DAY TWENTY FIVE

Unit Test 4

(Inorganic Chemistry)

1 Consider the following reactions.

$$Ag_2S + NaCN \longrightarrow (A)$$
$$(A) + Zn \longrightarrow (B)$$

(B) is a metal. Hence, (A) and (B) are

(a) $Na_2[Zn(CN)_4]$, Zn (b) $Na[Ag(CN)_2]$, Ag
(c) $Na_2[Ag(CN)_4]$, Ag (d) $Na_3[Ag(CN)_4]$, Ag

2 The process of isolation of metals by dissolving the ore in a suitable chemical reagent followed by precipitation of the metal by a more electropositive metal is called

➡ NCERT Exemplar

(a) hydrometallurgy (b) zone refining
(c) electrorefining (d) electrometallurgy

3 When a metal is to be extracted from its ore and the gangue associated with the ore is silica, then

(a) a basic flux is needed
(b) an acidic flux is needed
(c) both basic and acidic flux are needed
(d) neither of them is needed

4 The final step for the extraction of copper from copper pyrite in Bessemers converter involves the reaction

(a) $Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2$
(b) $4Cu_2O + FeS \longrightarrow 8Cu + FeSO_4$
(c) $2Cu_2O + FeS \longrightarrow 4Cu + Fe + SO_2$
(d) $Cu_2S + 2FeO \longrightarrow 2Cu + 2Fe + SO_2$

5 van-Arkel method of purification of metals involves converting the metal to a

(a) volatile stable compound
(b) non-volatile stable compound
(c) volatile unstable compound
(d) None of the above

6 Wolframite ore is separated from tin stone ore by the process of

(a) calcination (b) electromagnetic process
(c) roasting (d) smelting

7 Slow acting nitrogenous fertilizer among the following is

(a) $CaCN_2$ (b) NH_2CONH_2
(c) KNO_3 (d) NH_4NO_3

8 Which of the following is correct for hydrogen?

(a) It has same electronegativity as halogen
(b) It has a very high ionisation potential
(c) It is always collected at cathode
(d) It can form bonds in +1 as well as –1 oxidation state

9 Which one of the following equation depicts reducing nature of H_2O_2? ➡ NCERT Exemplar

(a) $2[Fe(CN)_6]^{4-} + 2H^+ + H_2O_2 \longrightarrow 2Fe(CN)_6]^{3-} + 2H_2O$
(b) $I_2 + H_2O_2 + 2OH^- \longrightarrow 2I^- + 2H_2O + O_2$
(c) $Mn^{2+} + H_2O_2 \longrightarrow Mn^{4+} + 2OH^-$
(d) $PbS + 4H_2O_2 \longrightarrow PbSO_4 + 4H_2O$

10 Setting of plaster of Paris is

(a) dehydration
(b) oxidation with atmospheric oxygen
(c) combination with atmospheric CO_2
(d) hydration to yield another hydrate

11 The most stable compound is ➡ NCERT Exemplar

(a) LiF (b) LiCl
(c) LiI (d) LiBr

12 In which of the following processes fused sodium hydroxide is electrolysed at 330°C temperature for extraction of sodium?

(a) Castner's process (b) Cyanide process
(c) Down's process (d) Both (b) and (c)

13 Match the items of Column I with the items of Column II and assign the correct code.

Column I		Column II	
A.	Cyanide process	1.	Ultrapure Ge
B.	Froth floatation process	2.	Dressing of ZnS
C.	Electrolytic reduction	3.	Extraction of Al
D.	Zone refining	4.	Extraction of Au
		5.	Purification of Ni

Codes

	A	B	C	D
(a)	4	2	3	1
(c)	1	2	3	4

	A	B	C	D
(b)	2	3	1	5
(d)	3	4	5	1

14 Which of the following is the poorest reducing agent?

(a) Atomic hydrogen
(b) Nascent hydrogen
(c) Dihydrogen
(d) All have same reducing strength

15 **Assertion** (A) The highest oxidation state of osmium is + 8.

Reason (R) Osmium is a 5*d*-block element.

