Q1. 21 January Shift 1

Given below are two statements :

Statement I : Among $[Cu(NH_3)_4]^{2+}$, $[Ni(en)_3)]^{2+}$, $[Ni(NH_3)_6]^{2+}$ and $[Mn(H_2O)_6]^{2+}$, $[Mn(H_2O)_6]^{2+}$ has the maximum number of unpaired electrons.

Statement II : The number of pairs among $\{[NiCl_4]^{2-}, [Ni(CO)_4]\}$, $\{[NiCl_4]^{2-}, [Ni(CN)_4]^{2-}\}$ and $\{[Ni(CO)_4], [Ni(CN)_4]^{2-}\}$ that contain only diamagnetic species is two.

In the light of the above statements, choose the correct answer from the options given below : Statement I is true but Statement II is false Both Statement I and Statement II are false

(1) Statement I is true but Statement II is false
(2) Both Statement I and Statement II are false
(3) Both Statement I and Statement II are true
(4) Statement I is false but Statement II is true

Q2. 21 January Shift 2

Given below are two statements :

Statement I : Crystal Field Stabilization Energy (CFSE) of $[Cr(H_2O)_6]^{2+}$ is greater than that of $[Mn(H_2O)_6]^{2+}$.

Statement II: Potassium ferricyanide has a greater spin-only magnetic moment than sodium ferrocyanide.

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

(1) Both Statement I and Statement II are true
(2) Both Statement I and Statement II are false
(3) Statement I is true but Statement II is false
(4) Statement I is false but Statement II is true

Q3. 21 January Shift 2

Identify the metal ions among $Co^{2+}, Ni^{2+}, Fe^{2+}, V^{3+}$ and Ti^{2+} having a spin-only magnetic moment value more than 3.0 BM. The sum of unpaired electrons present in the high spin octahedral complexes formed by those metal ions is ____.

Q4. 22 January Shift 1

Consider the transition metal ions $Mn^{3+}, Cr^{3+}, Fe^{3+}$ and Co^{3+} and all form low spin octahedral complexes. The correct decreasing order of unpaired electrons in their respective d-orbitals of the complexes is

(1) $Mn^{3+} > Fe^{3+} > Co^{3+} > Cr^{3+}$
(2) $Cr^{3+} > Mn^{3+} > Fe^{3+} > Co^{3+}$
(3) $Fe^{3+} > Co^{3+} > Mn^{3+} > Cr^{3+}$
(4) $Cr^{3+} > Fe^{3+} > Co^{3+} > Mn^{3+}$

Q5. 22 January Shift 2

$[Ni(PPh_3)_2Cl_2]$ is a paramagnetic complex. Identify the INCORRECT statements about this complex.

A. The complex exhibits geometrical isomerism.

B. The complex is white in colour.

C. The calculated spin-only magnetic moment of the complex is 2.84 BM .

D. The calculated CFSE (Crystal Field Stabilization Energy) of Ni in this complex is $-0.8\Delta_o$.

E. The geometrical arrangement of ligands in this complex is similar to that in $Ni(CO)_4$.

Choose the correct answer from the options given below :

(1) C, D and E Only (2) C and D Only (3) A, B and D Only (4) A and B Only

Q6. 23 January Shift 1

Given below are two statements :

Statement I: $[CoBr_4]^{2-}$ ion will absorb light of lower energy than $[CoCl_4]^{2-}$ ion.

Statement II : In $[CoI_4]^{2-}$ ion, the energy separation between the two set of d-orbitals is more than $[CoCl_4]^{2-}$ ion.

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

(1) Both Statement I and Statement II are false (2) Both Statement I and Statement II are true

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

Q7. 23 January Shift 1

The statements that are incorrect about the nickel(II) complex of dimethylglyoxime are :

A. It is red in colour.

B. It has a high solubility in water at $pH = 9$.

C. The Ni ion has two unpaired d-electrons.

D. The $N - Ni - N$ bond angle is almost close to 90°.

E. The complex contains four five-membered metallacycles (metal containing rings).

Choose the correct answer from the options given below :

(1) C and D Only (2) C and E Only (3) B, C and E Only (4) A, D and B Only

Q8. 23 January Shift 1

The crystal field splitting energy of $[Co(\text{ oxalate })_3]^{3-}$ complex is ' n′ times that of the $[Cr(\text{ oxalate })_3]^{3-}$ complex. Here ' n′ is ____. (Assume $\Delta_0 \gg P$)

Q9. 23 January Shift 2

Identify the CORRECT set of details from the following:

A. $[Co(NH_3)_6]^{3+}$: Inner orbital complex; d^2sp^3 hybridized

B. $[MnCl_6]^{3-}$: Outer orbital complex; $sp^3\ d^2$ hybridized

C. $[CoF_6]^{3-}$: Outer orbital complex; d^2sp^3 hybridized

D. $[FeF_6]^{3-}$: Outer orbital complex; $sp^3\ d^2$ hybridized

E. $[Ni(CN)_4]^{2-}$: Inner orbital complex; sp^3 hybridized

Choose the correct answer from the options given below:

(1) A, C & E Only (2) A, B & D Only (3) C & D Only (4) A, B, C, D & E

Q10. 23 January Shift 2

Total number of unpaired electrons present in the central metal atoms/ions of $[Ni(CO)_4]$, $[NiCl_4]^{2-}$, $[PtCl_2(NH_3)_2]$, $[Ni(CN)_4]^{2-}$ and $[Pt(CN)_4]^{2-}$ is ____.

Q11. 24 January Shift 1

Given below are two statements:

Statement I: Hybridisation, shape and spin only magnetic moment of $K_3[Co(CO_3)_3]$ is $sp^3\ d^2$, octahedral and 4.9 BM respectively.

