



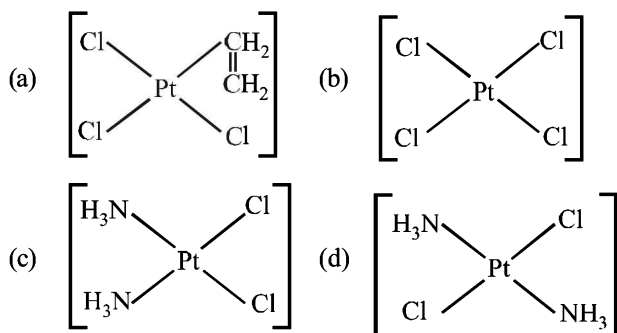
## Conceptual MCQs

- Which of the following is formed when *n*-butyl lithium reacts with tin (II) chloride?
  - LiBr
  - Et<sub>4</sub>Pb
  - (C<sub>4</sub>H<sub>9</sub>)<sub>4</sub>Sn
  - (C<sub>2</sub>H<sub>5</sub>)<sub>4</sub>Pb
- K<sub>3</sub>[Al(C<sub>2</sub>O<sub>4</sub>)<sub>3</sub>] is called :
  - Potassium aluminooxalate
  - Potassium trioxalatoaluminate (III)
  - Potassium aluminium (III) oxalate
  - Potassium trioxalatoaluminate (VI)
- Complex salt can be made by the combination of [Co<sup>III</sup>(NH<sub>3</sub>)<sub>5</sub>Cl]X with :
  - PO<sub>4</sub><sup>3-</sup>
  - Cl<sup>-</sup>
  - 2Cl<sup>-</sup>
  - 2K<sup>+</sup>
- The formula for the complex, dichlorobis (urea) copper (II) is :
  - [Cu{O=C(NH<sub>2</sub>)<sub>2</sub>}]Cl<sub>2</sub>
  - [Cu{O=C(NH<sub>2</sub>)<sub>2</sub>}Cl]Cl
  - [CuCl<sub>2</sub>{O=C(NH<sub>2</sub>)<sub>2</sub>}<sub>2</sub>]
  - [CuCl<sub>2</sub>][{O=C(NH<sub>2</sub>)<sub>2</sub>}]<sub>2</sub>
- Among the following which are ambidentate ligands?
  - NO<sub>2</sub><sup>-</sup>
  - NO<sub>3</sub><sup>-</sup>
  - EDTA<sup>4-</sup>
  - C<sub>2</sub>O<sub>4</sub><sup>2-</sup>
  - SCN<sup>-</sup>
  - H<sub>2</sub>NCH<sub>2</sub>CH<sub>2</sub>NH<sub>2</sub>
  - (i) and (ii)
  - (iii) and (iv)
  - (i) and (vi)
  - (i) and (v)
- The oxidation state of Cr in [Cr(NH<sub>3</sub>)<sub>4</sub>Cl<sub>2</sub>]<sup>+</sup> is :
  - 0
  - +1
  - +2
  - +3
- The value of *x* in [Cr(H<sub>2</sub>O)<sub>6</sub>]<sup>x</sup> is :
  - +3
  - +2
  - +4
  - +6
- K<sub>4</sub>[Fe(CN)<sub>6</sub>] is a :
  - double salt
  - complex compound
  - acid
  - base
- [Co(CN)<sub>6</sub>]<sup>3-</sup>, a complex ion of cobalt (III), absorbs radiations in violet region of the visible light. Its aqueous solution, therefore, appears :
  - Pink
  - Orange
  - Blue
  - Yellow
- The EAN of iron in potassium ferricyanide is :
  - 18
  - 54
  - 35
  - 23
- Which one of the following will give a white precipitate with AgNO<sub>3</sub> in aqueous medium?
  - [Co(NH<sub>3</sub>)<sub>5</sub>Cl](NO<sub>2</sub>)<sub>2</sub>
  - [Pt(NH<sub>3</sub>)<sub>2</sub>Cl<sub>2</sub>]
  - [Pt(en)Cl<sub>2</sub>]
  - [Pt(NH<sub>3</sub>)<sub>4</sub>]Cl<sub>2</sub>
- [Sc(H<sub>2</sub>O)<sub>6</sub>]<sup>3+</sup> ion is :
  - colourless and diamagnetic
  - coloured and octahedral
  - colourless and paramagnetic
  - coloured and paramagnetic
- Which of the following complex ion has least stability?
  - [Co(CN)<sub>6</sub>]<sup>3-</sup>
  - [Co(NH<sub>3</sub>)<sub>6</sub>]<sup>2+</sup>
  - [Co(NH<sub>3</sub>)<sub>6</sub>]<sup>3+</sup>
  - [Co(CO)<sub>6</sub>]<sup>3+</sup>
- The compound which is not coloured is :
  - K<sub>4</sub>[Fe(CN)<sub>6</sub>]
  - K<sub>3</sub>[Fe(CN)<sub>6</sub>]
  - Na<sub>2</sub>[CdCl<sub>4</sub>]
  - Na<sub>2</sub>[CuCl<sub>4</sub>]
- Octahedral complex  $\begin{matrix} a \\ \diagdown \\ M \\ \diagup \\ a \end{matrix} \begin{matrix} b \\ \diagdown \\ M \\ \diagup \\ b \end{matrix}$  is :
  - cis*
  - trans*
  - mer*
  - fac*