➡ NCERT Exemplar

(a) Both A and R are correct and R is correct explanation of A
(b) Both A and R are correct but R is not correct explanation of A
(c) A is correct but R is incorrect
(d) Both A and R are incorrect

16 In the metallurgy of aluminium ➡ NCERT Exemplar

(a) Al^{3+} is oxidised to Al (*s*)
(b) graphite anode is oxidised to carbon monoxide and carbon dioxide
(c) oxidation state of oxygen changes in the reaction at anode
(d) oxidation state of oxygen changes in the overall reaction involved in the process

17 Action of conc. HNO_3 on metallic tin produces

(a) stannic nitrate (b) stannous nitrite
(c) metastannic acid (d) stannous nitrate

18 NH_3 on reaction with hypochlorite anion, can form

(a) NO (b) N_2H_4 (c) NH_4Cl (d) HNO_2

19 The pentavalency in phosphorus is more stable as compared to that of nitrogen even though they belong to the same group. It is due to

(a) inert nature of nitrogen (b) reactivity of phosphorus
(c) larger size of phosphorus atom
(d) dissimilar electronic configuration

20 Oxygen is not evolved on reaction of ozone with

(a) H_2O_2 (b) Hg (c) SO_2 (d) KI

21 Conc. HNO_3 reacts with I_2 to give

(a) HI (b) HOI (c) HIO_3 (d) HIO_4

22 Alkali metals react with water vigorously to form hydroxides and dihydrogen. Which of the following alkali metals reacts with water least vigorously? ➡ NCERT Exemplar

(a) Li (b) Na (c) K (d) Cs

23 Which one of the following oxides is ionic?

(a) MnO (b) CrO_3 (c) P_2O_5 (d) Mn_2O_7

24 What is the magnetic moment of $[FeF_6]^{3-}$?

(a) 4 BM (b) 5.49 BM (c) 2.32 BM (d) 5.92 BM

25 Spiegeleisen is an alloy of

(a) Fe, Co and Cr (b) Fe, Co and Mg
(c) Fe, Mg and C (d) Fe, C and Mn

26 The number of moles of $KMnO_4$ that will be needed to react completely with one mole of ferrous oxalate,Fe (C_2O_4) in acidic solution is

(a) 1 (b) 2/5 (c) 3/5 (d) 4/5

27 Match the following and choose the correct option.

	Column I (Complex Ion)	Column II (Hybridisation, number of unpaired electrons)
A.	$[Cr(H_2O)_6]^{3+}$	1. dsp^2, 1
B.	$[Co(CN)_4]^{2-}$	2. sp^3d^2, 5
C.	$[Ni(NH_3)_6]^{2+}$	3. d^2sp^3, 3
D.	$[MnF_6]^{4-}$	4. sp^3d^2, 2

Codes

	A	B	C	D
(a)	3	1	4	2
(b)	4	1	2	3
(c)	3	2	4	1
(d)	4	1	2	3

28 The electronic configuration of Cu (II) is $3d^9$ while that of Cu (I) is $3d^{10}$. Which of the following statement is correct? ➡ NCERT Exemplar

(a) Cu (II) is more stable
(b) Cu (II) is less stable
(c) Cu (I) and Cu (II) are equally stable
(d) Stability of Cu (I) and Cu (II) depends on the nature of Cu salts

29 Which of the following is not true for ligand metal complex?

(a) Highly charged ligand forms strong bonds
(b) Greater the ionisation potential of central metal, the stronger is the bond
(c) Larger the permanent dipole moment of ligand, the more stable is the bond
(d) Larger the ligand, the more stable is the metal ligand bond

30 The number of ions formed, when cuprammonium sulphate is dissolved in water, is

(a) zero (b) 1 (c) 2 (d) 4

31 Given molecular formula of the hexa coordinated complexes (*A*) $CoCl_3 \cdot 6NH_3$ (*B*) $CoCl_3 \cdot 5NH_3$ (*C*)$CoCl_3 \cdot 4NH_3$. If the number of coordinated NH_3 molecules in *A*, *B* and *C* respectively are 6, 5 and 4, primary valency in *A*, *B* and *C* are

