**Q1 2021 (01 Sep Shift 2)**

The sum of oxidation states of two silver ions in $\left[Ag(NH_3)_2\right]\left[Ag(CN)_2\right]$ complex is ____.

**Q2 2021 (01 Sep Shift 2)**

The Crystal Field Stabilization Energy (CFSE) and magnetic moment (spin-only) of an octahedral aqua complex of a metal ion $\left(M^{2+}\right)$ are $-0.8\Delta_0$ and 3.87 BM, respectively. Identify $\left(M^2\right)$ :

(1) $V^{3+}$

(2) $Cr^{3+}$

(3) $Mn^{4+}$

(4) $Co^{2+}$

**Q3 2021 (31 Aug Shift 2)**

Spin only magnetic moment in BM of $[Fe(CO)_4\,(C_2O_4)]^+$ is :

(1) 5.92

(2) 0

(3) 1

(4) 1.73

**Q4 2021 (31 Aug Shift 1)**

The denticity of an organic ligand, biuret is :

(1) 2

(2) 4

(3) 3

(4) 6

**Q5 2021 (27 Aug Shift 2)**

The number of optical isomers possible for $\left[Cr(C_2O_4)_3\right]^{3-}$ is ____.

**Q6 2021 (27 Aug Shift 2)**

The addition of dilute NaOH to $Cr^{3+}$ salt solution will give :

(1) a solution of $[Cr(OH)_4]^-$

(2) precipitate of $Cr_2O_3(H_2O)_n$

(3) precipitate of $[Cr(OH)_6]^{3-}$

(4) precipitate of $Cr(OH)_3$

**Q7 2021 (27 Aug Shift 1)**

1 mol of an octahedral metal complex with formula $MCl_3 \cdot 2\ L$ on reaction with excess of $AgNO_3$ gives 1 mol of AgCl. The denticity of Ligand L is ____. (Integer answer)

**Q8 2021 (27 Aug Shift 1)**

Acidic ferric chloride solution on treatment with excess of potassium ferrocyanide gives a Prussian blue coloured colloidal species. It is :

(1) $Fe_4[Fe(CN)_6]_3$

(2) $K_5Fe[Fe(CN)_6]_2$

(3) $HFe\,[Fe(CN)_6]$

(4) $KFe\,[Fe(CN)_6]$

**Q9 2021 (26 Aug Shift 2)**

The overall stability constant of the complex ion $[Cu(NH_3)_4]^{2+}$ is $2.1 \times 10^{13}$. The overall dissociations constant is $y \times 10^{-14}$. Then y is ____ .(Nearest integer)

**Q10 2021 (26 Aug Shift 2)**

Arrange the following Cobalt complexes in the order of increasing Crystal Field Stabilization Energy (CFSE) value.

Complexes : $[CoF_A]^{3-}$, $[Co(H_2O)_6]^{2+}$, $[Co(NH_3)_6]^{3+}$ and $[Co(en)_3]^{3+}$

Choose the *correct* option :

(1) $A < B < C < D$

(2) $B < A < C < D$

(3) $B < C < D < A$

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

**Q11 2021 (26 Aug Shift 2)**

Indicate the complex/complex ion which did not show any geometrical isomerism :

(1) $[CoCl_2(en)_2]$

(2) $[Co(CN)_5(NC)]^{3-}$

(3) $[Co(NH_3)_3(NO_2)_3]$

(4) $[Co(NH_3)_4Cl_2]^+$

**Q12 2021 (26 Aug Shift 1)**

Which one of the following complexes is violet in colour?

(1) $[Fe(CN)_6]^{4-}$

(2) $[Fe(SCN)_6]^{4-}$

(3) $Fe_4[Fe(CN_6)]_3 \cdot H_2O$

(4) $[Fe(CN)_5NOS]^4$

# Answer Key

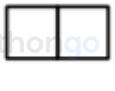
| | | | |
|---|---|---|---|
| **Q1** (2) | **Q2** (4) | **Q3** (4) | **Q4** (1) |
| **Q5** (2) | **Q6** (2) | **Q7** (2) | **Q8** (4) |
| **Q9** (5) | **Q10** (2) | **Q11** (2) | **Q12** (4) |

