SAIVEERA ACADEMY – 8098850809
REVOLUTION FOR LEARNING - COIMBATORE
SAIVEERA'S OFFICIAL QUARTERLY MODEL TEST
CHEMISTRY

Marks :70 **Time : 2 hr 30min**

Note : Draw diagrams and write equations wherever neccessary

SECTION – I

Note : (i) Answer all the questions. **15x1=15**
(ii) Choose the most appropriate answer from the given four alternatives

1. Oxidation state of Iron and the charge on the ligand NO in $[Fe(H_2O)_5NO]SO_4$ are
a) +2 and 0 respectively b) +3 and 0 respectively
c) +3 and -1 respectively d) +1 and +1 respectively

2. IUPAC name of the complex $K_3[Al(C_2O_4)_3]$ is
a) potassiumtrioxalatoaluminium(III) b) potassiumtrioxalatoaluminate(II)
c) potassiumtrisoxalatoaluminate(III) d) potassiumtrioxalatoaluminate(III)

3. How many moles of I_2 are liberated when 1 mole of potassium dichromate react with potassium iodide?
a) 1 b) 2 c) 3 d) 4

4. The catalytic behaviour of transition metals and their compounds is ascribed mainly due to
a) their magnetic behaviour b) their unfilled d orbitals
c) their ability to adopt variable oxidation states d) their chemical reactivity

5. Assertion : bond dissociation energy of fluorine is greater than chlorine gas
Reason: chlorine has more electronic repulsion than fluorine
a) Both assertion and reason are true and reason is the correct explanation of assertion.
b) Both assertion and reason are true but reason is not the correct explanation of assertion.
c) Assertion is true but reason is false.
d) Both assertion and reason are false.

6. The basicity of pyrophosphorous acid ($H_4P_2O_5$) is
a) 4 b) 2 c) 3 d) 5

7. Most easily liquefiable gas is
a) Ar b) Ne c) He d) Kr

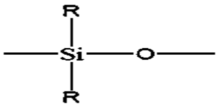
8. The co-ordination number of CsCl is
a) 3 b) 4 c) 6 d) 8

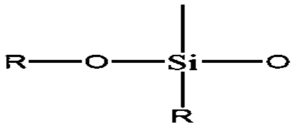
9. The geometry at which carbon atom in diamond are bonded to each other is
a) Tetrahedral b) hexagonal c) Octahedral d) none of these

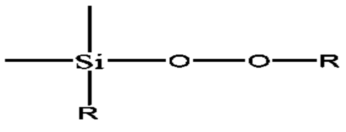
10. Wolframite ore is separated from tinstone by the process of
a) Smelting b) Calcination c) Roasting d) Electromagnetic separation

11. The repeating unit in silicone is v

a) SiO_2

b) 

c) 

d) 

12. The incorrect statement among the following is
a) Nickel is refined by Mond's process b) Titanium is refined by Van Arkel's process
c) Zinc blende is concentrated by froth floatation
d) In the metallurgy of gold, the metal is leached with dilute sodium chloride solution

13. The ratio of close packed atoms to tetrahedral hole in cubic packing is
a) 1:1 b) 1:2 c) 2:1 d) 1:4

14. Potassium has a bcc structure with nearest neighbor distance 4.52 A^0 . its atomic weight is 39. its density will be
a) 915 kg m^{-3} b) 2142 kg m^{-3} c) 452 kg m^{-3} d) 390 kg m^{-3}

15. During the decomposition of H_2O_2 to give dioxygen, 48 g O_2 is formed per minute at certain point of time. The rate of formation of water at this point is
a) 0.75 mol min^{-1} b) 1.5 mol min^{-1} c) 2.25 mol min^{-1} d) 3.0 mol min^{-1}

SECTION – II

Answer any six questions and question number 23 is compulsory. 6 x 2=12

16. What is linkage isomerism? Explain with an example.
17. What is crystal field stabilization energy (CFSE) ?
18.Explain why compounds of Cu^{2+} are coloured but those of Zn^{2+} are colourless.
19. Give a reason to support that sulphuric acid is a dehydrating agent.
20. Give the uses of Helium.
21. Give the limitations of Ellingham diagram.
22. Justify the position of lanthanides and actinides in the periodic table.
23. The composition of a sample of wurtzite is $Fe_{0.93}O_{1.00}$ what % of Iron present in the form of Fe^{3+} ?
24. Write Arrhenius equation and explains the terms involved.