## Application Based MCQs

16. Which of the following pairs represent linkage isomers?
- (a)  $[\text{Pd}(\text{PPh}_3)_2(\text{NCS})_2]$  and  $[\text{Pd}(\text{PPh}_3)_2(\text{SCN})_2]$   
 (b)  $[\text{Co}(\text{NH}_3)_5\text{NO}_3]\text{SO}_4$  and  $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{NO}_3$   
 (c)  $[\text{PtCl}_2(\text{NH}_3)_4]\text{Br}_2$  and  $[\text{PtBr}_2(\text{NH}_3)_4]\text{Cl}_2$   
 (d)  $[\text{Cu}(\text{NH}_3)_4][\text{PtCl}_4]$  and  $[\text{Pt}(\text{NH}_3)_4][\text{CuCl}_4]$
17. According to IUPAC nomenclature sodium nitroprusside is named as
- (a) Sodium pentacyanonitrosylferrate (III)  
 (b) Sodium nitroferrocyanide  
 (c) Sodium nitroferricyanide  
 (d) Sodium pentacyanonitrosylferrate (II)
18. Which of the following facts about the complex  $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$  is wrong?
- (a) The complex involves  $d^2sp^3$  hybridisation and is octahedral in shape.  
 (b) The complex is paramagnetic.  
 (c) The complex is an outer orbital complex.  
 (d) The complex gives white precipitate with silver nitrate solution.
19. The total number of possible isomers for the complex compound  $[\text{Cu}^{\text{II}}(\text{NH}_3)_4][\text{Pt}^{\text{II}}\text{Cl}_4]$
- (a) 3      (b) 6      (c) 5      (d) 4
20. The octahedral complex of a metal ion  $\text{M}^{3+}$  with four monodentate ligands  $\text{L}_1, \text{L}_2, \text{L}_3$  and  $\text{L}_4$  absorb wavelengths in the region of red, green, yellow and blue, respectively. The increasing order of ligand strength of the four ligands is:
- (a)  $\text{L}_4 < \text{L}_3 < \text{L}_2 < \text{L}_1$       (b)  $\text{L}_1 < \text{L}_3 < \text{L}_2 < \text{L}_4$   
 (c)  $\text{L}_3 < \text{L}_2 < \text{L}_4 < \text{L}_1$       (d)  $\text{L}_1 < \text{L}_2 < \text{L}_4 < \text{L}_3$
21. Which of the following is considered to be an anticancer species ?