Statement II: Geometry, hybridisation and spin only magnetic moment values (BM) of the ions $[Ni(CN)_4]^{2-}$, $[MnBr_4]^{2-}$ and $[CoF_6]^{3-}$ respectively are square planar, tetrahedral, octahedral; $dsp^2, sp^3, sp^3\ d^2$ and $0, 5.9, 4.9$.

In the light of the above statements, choose the correct answer from the options given below

(1) Statement I is true but Statement II is false (2) Both Statement I and Statement II are false

(3) Both Statement I and Statement II are true (4) Statement I is false but Statement II is true

Q12. 24 January Shift 1

Given below are two statements:

Statement I: The number of paramagnetic species among $[CoF_6]^{3-}$, $[TiF_6]^{3-}$, V_2O_5 and $[Fe(CN)_6]^{3-}$ is 3.

Statement II: $K_4[Fe(CN)_6] < K_3[Fe(CN)_6] < [Fe(H_2O)_6]SO_4 \cdot H_2O < [Fe(H_2O)_6]Cl_3$ is the correct order in terms of number of unpaired electron(s) present in the complexes.

In the light of the above statements, choose the correct answer from the options given below

(1) Both Statement I and Statement II are true (2) Statement I is false but Statement II is true

(3) Both Statement I and Statement II are false (4) Statement I is true but Statement II is false

Q13. 24 January Shift 1

Consider a mixture ' X ' which is made by dissolving 0.4 mol of $[Co(NH_3)_5SO_4]Br$ and 0.4 mol of $[Co(NH_3)_5Br]SO_4$ in water to make 4 L of solution. When 2 L of mixture ' X ' is allowed to react with excess of $AgNO_3$, it forms precipitate ' Y '. The rest 2 L of mixture ' X ' reacts with excess $BaCl_2$ to form precipitate ' Z '. Which of the following statements is CORRECT?

(1) 0.1 mol of ' Y ' is formed.
(2) 0.2 mol of ' Z ' is formed.
(3) 0.4 mol of ' Z ' is formed.
(4) 'Y' is $BaSO_4$ and ' Z ' is AgBr.

Q14. 24 January Shift 2

The wavelength of light absorbed for the following complexes are in the order

$\underset{(I)}{[Co(NH_3)_6]^{3+}}; \underset{(II)}{[Co(H_2O)_6]^{3+}}; \underset{(III)}{[Co(CN)_6]^{3-}}; \underset{(IV)}{[Co(NH_3)_5(H_2O)]^{3+}}; \underset{(V)}{[CoF_6]^{3-}}$

(1) III < I < IV < V < II
(2) III < I < IV < II < V
(3) III < I < II < IV < V
(4) III < IV < I < II < V

Q15. 24 January Shift 2

A chromium complex with a formula $CrCl_3 \cdot 6H_2O$ has a spin only magnetic moment value of 3.87 BM and its solution conductivity corresponds to 1 : 2 electrolyte. 2.75 g of the complex solution was initially passed through a cation exchanger. The solution obtained after the process was reacted with excess of $AgNO_3$. The amount of AgCl formed in the above process is ____ g. (Nearest integer)

[Given: Molar mass in $gmol^{-1}$ Cr : 52; Cl : 35.5, Ag : 108, O : 16, H : 1]

Q16. 28 January Shift 1

The correct statement among the following is:

(1) $Ni(CO)_4$ and $[Ni(CN)_4]^{2-}$ are diamagnetic and $[NiCl_4]^{2-}$ is paramagnetic.
(2) $Ni(CO)_4$ and $[NiCl_4]^{2-}$ are diamagnetic and $[Ni(CN)_4]^{2-}$ is paramagnetic.
(3) $[Ni(CN)_4]^{2-}$ and $[NiCl_4]^{2-}$ are diamagnetic and $Ni(CO)_4$ is paramagnetic.
(4) $Ni(CO)_4$ is diamagnetic and $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ are paramagnetic.

Q17. 28 January Shift 1

X is the number of geometrical isomers exhibited by $[Pt(NH_3)(H_2O)BrCl]$.
Y is the number of optically inactive isomer(s) exhibited by $[CrCl_2(ox)_2]^{3-}$
Z is the number of geometrical isomers exhibited by $[Co(NH_3)_3(NO_2)_3]$.
The value of X + Y + Z is ____.

Q18. 28 January Shift 2

The correct increasing order of spin-only magnetic moment values of the complex ions $[MnBr_4]^{2-}$(A), $[Cu(H_2O)_6]^{2+}$(B), $[Ni(CN)_4]^{2-}$(C) and $[Ni(H_2O)_6]^{2+}$(D) is :

(1) C = D < B < A

(2) C < B < D < A

(3) A = B < D < C

(4) $A = B < C < D$

Q19. 28 January Shift 2

The number of isoelectronic species among Sc^{3+}, Cr^{2+}, Mn^{3+}, Co^{3+} and Fe^{3+} is ' n'. If ' n' moles of AgCl is formed during the reaction of complex with formula $CoCl_3(en)_2NH_3$ with excess of $AgNO_3$ solution, then the number of electrons present in the t_{2g} orbital of the complex is ____.

ANSWER KEYS

1. (1)	**2.** (1)	**3.** 7	**4.** (2)	**5.** (3)	**6.** (3)	**7.** (4)	**8.** 2
9. (2)	**10.** 2	**11.** (3)	**12.** (1)	**13.** (2)	**14.** (2)	**15.** 3	**16.** (1)
17. 6	**18.** (2)	**19.** 6					