SECTION – III

Answer any six questions and question number 29 is compulsory. 6 x 3 =18

25. Write the oxidation state, coordination number , nature of ligand, magnetic property and electronic configuration in octahedral crystal field for the complex $K_4[Mn(CN)_6]$
26. Explain optical isomerism in coordination compounds with an example.
27. Describe the variable oxidation state of 3d series elements.
28. Compare lanthanide and actinides
29. Complete the following reactions
i).$5XeO_6^{4-}+2Mn^{2+}+14H^+ \longrightarrow$
ii). $6AgNO_3+PH_3+3H_2\longrightarrow$
iii) $4NaCl+MnO_2+4H_2SO_4 \longrightarrow$
30. Write the molecular formula and structural formula for the following molecules.
a) Nitric acid b) dinitrogen pentoxide c) phosphoric acid

31. Write a short note on anamolous properties of the first element of p-block.
32. Describe about zone refining
33. The half life of the homogeneous gaseous reaction $SO_2Cl_2 \rightarrow SO_2 + Cl_2$ which obeys first order kinetics is 8.0 minutes. How long will it take for the concentration of SO_2Cl_2 to be reduced to 1% of the initial value?

SECTION – IV

Answer all the questions. **5 x 5 =25**

34.(i). Write the postulates of Werner's theory.

Or

(i). Give two equations to illustrate the chemical behaviour of phosphine.

(ii). Give a reaction between nitric acid and a basic oxide.

(iii). Suggest a reason why HF is a weak acid, whereas binary acids of the all other halogens are strong acids.

35.(i). Which is more stable? Fe^{3+} or Fe^{2+} - explain.

(ii). Calculate the number of unpaired electrons in Ti^{3+} , Mn^{2+} and calculate the spin only magnetic moment.

(iii). What is lanthanide contraction and what are the effects of lanthanide contraction?

Or

(i). Based on VB theory explain why $[Cr(NH_3)_6]^{3+}$ is paramagnetic, while $[Ni(CN)_4]^{2-}$ is diamagnetic.

(ii). In an octahedral crystal field, draw the figure to show splitting of d orbitals.

36.(i). Describe the preparation of potassium dichromate.

Or

(i). Write a note on metallic nature of p-block elements.

37.(i) Explain pseudo first order reaction with an example.

(ii). Explain the rate determining step with an example.

(iii). Define average rate and instantaneous rate.

Or

(i). Distinguish between hexagonal close packing and cubic close packing.

38.(i). Describe the structure of diborane.

Or

(ii). Explain the principle of electrolytic refining with an example.

Push yourself , because no else is going to do it for you

SECTION -I

1. c) +3 and -1 respectively
2.d) potassiumtrioxalatoaluminate(III)
3.c) 3
4. c) their ability to adopt variable oxidation states
5. d) Both assertion and reason are false.
6.b) 2
7.c) He
8.d) 8
9. a) Tetrahedral
10. d) Electromagnetic separation
11. b
12. d) In the metallurgy of gold, the metal is leached with dilute sodium chloride solution
13. b) 1:2
14. a) 915 kg m^{-3}
15. d) 3.0 mol min^{-1}

SECTION – II

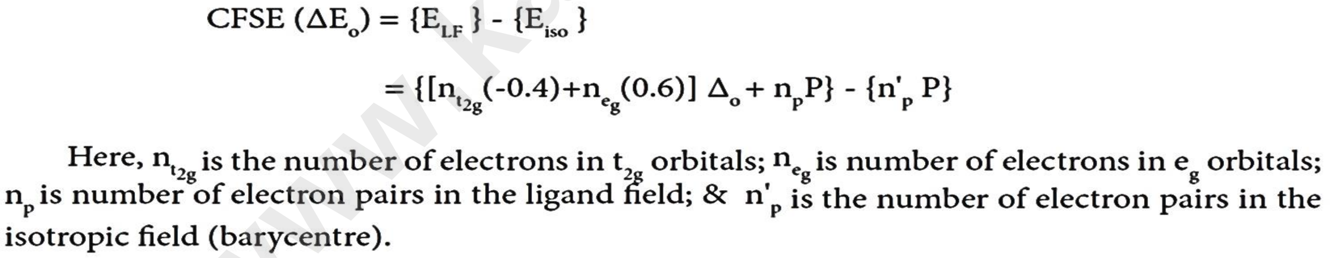
16. This type of isomers arises when an **ambidentate ligand is bonded to the central metal atom/ion through either of its two different donor atoms.**

For example

Nitrite ion is bound to the central metal ion Co^{3+} through a nitrogen atom in one complex (i) and through oxygen atom in other complex (ii).