22. On treatment of 100 mL of 0.1 M solution of  $\text{CoCl}_3 \cdot 6\text{H}_2\text{O}$  with excess  $\text{AgNO}_3$ ;  $1.2 \times 10^{22}$  ions are precipitated. The complex is :
- (a)  $[\text{Co}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl} \cdot 2\text{H}_2\text{O}$  (b)  $[\text{Co}(\text{H}_2\text{O})_3\text{Cl}_3] \cdot 3\text{H}_2\text{O}$   
 (c)  $[\text{Co}(\text{H}_2\text{O})_6]\text{Cl}_3$  (d)  $[\text{Co}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$
23. Which has maximum paramagnetic nature ?
- (a)  $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$  (b)  $[\text{Cu}(\text{NH}_3)_4]^{2+}$   
 (c)  $[\text{Fe}(\text{CN})_6]^{4-}$  (d)  $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$
24. The reaction  $[\text{Fe}(\text{CNS})_6]^{3-} \rightarrow [\text{FeF}_6]^{3-}$  take place with :
- (a) decrease in magnetic moment  
 (b) increase in magnetic moment  
 (c) decrease in co-ordination number  
 (d) increase in co-ordination number
25. Which one of the following complexes is an outer orbital complex ?
- (a)  $[\text{Co}(\text{NH}_3)_6]^{3+}$  (b)  $[\text{Mn}(\text{CN})_6]^{4-}$   
 (c)  $[\text{Fe}(\text{CN})_6]^{4-}$  (d)  $[\text{Ni}(\text{NH}_3)_6]^{2+}$   
 (Atomic nos. : Mn = 25; Fe = 26; Co = 27, Ni = 28)
26. Given the molecular formula of the hexa coordinated complexes (A)  $\text{CoCl}_3 \cdot 6\text{NH}_3$  (B)  $\text{CoCl}_3 \cdot 5\text{NH}_3$  (C)  $\text{CoCl}_3 \cdot 4\text{NH}_3$ . If the number of co-ordinated  $\text{NH}_3$  molecules in A, B and C respectively are 6, 5 and 4, the primary valency in (A), (B) and (C) are :
- (a) 6, 5, 4 (b) 3, 2, 1 (c) 0, 1, 2 (d) 3, 3, 3
27. Which of the following does **not** have a metal- carbon bond?
- (a)  $\text{Al}(\text{OC}_2\text{H}_5)_3$  (b)  $\text{C}_2\text{H}_5\text{MgBr}$   
 (c)  $\text{K}[\text{Pt}(\text{C}_2\text{H}_4)\text{Cl}_3]$  (d)  $\text{Ni}(\text{CO})_4$
28. For the given complex  $[\text{CoCl}_2(\text{en})(\text{NH}_3)_2]^+$ , the number of geometrical isomers, the number of optical isomers and total number of isomers of all possible type respectively are :
- (a) 3, 2 and 4 (b) 3, 2 and 3  
 (c) 2, 0 and 2 (d) 0, 2 and 2
29. In  $\text{Fe}(\text{CO})_5$ , the Fe – C bond possesses :
- (a) ionic character (b)  $\sigma$ -character only  
 (c)  $\pi$ -character (d) both  $\sigma$  and  $\pi$  characters
30. The correct order for the wavelength of absorption in the visible region is :
- (a)  $[\text{Ni}(\text{NO}_2)_6]^{4-} < [\text{Ni}(\text{NH}_3)_6]^{2+} < [\text{Ni}(\text{H}_2\text{O})_6]^{2+}$   
 (b)  $[\text{Ni}(\text{NO}_2)_6]^{4-} < [\text{Ni}(\text{H}_2\text{O})_6]^{2+} < [\text{Ni}(\text{NH}_3)_6]^{2+}$   
 (c)  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+} < [\text{Ni}(\text{NH}_3)_6]^{2+} < [\text{Ni}(\text{NO}_2)_6]^{4-}$   
 (d)  $[\text{Ni}(\text{NH}_3)_6]^{2+} < [\text{Ni}(\text{H}_2\text{O})_6]^{2+} < [\text{Ni}(\text{NO}_2)_6]^{4-}$

31. The  $\pi$ -bonded organometallic compound which has ethene as one of its component is :
- (a) Zeise's salt (b) Ferrocene  
(c) Dibenzene chromium (d) Tetraethyl tin
32. Which of the following compounds is colourless ?
- (a)  $\text{Cu}_2(\text{CH}_3\text{COO})_4 \cdot 2\text{H}_2\text{O}$  (b)  $\text{Cu}_2\text{Cl}_2$   
(c)  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$  (d)  $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4 \cdot 4\text{H}_2\text{O}$
33. Which of the following has an optical isomer?
- (a)  $[\text{Co}(\text{en})(\text{NH}_3)_2]^{2+}$  (b)  $[\text{Co}(\text{H}_2\text{O})_4(\text{en})]^{3+}$   
(c)  $[\text{Co}(\text{en})_2(\text{NH}_3)_2]^{3+}$  (d)  $[\text{Co}(\text{NH}_3)_3\text{Cl}]^+$
34. Which of the following may be considered to be an organometallic compound?
- (a) Nickel tetracarbonyl (b) Chlorophyll  
(c)  $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$  (d)  $[\text{Co}(\text{en})_3]\text{Cl}_3$
35. Which of the following complexes are not correctly matched with the hybridisation of their central metal ion?
- (a)  $[\text{Ni}(\text{CO})_4]sp^3$  (b)  $[\text{Ni}(\text{CN})_4]^{2-} dsp^2$   
(c)  $[\text{CoF}_6]^{3-} d^2sp^3$  (d)  $[\text{Fe}(\text{CN})_6]^{3-} d^2sp^3$
36. The number of unpaired electrons in the complex  $[\text{Cr}(\text{NH}_3)_6]\text{Br}_3$  is (Atomic number Cr = 24) :
- (a) 4 (b) 1 (c) 2 (d) 3
37. Both geometrical and optical isomerism are exhibited by :
- (a) Dichlorobis(ethylenediamine) cobalt(III) ion  
(b) Pentaamminechlorocobalt(III)  
(c) Triamminotrichlorocobalt(III) ion  
(d) Tetraamminedichlorocobalt(III) ion
38. In Grignard reagent, the carbon-magnesium bond is :
- (a) electrovalent (b) covalent  
(c) dative (d) hydrogen bonding
39. Which of the following organometallic compound is  $\sigma$  and  $\pi$  bonded?
- (a)  $[\text{Fe}(\eta^5-\text{C}_5\text{H}_5)_2]$  (b)  $\text{Fe}(\text{CH}_3)_3$   
(c)  $\text{K}[\text{PtCl}_3(\eta^2-\text{C}_2\text{H}_4)]$  (d)  $[\text{Co}(\text{CO})_5\text{NH}_3]^{2+}$
40. Coordination compounds have great importance in biological systems. In this context which of the following statements is **incorrect** ?
- (a) Cyanocobalamin is  $\text{B}_{12}$  and contains cobalt.  
(b) Haemoglobin is the red pigment of blood and contains iron.  
(c) Chlorophylls are green pigments in plants and contain calcium.  
(d) Carboxypeptidase - A is an enzyme and contains zinc.