(a) 0, 1, 2 (b) 3, 2, 1 (c) 6, 5, 4 (d) 3, 3, 3

32 1 mole each of H_3PO_2, H_3PO_3 and H_3PO_4 will neutralise *x* moles of NaOH, *y* moles of $Ca(OH)_2$ and *z* moles of $Al(OH)_3$ (assuming all as strong electrolytes). *x, y, z* are in the ratio of

(a) 3 : 1.5 : 1 (b) 1 : 2 : 3
(c) 3 : 2 : 1 (d) 1 : 1 : 1

33 Finely divided iron combines with CO to give

(a) $Fe(CO)_5$ (b) $Fe_2(CO)_6$
(c) $Fe(CO)_{12}$ (d) $Fe_2(CO)_9$

34 The IUPAC name of $K_2[Cr(CN)_2O_2(O)_2(NH_3)]$ is

(a) potassiumamminedicyanodioxoperoxo chromate (VI)
(b) potassiumamminecyanoperoxodioxo chromate (IV)
(c) potassiumamminecyanoperoxodioxo chromium (VI)
(d) potassiumamminecyanoperoxodioxo chromium (VI)

35 NH_3 cannot be obtained by
(a) heating of NH_4NO_3 or NH_4NO_2
(b) heating of NH_4Cl or $(NH_4)_2CO_3$
(c) heating of NH_4NO_3 with NaOH
(d) reaction of AlN or Mg_3N_2 or $CaCN_2$ with H_2O

36 What mass of CaO will be required to remove the hardness of 1000 L of water containing 1.62 g of calcium bicarbonate per litre?
(a) 0.56 g (b) 560 g (c) 162 g (d) 56 g

37 In which of the following arrangements the order is not according to the property indicated against it?
(a) Li < Mg < Ca (increasing reactivity with N_2)
(b) Be < Mg < Ca< Sr (increasing basic nature)
(c) BeO < MgO < CaO (increasing refractory properties)
(d) $BBr_3 > BCl_3 > BF_3$ (decreasing acidic nature)

38 The optically active compound of boron is
(a) borosalicylic acid (b) borax
(c) borazole (d) boron nitride

39 A black compound (*A*) in solid state is fused with KOH and $KClO_3$. The aqueous extract is green colour solution (*B*). On passing CO_2 gas through it, pink colour of (*C*) is noticed along with some black insoluble mass of *A*. The pink coloured solution is decolourised by Fe^{2+} in acidic medium. Identify *A*.
(a) MnO_2 (b) Fe_2O_3 (c) PbS (d) $ZnSO_4$

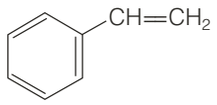
40 The dissociation of a complex may be expressed as $[ML_x]^{y+} \rightleftharpoons M^{y+} + xL$ and equilibrium constant of this dissociation is known as instability constant, which is a measure of stability. Hence, identify which of the following complexes is most stable?
(a) $[Cu(CN)_2]^-$, $K_s = 1 \times 10^{-16}$
(b) $[Fe(CN)_6]^{4-}$, $K_s = 1 \times 10^{-37}$
(c) $[Fe(CN)_6]^{3-}$, $K_s = 1 \times 10^{-44}$
(d) $[Ag(CN)_2]^-$, $K_s = 1 \times 10^{-20}$

41 Cu^{2+} has a stronger polarising power than that of Ca^{2+} because
(a) Cu^{2+} ion is smaller than Ca^{2+} ion
(b) Ca^{2+} ion has inert gas configuration whereas Cu^{2+} ion does not
(c) copper shows variable valency, calcium does not
(d) Cu^{2+} ion is smaller than Ca^{2+} ion and the *d*-electrons in Cu^{2+} ion shield the nucleus poorly

42 Magnetic moment of the complexes is zero in
(a) $[Ni(CN)_4]^{2-}$, $[Ni(CO)_4]$
(b) $[Ni(H_2O)_4]^{2+}$, $[Ni(CN)_4]^{2-}$
(c) $[Ni(H_2O)_4]^{2+}$, $[Ni(CO)_4]$
(d) $[Fe(CN)_6]^{4-}$, $[Fe(CN)_6]^{3-}$

