_4]$ paramagnetic

(4) $[Ni(CO)_4]$ diamagnetic, $[NiCl_4]^{2-}$ paramagnetic

Answer Key

Q1 (2)	**Q2** (1)	**Q3** (2)	**Q4** (1)
Q5 (4)	**Q6** (1)	**Q7** (4)	**Q8** (0)
Q9 (1)	**Q10** (2)	**Q11** (1)	**Q12** (3)
Q13 (3)	**Q14** (1)	**Q15** (4)	**Q16** (4)
Q17 (4)	**Q18** (4)		

Q1

$\left[\mathrm{Ni}\left(\mathrm{H}_2\mathrm{O}\right)_6\right]^{+2} \rightarrow$ Green colour solution due to $\mathrm{d}-\mathrm{d}$ transition.

$\left[\mathrm{Ni}(\mathrm{CN})_4\right]^{-2} \rightarrow$ is diamagnetic and it is colourless.

Q2

In Homoleptic complex all the ligand attached with the central atom should be the same. Hence $\left[\mathrm{Ni}(\mathrm{CN})_4\right]^{2-}$ is a homoleptic complex.

Q3

$\left[\mathrm{Co}\left(\mathrm{NH}_3\right)_6\right]^{3+}$

Co^{3+} (strong field ligand) $\Rightarrow 3\ \mathrm{d}^6\ \left(\mathrm{t}_{2\,\mathrm{g}}^6, \mathrm{e}_{\mathrm{g}}^0\right)$,

Hybridisation : $\mathrm{d}^2\mathrm{sp}^3$

Inner obital complex(spin paired complex)

Pairing will take place.

$\left[\mathrm{CoF}_6\right]^{3-}$

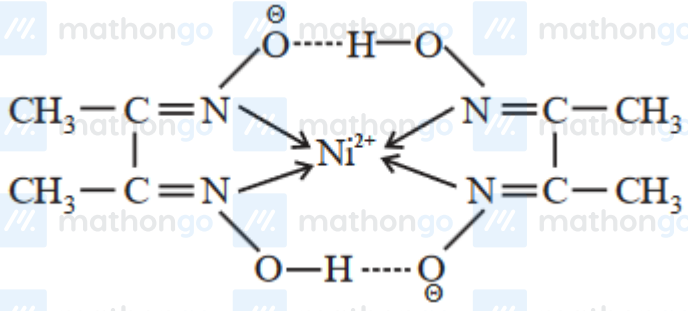
Co^{3+} (weak field ligand) $\Rightarrow 3\ \mathrm{d}^6\ \left(\mathrm{t}_{2\,\mathrm{g}}^4, \mathrm{e}_{\mathrm{g}}^2\right)$

Hybridisation : $\mathrm{sp}^3\ \mathrm{d}^2$

Outer orbital complex (spin free complex) no pairing will take place

Q4

$\mathrm{Ni}^{2+} + \mathrm{NH}_4\mathrm{OH} + \mathrm{dmg} \rightarrow$



2 Five member ring

III II

$Fe_4[Fe(CN)_6]_3$

Prussian Blue

Q5

$PbCrO_4 + NaOH$ (hot excess) $\rightarrow [Pb(OH)_4]^{-2} + Na_2CrO_4$

Dianionic complex with coordination number four

Q6

$[Co(NH_3)_6]^{+3} - d^2sp^3$ hybridization

$BrF_5 - sp^3\ d^2$ hybridization

$[PtCl_4]^{-2} - dsp^2$ hybridization

$SF_6 - sp^3\ d^2$ hybridization

Q7

The catalyst used in Wacker's process is $PdCl_2$

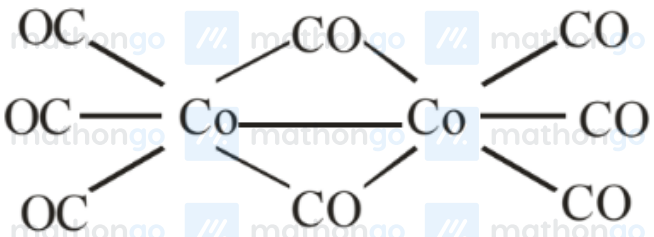
Q8

$Pt^{2+}\ (d^8)$

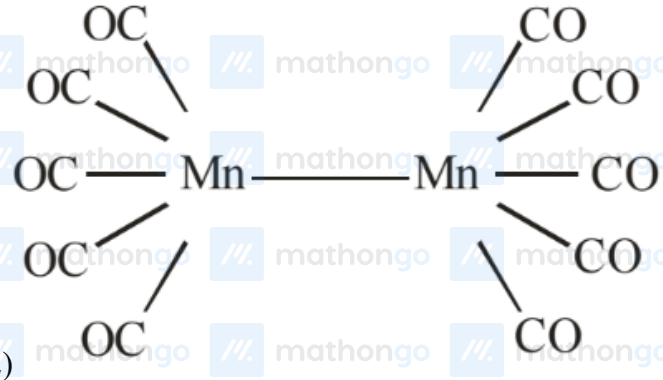
$Pt^{2+} \rightarrow dsp^2$ hybridization and have no unpaired e^-s.