## Skill Based MCQs

41. A solution containing 2.675 g of  $\text{CoCl}_3 \cdot 6\text{NH}_3$  (molar mass =  $267.5 \text{ g mol}^{-1}$ ) is passed through a cation exchanger. The chloride ions obtained in solution were treated with excess of  $\text{AgNO}_3$  to give 4.78 g of  $\text{AgCl}$  (molar mass =  $143.5 \text{ g mol}^{-1}$ ). The formula of the complex is : (At. mass of Ag = 108 u)
- (a)  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$  (b)  $[\text{CoCl}_2(\text{NH}_3)_4]\text{Cl}$   
(c)  $[\text{CoCl}_3(\text{NH}_3)_3]$  (d)  $[\text{CoCl}(\text{NH}_3)_5]\text{Cl}_2$
42. Isomerism exhibited by  $[\text{Cr}(\text{NH}_3)_2(\text{H}_2\text{O})_2\text{Cl}_2]^+$  are –
- (a) ionization, optical  
(b) hydrate, optical  
(c) geometrical, optical  
(d) coordinate, geometrical
43. Two complexes  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  (A) and  $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$  (B) are violet and yellow coloured, respectively. The incorrect statement regarding them is:
- (a)  $\Delta_0$  values of (A) and (B) are calculated from the energies of violet and yellow light, respectively.  
(b) both are paramagnetic with three unpaired electrons.  
(c) both absorb energies corresponding to their complementary colors.  
(d)  $\Delta_0$  value for (A) is less than that of (B).
44. A complex cation is formed by Pt (in some oxidation state) with ligands (in proper number so that coordination number of Pt becomes six). Which of the following can be its correct IUPAC name ?
- (a) Diammineethylenediaminedithiocyanato-S-platinum (II)  
(b) Diammineethylenediaminedithiocyanato-S-platinate (IV) ion  
(c) Diammineethylenediaminedithiocyanato-S-platinum (IV) ion  
(d) Diamminebis(ethylenediamine) dithiocyanato-S-platinum (IV) ion
45. The correct order of the spin-only magnetic moment of metal ions in the following low-spin complexes,  $[\text{V}(\text{CN})_6]^{4-}$ ,  $[\text{Fe}(\text{CN})_6]^{4-}$ ,  $[\text{Ru}(\text{NH}_3)_6]^{3+}$ , and  $[\text{Cr}(\text{NH}_3)_6]^{2+}$ , is
- (a)  $\text{Cr}^{2+} > \text{Ru}^{3+} > \text{Fe}^{2+} > \text{V}^{2+}$   
(b)  $\text{V}^{2+} > \text{Cr}^{2+} > \text{Ru}^{3+} > \text{Fe}^{2+}$   
(c)  $\text{V}^{2+} > \text{Ru}^{3+} > \text{Cr}^{2+} > \text{Fe}^{2+}$   
(d)  $\text{Cr}^{2+} > \text{V}^{2+} > \text{Ru}^{3+} > \text{Fe}^{2+}$