43 Which complex gives three chloride ions per formula unit?
(a) $CrCl_3 \cdot 6H_2O$ (b) $CrCl_3 \cdot 5H_2O$
(c) $CrCl_3 \cdot 4H_2O$ (d) All of these

44 Alkaline $KMnO_4$ (Baeyer's reagent) can be used to test unsaturation in (*A*).



(*A*)

In this case
(a) unsaturation in side-chain is affected
(b) unsaturation in benzene nucleus is affected
(c) unsaturation in both is affected
(d) Baeyer's reagent cannot be used

45 The CFSE for octahedral $[CoCl_6]^{4-}$ is 18000 cm^{-1}. The CFSE for tetrahedral $[CoCl_4]^{2-}$ will be ➡ NCERT Exemplar
(a) 18000 cm^{-1} (b) 16000 cm^{-1}
(c) 8000 cm^{-1} (d) 20000 cm^{-1}

46 One mole of the complex $CoCl_3 \cdot 6H_2O$ on reaction with excess of $AgNO_3$ gives two moles of white precipitate. Thus, complex is
(a) $[Co(H_2O)_6]Cl_3$ (b) $[Co(H_2O)_5Cl]Cl_2 \cdot H_2O$
(c) $[Co(H_2O)_4Cl_2]Cl \cdot 2H_2O$ (d) $[Co(H_2O)_3Cl_3] \cdot 3H_2O$

Direction (Q. Nos. 47-50) *In the following questions Assertion* (A) *followed by Reason* (R) *is given. Choose the correct option out the following choices.*
(a) Both (A) and (R) are correct and (R) is correct explanation of (A)
(b) Both (A) and (R) are correct but (R) is not correct
(c) (A) is correct but (R) is incorrect
(d) Both (A) is and (R) are incorrect

47 **Assertion** (A) $E°$ for Mn^{3+}/Mn^{2+} is more positive than Cr^{3+}/Cr^{2+}.
Reason (R) The third ionisation energy of Mn is larger than that of Cr.

48 **Assertion** (A) $K_2Cr_2O_7$ is used as a primary standard in volumetric analysis.
Reason (R) $K_2Cr_2O_7$ has a good solubility in water.

49 **Assertion** (A) Silicones are hydrophobic in nature.
Reason (R) Si — O — Si linkages are moisture sensitive.

50 **Assertion** (A) Potassium ferrocyanide and potassium ferricyanide both are diamagnetic.
Reason (R) The former does not have any unpaired electron.

ANSWERS

1 (b)	**2** (a)	**3** (a)	**4** (a)	**5** (a)	**6** (b)	**7** (a)	**8** (d)	**9** (b)	**10** (d)
11 (a)	**12** (a)	**13** (a)	**14** (c)	**15** (b)	**16** (b)	**17** (c)	**18** (b)	**19** (c)	**20** (c)
21 (c)	**22** (a)	**23** (a)	**24** (d)	**25** (d)	**26** (c)	**27** (a)	**28** (a)	**29** (d)	**30** (c)
31 (b)	**32** (d)	**33** (a)	**34** (a)	**35** (a)	**36** (b)	**37** (c)	**38** (a)	**39** (a)	**40** (c)
41 (a)	**42** (a)	**43** (a)	**44** (a)	**45** (c)	**46** (b)	**47** (b)	**48** (d)	**49** (c)	**50** (d)

Hints and Explanations

1 $Ag_2S + NaCN \longrightarrow \underset{(A)}{Na[Ag(CN)_2]}$

$Na[Ag(CN)_2] + Zn \longrightarrow \underset{(A)}{Ag} + \underset{(B)}{Na[Ag(CN)_2]}$

Compound (*A*) and (*B*) are $Na[Ag(CN)_2]$ and Ag.

2 Hydrometallurgy is the technique used for the isolation of metals by dissolving the ore in a suitable reagent followed by the precipitation of the metal.