$\therefore$ Magnetic moment $= 0$

Q9



(1)



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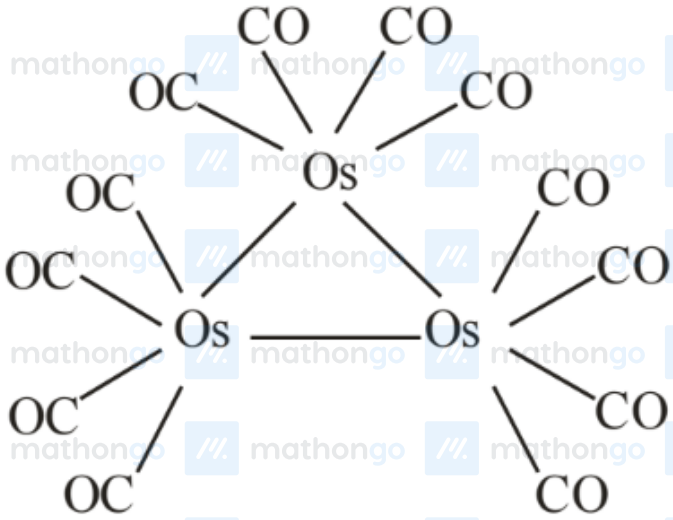

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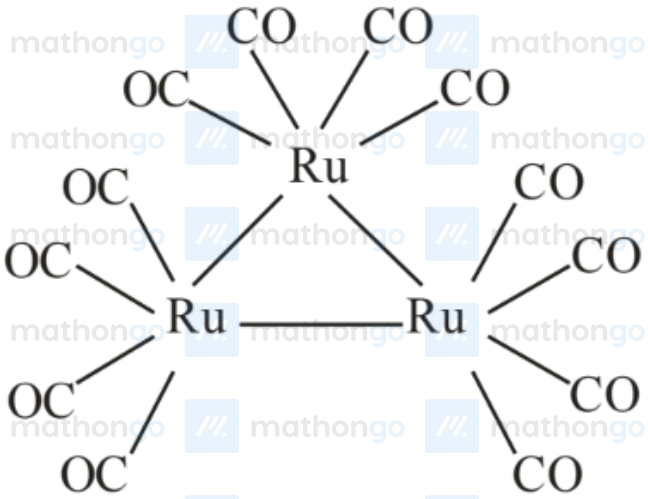


(4)

Q10

K_2MnO_4

$2 + x - 8 = 0$

$\Rightarrow x = +6$

O.S. of $Mn = +6$

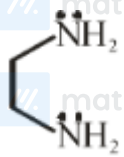
IUPAC Name =

Potassium tetraoxidomanganate(VI)

Q11

$AlCl_3$ in acidified aqueous solution forms octahedral geometry $\left[Al(H_2O)_6\right]^{3+}$

Q12



Bidentate, chelating

Based on Hall-Heroults process

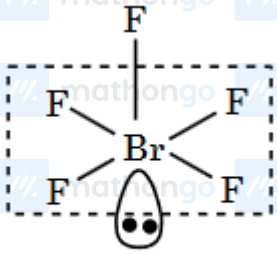
$\left[Rh(PPh_3)_3Cl\right]$ Wilkinson's catalyst

$Ag_2S + NaCN \overset{Air}{\rightleftharpoons} Na[Ag(CN)_2] + Na_2S$

Ca^{++} ion forms more stable complex with EDTA

Q13

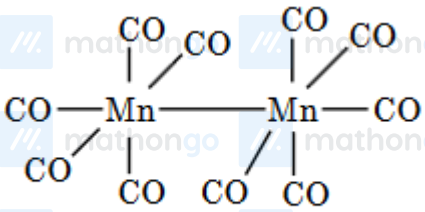
BrF_5



Square Pyramidal.

Q14

$Mn_2(CO)_{10}$



Octahedral around Mn

Q15

cis $-[Cr(ox)_2Cl_2]^{3-} \rightarrow$ can show optical isomerism (no POS & COS)

$[Co(en)_3]^{3+} \rightarrow$ can show (no POS & COS)

cis $-[Pt(en)_2Cl_2]^{2+} \rightarrow$ can show (no POS & COS)

cis $-[Co(en)_2Cl_2]^{+} \rightarrow$ can show (no POS & COS)

trans $-[Pt(en)_2Cl_2]^{2+} \rightarrow$ can't show (contains POS & COS)

trans $-[Cr(ox)_2Cl_2]^{3-} \rightarrow$ can't show (contains POS & COS)

Q16

B. VBT does not explain stability of complex

C. Hybridisation of $[Ni(CN)_4]^{-2}$ is dsp ^{2}.

Q17

$\left[Cr(H_2O)_6\right]^{3+}$ Contains Cr^{3+} : $[Ar]3\,d^3$: $t_{2\,g}^3 e_g^\circ$

$\left[Fe(H_2O)_6\right]^{3+}$ Contains Fe^{3+} : $[Ar]3\,d^5$: $t_{2\,g}^3 eg_g^2$

$\left[Ni(H_2O)_6\right]^{2+}$ Contains Ni^{2+} : $[Ar]3\,d^8$: $t_{2\,g}^6 e_g^2$

$\left[V(H_2O)_6\right]^{3+}$ Contains V^{3+} : $[Ar]3\,d^2$: $t_{2\,g}^2 e_g^\circ$

Q18

$[Ni(CO)_4] \rightarrow$ diamagnetic, sp^3 hybridisation, number of unpaired electrons $= 0$

$[NiCl_4]^{2-}, \rightarrow$ paramagnetic, sp^3 hybridisation, number of unpaired electrons $= 2$