(i). $[Co(NH_3)_5(NO_2)]^{2+}$ (ii). $[Co(NH_3)_5ONO]^{2+}$

17. The crystal field stabilisation energy is defined as the energy difference of electronic configurations in the ligand filed **($E_{L.F}$)** and the isotropic field/barycentre **(E_{iso}).**



$$\text{CFSE } (\Delta E_o) = \{E_{LF}\} - \{E_{iso}\}$$

$$= \{[n_{t_{2g}}(-0.4)+n_{e_g}(0.6)]\,\Delta_o + n_pP\} - \{n'_p\,P\}$$

Here, $n_{t_{2g}}$ is the number of electrons in t_{2g} orbitals; n_{e_g} is number of electrons in e_g orbitals; n_p is number of electron pairs in the ligand field; & n'_p is the number of electron pairs in the isotropic field (barycentre).

18. **i)Cu^{+2} – $3d^9$ ii)Zn^{+2} - $3d^{10}$**

- In Zn^{+2} **d-d transition** is **not possible** because it has completely filled d orbital . So they are colourless
- In Cu^{+2} **d-d transition is possible** because it has **paired electrons** in their outer d orbital. So they are coloured **(blue)**

19. Sulphuric acid is highly soluble in water.

- It has strong affinity towards water and thus it absorbs water quickly.
- Hence it can be used as a dehydrating agent.
- When dissolved in water, it forms **mono ($H_2SO_4.H_2O$) and dihydrates**

20. Helium and oxygen mixture is used by divers in place of air oxygen mixture.This Prevents the painful dangerous condition called bends.

Helium is used to provide inert atmosphere in electric arc welding of metals.
Helium has lowest boiling point hence used in cryogenics)
Helium is much less denser than air and hence used for filling air balloons.

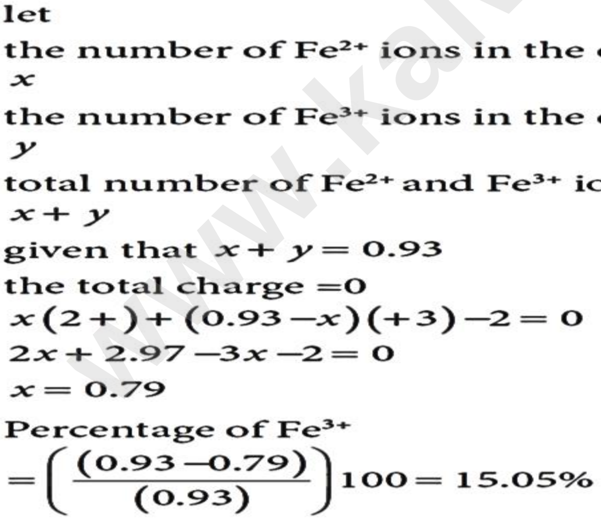
21. 1. Ellingham diagram is constructed based only on thermodynamic considerations. It gives information about the thermodynamic feasibility of a reaction. It does not tell anything about the rate of the reaction. More over, it does not give any idea about the possibility of other reactions that might be taking place.
2. The interpretation of ΔG is based on the assumption that the reactants are in equilibrium with the product which is not always true.

22.

1) The actual position of Lanthanoids in the periodic table is at group number 3 and period
2) number 6.
3) However, in the sixth period after lanthanum, the electrons are preferentially filled in inner 4f sub shell and these fourteen elements following lanthanum show similar chemical properties.
4) Therefore these elements are grouped together and placed at the bottom of the periodic table.
5) If we place these elements after Lanthanum in the periodic table below 4d series, the properties of the elements belongs to a group would be different and it would affect the proper structure of the periodic table.
6) Hence a separate position is provided to the inner transition elements.

Justify the position of lanthanides and actinides in the periodic table.

23.



let
the number of Fe^{2+} ions in the crystal be
x
the number of Fe^{3+} ions in the crystal be
y
total number of Fe^{2+} and Fe^{3+} ions is
$x+y$
given that $x+y=0.93$
the total charge $=0$
$x(2+)+(0.93-x)(+3)-2=0$
$2x+2.97-3x-2=0$
$x=0.79$
Percentage of Fe^{3+}
$=\left(\frac{(0.93-0.79)}{(0.93)}\right)100=15.05\%$

24. k = $Ae^{\frac{-E_a}{RT}}$
A = Frequency factor or Arrhenius factor
E_a = Activation energy
R = gas constant
T = temperature