3 To extract a metal from its ore when a gangue associated with are is silica then a basic flux is needed.

$$\underset{\text{Acidic impurity}}{SiO_2} + \underset{\text{Basic flux}}{CaO} \longrightarrow \underset{\text{Slag}}{CaSiO_3}$$

4 In Bessemer's converter, copper sulphide is partially oxidised to cuprous oxide which further reacts with remaining copper sulphide to form copper and SO_2.

$$Cu_2S + 2Cu_2O \longrightarrow 6Cu + SO_2$$

5 $Ti + 2I_2 \xrightarrow{500\,K} \underset{\text{Volatile stable compound}}{TiI_4} \xrightarrow{1700\,K} \underset{\text{Pure metal}}{Ti} + 2I_2$

6 Wolframite ore $[FeWO_4]$ is present in tin stone as impurity and it has same mass per unit volume as that of tin stone, so it is separated by electromagnetic separation because wolframite is magnetic in nature, hence it gets attracted by magnet while tin stone does not.

7 CaNCN decomposes very slowly.

$$CaNCN + 2H_2O \longrightarrow \underset{}{CaCO_3} + NH_2CONH_2$$

$$NH_2CONH_2 + H_2O \longrightarrow CO_2 + 2NH_3$$

$$NH_3 \xrightarrow{\text{Nitrifying bacteria}} \text{Soluble nitrates} \longrightarrow \text{Plants}$$

8 Hydrogen forms bond in +1 and –1 oxidation states.

9 H_2O_2 acts as an oxidising as well as reducing agent in alkaline media. Following reaction shows the reducing action in basic medium.

$$I_2 + H_2O_2 + 2OH^- \longrightarrow 2I^- + 2H_2O + O_2$$

10 Setting of plaster of Paris is hydration process to yield another hydrate. It is an exothermic process.

$$CaSO_4 \cdot \frac{1}{2}H_2O \xrightarrow{H_2O} \underset{\text{Orthorhombic}}{CaSO_4 \cdot 2H_2O}$$

$$\xrightarrow[\text{Hardening}]{} \underset{\text{Monoclinic (gypsum)}}{CaSO_4 \cdot 2H_2O}$$

11 Due to the small size of Li and F, LiF has highest lattice enthalpy and hence, most stable compound.

12 Castner's process is used to obtain Na by electrolysis of fused sodium hydroxide.

13 A → 4,B → 2,C → 3,D → 1

14 Dihydrogen is the poorest reducing agent as it is least reactive.

15 **Correct Explanation** Osmium has the electronic configuration $5d^6 6s^2$. As 5*d* and 6*s* are close in energy, all the 8 electrons can participate in bonding.

16 In the metallurgy of aluminium, the graphite anode is oxidised to CO and CO_2 by the released O_2.

17 $Sn + \text{Conc. } 4HNO_3 \longrightarrow \underset{\text{Metastannic acid}}{H_2SnO_3} + 4NO_2$

18 $\underset{\text{(Excess)}}{2NH_3} + OCl^- \longrightarrow NH_2{-}NH_2 + NH_4Cl + OH^-$

19 Pentavalency in P is more stable than N due to larger size of phosphorus atom.

20 $3SO_2 + O_3 \longrightarrow 3SO_3$

Whole oxygen of ozone is used up for oxidation.

21 $I_2 + 10HNO_3 \longrightarrow 2HIO_3 + 10NO_2 + 4H_2O$

22 Li has most negative standard reduction potential due to very high enthalpy of hydration, Thus, reaction of Li with water will be most exothermic, but surprisingly Li reacts with water gently, whereas Na and K vigorously.

The explanation is in kinetics and not in thermodynamics of the reaction. No doubt, maximum energy is evolved with Li but its fusion, vaporisation and ionisation consume more energy. As a result reaction proceeds slowly.

Na or K have low melting points and molten metal spreads over water exposing a large surface to water, making the reaction more vigorous.

23 MnO is ionic due to lower oxidation state of Mn i.e. +2.

24 Fe^{3+} ion has five unpaired electrons.

$$\mu = \sqrt{5(5+2)}\ BM = \sqrt{35} = 5.916\ BM$$

25 Spiegeleisen is an alloy of Fe, C and Mn.

26 $3MnO_4^- + 5\,[Fe^{2+}\ C_2O_4^{2-}] + 24H^+ \longrightarrow 3Mn^{2+} + 5Fe^{3+} + 10CO_2 + 12H_2O$

Thus, 5 moles of FeC_2O_4 are oxidised by 3 moles of $KMnO_4$, therefore 1 mole of FeC_2O_4 is oxidised by 3/5 mole of $KMnO_4$.