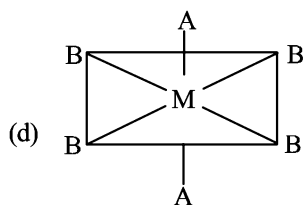
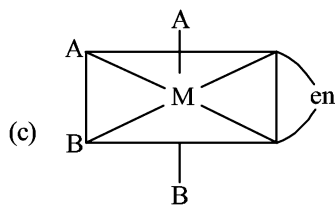
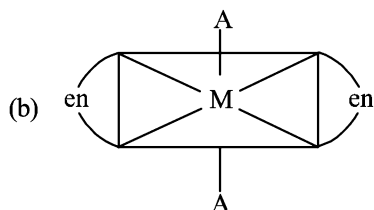
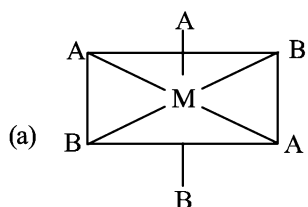
46. The coordination numbers of Co and Al in  $[\text{Co}(\text{Cl})(\text{en})_2]\text{Cl}$  and  $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3]$ , respectively, are :

(en = ethane-1, 2-diamine)

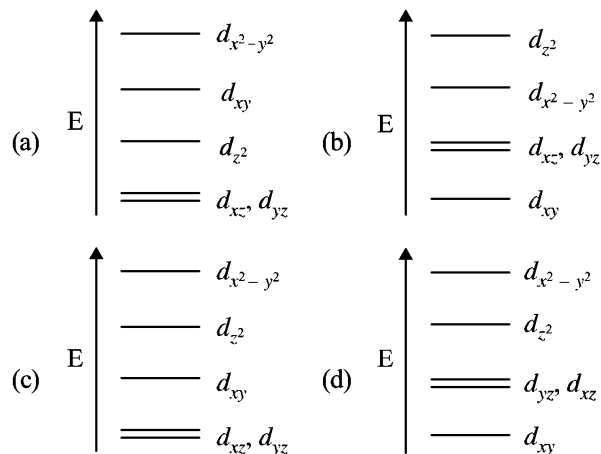
- (a) 5 and 3                      (b) 3 and 3  
(c) 6 and 6                      (d) 5 and 6

47. The one that will show optical activity is:

(en = ethane 1, 2-diamine)



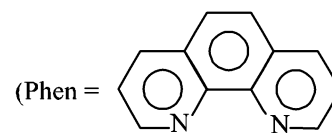
48. Complete removal of both the axial ligands (along the z-axis) from an octahedral complex leads to which of the following splitting patterns? (relative orbital energies not on scale)



49. Three complexes,  $[\text{CoCl}(\text{NH}_3)_5]^{2+}$  (I),  $[\text{Co}(\text{NH}_3)_5\text{H}_2\text{O}]^{3+}$  (II) and  $[\text{Co}(\text{NH}_3)_6]^{3+}$  (III) absorb light in the visible region. The correct order of the wavelength of light absorbed by them is :

- (a) (III) > (I) > (II)                      (b) (III) > (II) > (I)  
(c) (II) > (I) > (III)                      (d) (I) > (II) > (III)

50. The complex ion that will lose its crystal field stabilization energy upon oxidation of its metal to +3 state is :



and  
ignore pairing energy)

- (a)  $[\text{Co}(\text{phen})_3]^{2+}$                       (b)  $[\text{Ni}(\text{phen})_3]^{2+}$   
(c)  $[\text{Zn}(\text{phen})_3]^{2+}$                       (d)  $[\text{Fe}(\text{phen})_3]^{2+}$

### ANSWER KEY

#### Conceptual MCQs

1	(c)	3	(c)	5	(d)	7	(a)	9	(d)	11	(d)	13	(b)	15	(d)				
2	(b)	4	(c)	6	(d)	8	(b)	10	(c)	12	(a)	14	(c)						

#### Application Based MCQs

16	(a)	19	(d)	22	(d)	25	(d)	28	(a)	31	(a)	34	(b)	37	(a)	40	(c)		
17	(a)	20	(b)	23	(a)	26	(b)	29	(d)	32	(b)	35	(c)	38	(b)				
18	(c)	21	(c)	24	(b)	27	(a)	30	(a)	33	(c)	36	(d)	39	(d)				

#### Skill Based MCQs

41	(a)	42	(c)	43	(a)	44	(c)	45	(b)	46	(d)	47	(c)	48	(a)	49	(d)	50	(d)
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