**Q1 (2)**

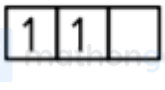
$[Ag(NH_3)_2]^+$ $[Ag(CN)_2]^-$

$+1$ $+1$

**Q2 (4)**

$V^{3+} \Rightarrow$  $e_g$

$= 2 \times 0.4\Delta_0$

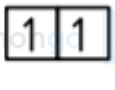


$t_{2g}$

$= -0.8\Delta_0$

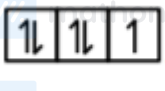
$= 2$ unpaired $e^-$

$\mu = 2.89 \text{Bm}$

$Co^{2+} \Rightarrow$  $e_g$

$[2 \times 0.6\Delta_0 - 5 \times 0.4\Delta_0]$

$= -0.8\Delta_0$



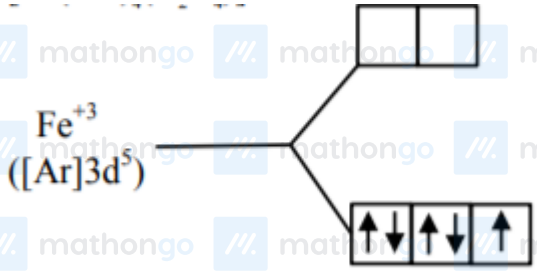
$t_{2g}$

3 unpaired $e^- \Rightarrow \mu = 3.87$ BM

hence $d^7$ configuration is of $Co^{2+}$ Ans.

**Q3 (4)**

$[Fe(CO)_4(C_2O_4)]^+$

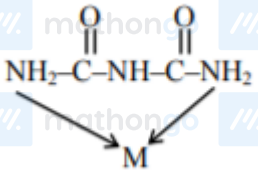



One unpaired electron

Spin only magnetic moment

$= \sqrt{3}\,B \cdot M. = 1.73BM$

**Q4 (1)**

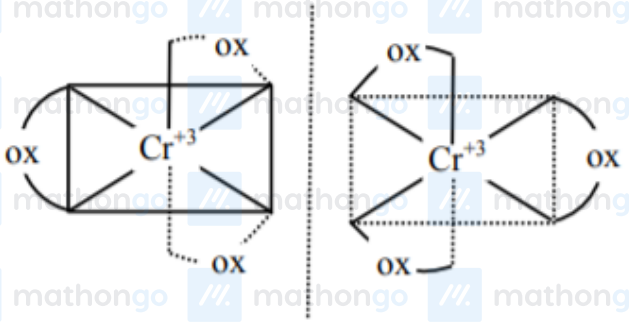



Biuret :- Bidentate ligand

The denticity of organic ligand is 2 .

**Q5 (2)**

The number of optical isomers for $\left[Cr(C_2O_4)_3\right]^{3-}$ is two.




**Q6 (2)**

$$Cr^{3+} + \underset{\text{dil.}}{NaOH} \longrightarrow \underset{\text{precipitate}}{Cr_2O_3.(H_2O)_n}$$

**Q7 (2)**

$MCl_3.2\ L$ octahedral

$\underset{1\text{ mole}}{MCl_3.2\ L} \xrightarrow{Ex.AgNO_3} 1$ mole of AgCl

Its means that one $Cl^-$ ion present in ionization sphere.

$\therefore$ formula $= [MCl_2\ L_2]\ Cl$

For octahedral complex coordination no. is 6

$\therefore$ L act as bidentate ligand

**Q8 (4)**

$FeCl_3 + K_4\ [Fe(CN)_6]$( excess )

$\downarrow$

$KFe\ [Fe(CN)_6]$

Colloidal species

**Q9 (5)**

Given $k_f = 2.1 \times 10^{13}$

$K_d = \frac{1}{k_f} = 4.7 \times 10^{-14}$

$\therefore y = 4.7 \approx 5$

**Q10 (2)**

(i) CFSE $\propto$ charge or oxidation no. of central metal ion.

(ii) CFSE $\propto$ strength of ligand

$en > NH_3 > H_2O > F^-$

$\therefore$ order of CFSE

$$[\overset{III}{Co}(en)_3]^{+3} > \overset{III}{Co}(NH_3)_6]^{+3} > [\overset{III}{CoF_6}]^{-3} > [\overset{II}{Co}(H_2O)_6]^{+2}$$

**Q11 (2)**

(1) $[CoCl_2(en)_2]$ show

Cis-trans isomerism

(2) $[Co(CN)_5(NC)]^{-3}$ can't

Show G.I.

(3) $\left[Co(NH_3)_3(NO_2)_3\right]$

Show fac & mer isomerism

(4) $\left[Co(NH_3)_4Cl_2\right]^{\oplus}$ show cis & trans isomerism

**Q12 (4)**

(1) $[Fe(CN)_6]^{4-} \rightarrow$ Pale yellow solution

(2) $[Fe(SCN)_6]^4 \rightarrow$ Blood red colour

(3) $Fe_4[Fe(CN_6)]_3 \cdot H_2O \rightarrow$ Prussian blue

(4) $[Fe(CN)_5NOS]^{4-} \rightarrow$ Violet colour