SECTION - III

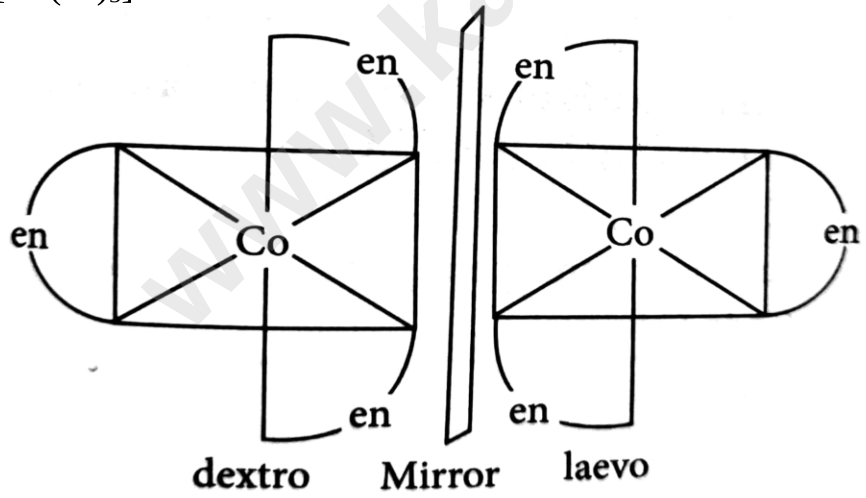
25.

i.	**oxidation state**	4 + x + 6 (-1) = 0 **x = +2**
ii	**coordination number ,**	6
iii	**nature of ligand,**	Negative ligand (strong ligand)
iv.	**magnetic property**	Paramagnetic
v.	**electronic configuration**	d^5 ; t_{2g}^5

26.

- .Coordination compounds which possess **chirality** exhibit optical isomerism similar to organic compounds.
- The **pair of two optically active isomer**s which are **mirror images of each other** are called enantiomers.
- Their solutions rotate the plane of the plane polarised light either clockwise or anticlockwise and the corresponding isomers are called **'d' (dextro rotatory) and 'l' (levo rotatory) forms** respectively.
- The octahedral complexes of type **$[M(xx)_3]^{n\pm}$, $[M(xx)AB]^{n\pm}$, $[M(xx)_2B_2]^{n\pm}$ exhibit optical isomerism.**

Eg ; $[Co(en)_3]^{3+}$



27.

1) The first transition metal Scandium exhibits **only +3 oxidation state**, but all other transition elements exhibit variable oxidation states by loosing electrons from (n-1)d orbital and ns orbital as the energy difference between them is very small.
2) At the beginning of the series, +3 oxidation state is stable but towards the end **+2 oxidation state becomes stable**.
3) The number of oxidation states increases with the number of electrons available, and it decreases as the number of paired electrons increases.

4) Hence, **the first and last elements show less number of oxidation states and the middle elements with more number of oxidation states.**
5) For example, the first element **Sc has only one oxidation state +3**; the middle element **Mn has six different oxidation states from +2 to +7**. The last element **Cu shows +1 and +2 oxidation states** only.

28.

Lanthanoids	**Actinoids**
Differentiating electron enters in **4f orbital**	Differentiating electron enters in **5f orbital**
Binding energy of 4f orbitals are **higher**	**Binding energy** of 5f orbitals are **lower**
They show **less tendency** to **form complexes**	They show **greater tendency to form complexes**
Besides +3 oxidation states lanthanoids show +2 and +4 oxidation states in few cases.	Besides +3 oxidation states actinoids show higher oxidation states such as +4, +5, +6 and +7
They do **not form oxo cations**	They do form **oxo cations such as UO_2^{2+}**
Most of the lanthanoids are **colourless**	Most of the actinoids are **coloured**. For example. U^{3+} (red),

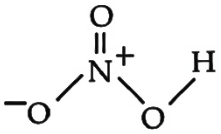
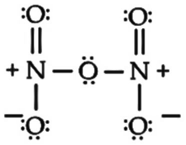
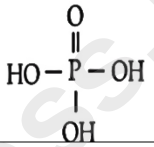
29. i).$5XeO_6^{4-}+2Mn^{2+}+14H^+ \longrightarrow \mathbf{2MnO_4^-+5XeO_3+7H_2O}$

ii). $6AgNO_3+PH_3+3H_2 \longrightarrow \mathbf{6Ag + 6HNO_3 + H_3PO_3}$

iii) $4NaCl+MnO_2+4H_2SO_4 \longrightarrow \mathbf{Cl_2 + MnCl_2 + 4NaHSO_4 + 2H_2O}$

30.

Compound	***Molecular Formula***	***Structural Formula***

a) Nitricacid	HNO_3	
b)Dinitrogen pentoxide	N_2O_5	
c)Phosphoric acid	H_3PO_4	

31. 1. Small size of the first member
2.High ionisation enthalpy and high electronegativity
3. Absence of d orbitals in their valance shell

* The first member of the group 13, boron is a metalloid while others are reactive metals

* In group 14, the first element carbon is strictly a nonmetal while other elements are metalloids (silicon & germanium) or metals (tin & lead).

