CHAPTER - 17
COORDINATION COMPOUNDS

1. 2 Primary valence = Oxidation number = +3

   Secondary valence = Co-ordination number = 6

2. 2 NO_2^- and SCN^- are ambidentate ligands

3. 2 The correct name is potassium trioxalatochromate (III)

4. 4 The given complex can show geometrical as well as ionisation isomerism. It cannot show linkage and optical isomerism

5. 4 Compounds 1, 2 and 3 are optically inactive since they possess plane of symmetry

6. 1

Complex	Hybridisation
A	d^2sp^3
B	dsp^2
C	sp^3d^2
D	sp^3d^2

7. 1 $[CoF_6]^{3-}$ has sp^3d^2 hybridisation. Thus it uses 4d orbitals for hybridisation

8. 1 Complex (1) has d^2sp^3 hybridisation with Fe^{3+} $(3d^5)$ central metal. Thus it is both inner orbital and paramagnetic in nature.

9. 4 Mn^{3+} in strong octahedral field

   $\therefore$ configuration is, $t_{2g}^4 e_g^0$

10. 4 Valence bond theory cannot predict exactly the structure of 4-co-ordinate complexes

11. 3 $[Ti(H_2O)_6]^{3+}$ absorbs light corresponding to the energy of blue-green region, thus appears violet in colour.

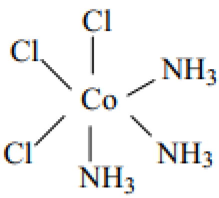
12. 2 In the tetrahedral field, $e < t_2$

$d_{x^2-y^2}$ and d_{z^2} orbitals constitute the e-set

13. 4 Ligand strength follows the order, $H_2O < NH_3 < NO_2^-$. Thus, wavelength of absorption decreases in the order $\left[Ni(H_2O)_6\right]^{2+} > \left[Ni(NH_3)_6\right]^{2+} > \left[Ni(NO_2)_6\right]^{4-}$

14. 4 Wilkinson's catalyst is $[Rh(PPh_3)_3Cl]$

15. 3 [Mabcd] type square planar complex has three geometrical isomers

16. 3 

It contains three Cl–Co–Cl angles at 90°

17. 4

$$[CoBr(NH_3)_5]SO_4 \longrightarrow [CoBr(NH_3)_5]^{2+} + SO_4^{2-}$$

$$[Co(SO_4)(NH_3)_5]Br \longrightarrow [Co(SO_4)(NH_3)_5]^{+} + Br^{-}$$

molar conductivity of compounds given in option (4) will differ greatly in magnitude as their constituent ions have different magnitude of charges.

18. 1

Millimoles of $Cl^{\ominus}$ liberated = millimoles of NaOH consumed

$= 28.5\ mL \times 0.125\ N$

$= 3.5625$ mmol

Millimoles of complex present $= \frac{0.319}{266.5} \times 10^{3} = 1.197$ mmol

$\therefore$ Moles of $Cl^{\ominus}$ liberated from one mole of complex is, $\frac{3.5625}{1.197} \approx 3$ mol

Thus, formula of the complex is $[Cr(H_2O)_6]Cl_3$.

19. C Geometrical isomerism is possible in complexes (iii), (iv), (v) and (vi).

20. ABCD Synergic bonding is present in metal carbonyls.
As positive oxidation state of metal decreases, metal to ligand backbonding increases, thus M–C bond order increases and C–O bond order decreases.

21. BCD $[Co(NH_3)_5(NO_2)]Cl_2$ is yellow and $[Co(NH_3)_5(ONO)]Cl_2$ is red in colour

22. ABD $[Ni(CN)_4]^{2-}$ is square planar. All other complexes are tetrahedral

23. ABD Correct electronic configuration of Fe in $[FeCl_4]^-$ is $e^2 t_2^3$.

24. 5.91-5.96

$$\Delta H_1^\circ - T\Delta S_1^\circ = -RT\ln K_1$$
$$\Delta H_2^\circ - T\Delta S_2^\circ = -RT\ln K_2$$

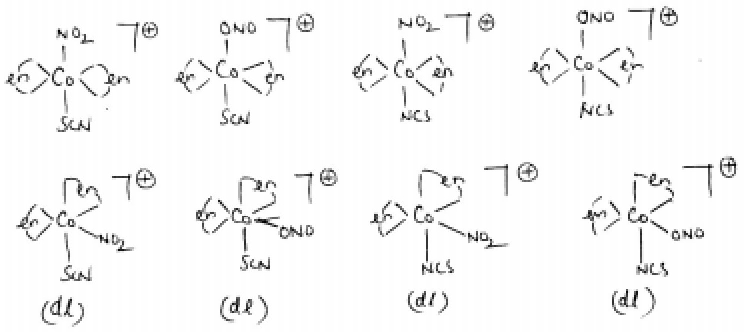
$$T\left(\Delta S_2^\circ - \Delta S_1^\circ\right) = RT\ln\frac{K_2}{K_1}$$

or $$\Delta S_2^\circ - \Delta S_1^\circ = 2.303\,R\log\frac{K_2}{K_1} = 2.303\times 8.314\times\log\left(2\times 10^9\right) = 30x$$

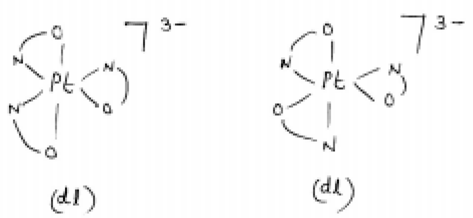
$$\Rightarrow x = 5.94$$

25. 16

12 isomers are possible for $[Co(en)_2(NO_2)(SCN)]^+$



4 isomers are possible for $[Pt(Gly)_3]^{3-}$



26. 8

There are two Co–N and four Co–O bonds in $[Co(EDTA)]^-$. Thus, a total of eight N–Co–O bond angles are present.

27. 480

$[Ti(H_2O)_6]^{3+}, \left(Ti^{3+} = 3d^1\right)$

$$CFSE = -0.4 \times \Delta_0 = -\frac{96 \times 10^3}{N_0}$$

$$\Delta_0 = \frac{96 \times 10^3}{0.4 \times 6 \times 10^{23}}; \qquad \text{But } \Delta_0 = \Delta E = h\frac{c}{\lambda}$$

$$\therefore \frac{hc}{\lambda} = \frac{96 \times 10^3}{0.4 \times 6 \times 10^{23}}; \qquad \lambda = \frac{0.4 \times 6 \times 10^{23} \times 6.4 \times 10^{-34} \times 3 \times 10^8}{96 \times 10^3}$$

$$= 0.48 \times 10^{-6}\, m = 480 \times 10^{-9}\, m = 480\, nm$$

28. C Order of absorption of energy is : $\overline{IV} > I > II > \overline{III}$

29.

Complex	No. of unpaired electrons
I	Zero
II	Two
III	Zero
IV	Four

So, answer must be, $I \rightarrow S$, $II \rightarrow R$, $III \rightarrow S$, $IV \rightarrow P$.