

NATIONAL ACADEMY FOR LEARNING, BENGALURU
CHEMISTRY

Grade: 12 ISC

Type of Assessment: WS

Topic: Coordination compounds

1. Outer orbital complexes involve _____ hybridization and are _____ spin complexes.
2. The type of hybridization involved in Octahedral complexes is:
3. In coordination complexes, the central metal atom or ion behaves as _____ and the ligands behave as _____. (Lewis base, Lewis acid)
4. The coordination number and oxidation state of the complex $K_4[Fe(CN)_6]$ are ----- and ----- respectively.
5. The number of ions that will be produced when potassium ferrocyanide, $K_4[Fe(CN)_6]$, dissolves in water is _____. This shows that _____ is the ligand in the coordination compound.
6. Crystal field splitting energy (CFSE) for high spin d^4 octahedral complex is:
(a) $-1.6 \Delta_o$ (b) $-1.2 \Delta_o$ (c) $-0.8 \Delta_o$ (d) $-0.6 \Delta_o$
7. For the complex ion $[Fe(CN)_6]^{3-}$, state:
 - a. the type of hybridisation.
 - b. the magnetic behaviour.
 - c. the oxidation number of the central metal atom.
8. Write the IUPAC name of $[Co(en)_2Cl_2]^+$ ion and draw the structures of its geometrical isomers.
9. When a coordination compound $CoCl_3 \cdot 6NH_3$ is mixed with $AgNO_3$, three moles of $AgCl$ are precipitated per mole of the compound. Write the structural formula and IUPAC name of the coordination compound.
10. Write the formula of each of the following compounds:
 - a. Potassium trioxalatoaluminate (III)
 - b. Triammine triaquachromium (III) chloride
11. Write the IUPAC names of the following:
 - a. $K_3[Fe(C_2O_4)_3]$
 - b. $[Co(NH_3)_5Cl]SO_4$
 - c. $[Cu(NH_3)_4]SO_4$
 - d. $[Co(en)_2Cl_2]$
 - e. $K_3[Al(C_2O_4)_3]$
 - f. $[Pt Cl_2 (NH_3)_4] Br_2$
 - g. $[Co(NH_3)_4(H_2O)_2]Cl_3$
 - h. $K_2[Ni(CN)_4]$
12. Name of the type of isomerism exhibited by the following pairs of compounds:
 - a. $[Co(ONO)(NH_3)_5]^{2+}$ and $[Co(NO_2)(NH_3)_5]^{2+}$
 - b. $[Cr(H_2O)_4Cl_2] \cdot 2H_2O$ and $[Cr(H_2O)_5Cl]Cl_2 \cdot H_2O$
 - c. $[Co(NH_3)_6] [Cr(CN)_6]$ and $[Cr(NH_3)_6] [Co(CN)_6]$

- d. $[\text{Pt Cl}_2 (\text{NH}_3)_4] \text{Br}_2$ and $[\text{Pt Br}_2 (\text{NH}_3)_4] \text{Cl}_2$
- e. $[\text{CoCl}_2 (\text{NH}_3)_4] \text{Cl} \cdot \text{H}_2\text{O}$ and $[\text{CoCl} (\text{H}_2\text{O}) (\text{NH}_3)_4] \text{Cl}_2$
- f. $[\text{Cr} (\text{NH}_3)_5 \text{Br}] \text{SO}_4$ and $[\text{Cr} (\text{NH}_3)_5 \text{SO}_4] \text{Br}$
- g. $[\text{Pt} (\text{H}_2\text{O})_4 \text{Cl}_2] \text{Cl}_2 \cdot \text{H}_2\text{O}$ and $[\text{Pt} (\text{H}_2\text{O})_3 \text{Cl}_3] \text{Cl} \cdot 2\text{H}_2\text{O}$
- h. $[\text{Co} (\text{NH}_3)_4 \text{Cl}_2] \text{Br}_2$ and $[\text{Co} (\text{NH}_3)_4 \text{Br}_2] \text{Cl}_2$
- i. $[\text{Cr} (\text{H}_2\text{O})_5 (\text{SCN})] \text{Cl}_2$ and $[\text{Cr} (\text{H}_2\text{O})_5 (\text{NCS})] \text{Cl}_2$

13. Using the valence bond approach, predict the shape, hybridisation and magnetic behaviour of $[\text{Ni} (\text{CO})_4]$. (at. no. of Ni = 28)

14. What type of isomers are $[\text{Co} (\text{NH}_3)_5 \text{Br}] \text{SO}_4$ and $[\text{Co} (\text{NH}_3)_5 \text{SO}_4] \text{Br}$? Give a chemical test to distinguish between the two isomers.

15. Write the structures of optical isomers of the complex ion $[\text{Co} (\text{en})_2 \text{Cl}_2]^+$.

16. Write the IUPAC name of the complex $[\text{Cr} (\text{NH}_3)_4 \text{Cl}_2]^+$. Which type of isomerism will be exhibited by it?

17. For the complex ion $[\text{Co} (\text{NH}_3)_6]^{3+}$, state the oxidation state of central metal atom and the coordination number of the complex ion.

18. $[\text{Fe} (\text{CN})_6]^{4-}$ is a coordination complex ion. (atomic number of Fe = 26)

- a. Calculate the oxidation number of iron in the complex.
- b. Is the complex ion diamagnetic or paramagnetic?
- c. What is the hybridisation state of the central metal atom?
- d. Write the IUPAC name of the complex ion.

19. With reference to the coordination complex ion $[\text{Fe} (\text{H}_2\text{O})_6]^{2+}$ answer the following:

- a. Give the IUPAC name of the complex ion.
- b. What is the oxidation number of the central metal atom?
- c. How many unpaired electrons are there in the complex ion?
- d. State the type of hybridisation of the complex ion.

20. Consider the complex ion $[\text{Co} (\text{CN})_6]^{3-}$ and answer the following questions:

(atomic number of Co = 27)

- a. Type of hybridisation of central metal atom
- b. Magnetic nature
- c. Geometry of the complex ion
- d. Low spin complex or high spin complex

21(i) When one mole of an isomer of the complex $[\text{Cr} (\text{H}_2\text{O})_6] \text{Cl}_3$ is treated with AgNO_3 , it produces 1 mole of a white precipitate of AgCl . Write the formula of this isomer of the complex and show how the metal-ligand bonding differs in the isomers.

(ii) A coordination compound shows d^2sp^3 hybridisation. Identify the nature of ligand as weak or strong. What will be the geometry of the compound?