27 A → 3,B → 1, C → 4,D → 2

28 Though Cu(I) possess $3d^{10}$ electronic configuration while that of Cu(II) has $3d^9$ configuration yet Cu (II) is more stable than Cu (I) due to greater effective nuclear charge of Cu (II).

29 Large ligand does not destabilise the metal-ligand bond. Higher the charge and smaller the size of ligand, more stable is the complex formed.

30 Cuprammonium salt is $[Cu(NH_3)_4]SO_4$.

$$[Cu(NH_3)_4]SO_4 \rightleftharpoons [Cu(NH_3)_4]^{2+} + SO_4^{2-}$$

31 The complexes can be written as follows:

$[Co(NH_3)_6]Cl_3$, $[Co(NH_3)_5Cl]Cl_2$, $[Co(NH_3)_4Cl_2]\,Cl$

So, the primary valency in *A, B* and *C* respectively are 3, 2, 1.

32. H_3PO_2 is monobasic acid.

$$\underset{1\text{ mol}}{H_3PO_2} + \underset{1\text{ mol}}{NaOH} \longrightarrow NaH_2PO_2 + H_2O$$

$\therefore \quad x = 1$

H_3PO_3 is dibasic acid

$$\underset{1\text{ mol}}{H_3PO_3} + \underset{1\text{ mol}}{Ca(OH)_2} \longrightarrow CaHPO_3 + 2H_2O$$

$y = 1$

H_3PO_4 is tribasic acid

$$\underset{1\text{ mol}}{H_3PO_4} + \underset{1\text{ mol}}{Al(OH)_3} \longrightarrow AlPO_4 + 3H_2O$$

$z = 1$

Thus, $x : y : z :: 1 : 1 : 1$

33. $Fe + 5\,CO \xrightarrow[\text{pressure}]{\text{Heat}} \underset{\text{Iron penta carbonyl}}{[Fe(CO)_5]}$

34. IUPAC name is potassiumamminedicyano dioxoperoxo chromate (VI).

35. (a) $NH_4NO_2 \xrightarrow{\Delta} N_2O + 2H_2O$

$NH_4NO_2 \xrightarrow{\Delta} N_2 + 2H_2O$

(b) $NH_4Cl \xrightarrow{\Delta} NH_3 + HCl$

(c)

$(NH_4)_2\,CO_3 \xrightarrow{\Delta} 2NH_3 + CO_2 + H_2O$

(d) $NH_4NO_3 + NaOH \xrightarrow{\Delta}$

$NH_3 + NaNO_3 + H_2O$

(e) $\left.\begin{matrix} AlN \\ Mg_3N_2 \\ CaCN_2 \end{matrix}\right] \xrightarrow{H_2O} NH_3$

36. $CaO + Ca(HCO_3)_2 \longrightarrow 2CaCO_3 + H_2O$

For one litre water,

Meq. of CaO = Meq. of $Ca(HCO_3)_2$

$$\frac{w \times 1000}{56/2} = \frac{1.62 \times 1000}{162/2}$$

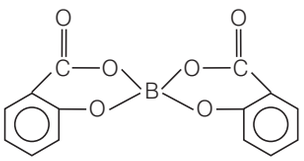
$\therefore \quad w_{CaO} = 0.56$ g

Thus, CaO required for 10^3 L H_2O

$= 0.56 \times 10^3 = 560$ g

37. Refractory property of alkaline earth metal oxides decreases on moving down the group. Thus, the correct order is BeO > MgO > CaO.

38. Borosalicylic acid is an optically active compound of boron.



39. $\underset{(A)\ \text{(Black)}}{3MnO_2} + 6KOH + KClO_3 \xrightarrow{\Delta}$

$\underset{(B)\ \text{(Green)}}{3K_2MnO_4} + KCl + 3H_2O$

In the presence of CO_2, the medium becomes acidic.

$\underset{(B)\ \text{(Green)}}{3\,MnO_4^{2-}} + 4H^+ \longrightarrow \underset{(A)}{MnO_2} + \underset{(C)}{2MnO_4^-} + 2H_2O$

$\underset{(C)\ \text{(Pink)}}{MnO_4^-} + 5Fe^{2+} + 8H^+ \xrightarrow{\Delta} Mn^{2+} + 5Fe^{3+} + 4H_2O$

40. As dissociation constants of complexes are inversely proportional to their stability constants, their stability constants are given as:

$[Cu(CN)_2]^- \quad K_S = \frac{1}{K_d} = 1 \times 10^{16}$

$[Fe(CN)_6]^{4-} \quad K_S = 1 \times 10^{37}$

$[Fe(CN)_6]^{3-} \quad K_S = 1 \times 10^{44}$

$[Ag(CN)_2]^- \quad K_S = 1 \times 10^{20}$

41. It is due to screening effect based on Fajan's rule. It states that smaller the cationic size more is the polar using power ($Cu^{2+} < Ca^{2+}$).

42.

Complex	Hybridisation	Unpaired electrons	Effect of ligand
$[Ni(CN)_4]^{2-}$	dsp^2	zero	CN^- is a strong ligand
$[Ni(H_2O)_4]^{2+}$	sp^3	4	H_2O is a weak ligand
$[Ni(CO)_4]$	sp^3	zero	CO is a strong ligand
$[Fe(CN)_6]^{4-}$	d^2sp^3	zero	CN^- is a strong ligand
$[Fe(CN)_6]^{3-}$	d^2sp^3	1	CN^- is a strong ligand

43. $(Cr(H_2O)_6)\,Cl_3 \rightleftharpoons (Cr(H_2O)_6)^{3+} + 3Cl^-$

C.N. of Cr = 6 in only (a)

44. $KMnO_4$ is decolourised by unsaturated compounds in side chain.

45. CFSE for octahedral and tetrahedral complexes are closely related to each other by formula $\Delta_t = \frac{-4}{9}\Delta_o$.

where, Δ_o = CFSE for octahedral complex, Δ_t = CFSE for tetrahedral complex ($\Delta E = h\nu$, i.e. $\Delta E \propto \nu$)

According to question,

$\Delta_o = 18000\ cm^{-1}$

$\therefore \quad \Delta_t = \frac{4}{9}\Delta_o = \frac{4}{9} \times 18000\ cm^{-1}$

$= 4 \times 2000\ cm^{-1} = 8000\ cm^{-1}$

46. $CoCl_3 \cdot 6H_2O + AgNO_3 \rightarrow 2$ mol AgCl

1 mol

Thus, two Cl atoms are outside the coordinate sphere.

C.N. of Co = 6

Thus, $[Co(H_2O)_5Cl]\,Cl_2 \cdot H_2O$.

47. Mn is present below Cr in electrochemical series. So, its reduction potential is less than that of Cr. The third ionisation energy for Mn is 3258 kJ mol^{-1} and for Cr is 2994 kJ mol^{-1}.

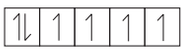
48. Potassium dichromate is used in volumetric analysis mostly in oxidation titration because it is not deliquescent. It forms compound with other elements and precipitate out. It is water soluble.

49. Silicones are insoluble in water and does not react with it. So, they are hydrophobic in nature. The crystal structure of silica has Si—O—Si linkage and it is extremely stable and considerable energy is required to break the silicon oxygen bonds in it. So, silicones are hard and have high melting point.

50. Potassium ferrocyanide is $K_4[Fe(CN)_6]$.

In, this complex, Fe is present as Fe^{2+}.

$Fe^{2+} = [Ar]\,3d^6$

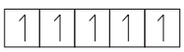


In $[Fe(CN)_6]^{4-}$

d^2sp^3-hybridisation
diamagnetic, no
unpaired electron

Potassium ferricyanide is $K_3[Fe(CN)_6]$.

Fe is present as $Fe^{3+} = [Ar]\,3d^5$



In $[Fe(CN)_6]^{3-}$

One unpaired
electron

d^2sp^3-hybridisation,
paramagnetic