* In group 15 Nitrogen is a diatomic gas unlike the other members of the group. In group 16, the first element, oxygen also exists as a diatomic gas in that group. Due to its high electronegativity it forms hydrogen bonds.

* The first element of group 17, fluorine the most electronegative element. It shows only -1 oxidation state while the other halogens have +1, +3, +5 and +7 oxidation states in addition to -1 state. The fluorine also is the strongest oxidising agent and the most reactive element among the halogens

32.
This method is based on the principles of fractional crystallisation. When an impure metal is melted and allowed to solidify, the impurities will prefer to be in the molten region. i.e. impurities are more soluble in the melt than in the solid state metal. In this process the impure metal is taken in the form of a rod. One end of the rod is heated using a mobile induction heater which results in melting of the metal on that portion of the rod. When the heater is slowly moved to the other end the pure metal crystallises while the impurities will move on to the adjacent molten zone formed due to the movement of the heater. As the heater moves further away, the molten zone containing impurities also moves along with it. The process is repeated several times by moving the heater in the same direction again and again to achieve the desired purity level. This process is carried out in an inert gas atmosphere to prevent the oxidation of metals . Elements such as germanium (Ge), silicon (Si) and galium (Ga) that are used as semiconductor are refined using this process.

33. $t_{1/2}$ = 8.0 minutes

$t_{1/2} = \frac{0.6932}{k}$ k = 0.087 minutes

Integrated form of first order rate constant

$k = \frac{2.303}{t} \log [A_0] / [A]$

$t = \frac{2.303}{0.087} \log [100] / [1]$

t = 52.93 min

SECTION - IV

34.**1.** Most of the elements exhibit, two types of valence namely primary valence and secondary valence and each element tend to satisfy both the valences .

2. **Primary valence is referred as the oxidation state of the metal atom** .The primary valence of a metal ion is positive in most of the cases and zero in certain cases. They are always satisfied by negative ions.

3. Secondary valence is referred as the coordination number. The secondary valence is satisfied by negative ions, neutral molecules, positive ions or the combination of these.

4. The primary valences are non-directional while the secondary valences are directional.

5. According to Werner, there are two spheres of attraction around a metal atom/ion in a complex. The inner sphere is known as coordination sphere and the groups present in this sphere are firmly attached to the metal. The outer sphere is called ionisation sphere. The groups present in this sphere are loosely bound to the central metal ion and hence can be separated into ions upon dissolving the complex in a suitable solvent.

Or

(i). **Basic Nature**

Phosphine is weakly basic and forms phosphonium salts.

$PH_3 + HI \rightarrow PH_4I$

$PH_4I + H_2O \xrightarrow{\Delta} PH_3 + H_3O^+ + I^-$

Combustion

When phosphine is heated with air or oxygen it burns to give metaphosphoric acid

$4PH_3 + 8O_2 \xrightarrow{\Delta} P_4O_{10} + 6H_2O$

Phosphorous pentoxide

$P_4O_{10} + 6H_2O \xrightarrow{\Delta} 4HPO_3 + 4H_2O$

Metaphosphoric acid

(ii). Nitric acid reacts with a basic oxide to form **salt** and **water**.

$\mathbf{3FeO + 10HNO_3 \longrightarrow 3Fe(NO_3)_3 + NO + 5H_2O.}$

- (iii). Among halogen acids, the **electronegativity difference is maximum** (1.9) in HF acid.
- Hence the **bond between H and F is stronger** and the acid HF is weaker.
- It takes tremendous amount of energy to break the H-F bond in water.

35.(i). **Fe^{3+} has** $3d^5$ configuration in its outermost shell
Fe^{2+} has $3d^6$ configuration in its outermost shell
Fe^{3+} ion is more stable due to its **half filled configuration**

(ii). **Ti^{3+} - $1s^22s^22p^63s^23p^63d^1$** No of unpaired electron = **1**

$\mu = \sqrt{n(n+2)} = \sqrt{1(3)} = \sqrt{3}$ = **1.732B.M**

Mn^{2+} - $1s^22s^22p^63s^23p^63d^5$ No of unpaired electron = **5**

$\mu = \sqrt{n(n+2)} = \sqrt{5(7)} = \sqrt{35}$ = **5.92 B.M**

(iii). **Lanthanide contraction**

As we move across 4f series, the atomic and ionic radii of lanthanoids show gradual decrease with increase in atomic number. This decrease in ionic size is called lanthanoid contraction.

Effects of lanthanide contraction

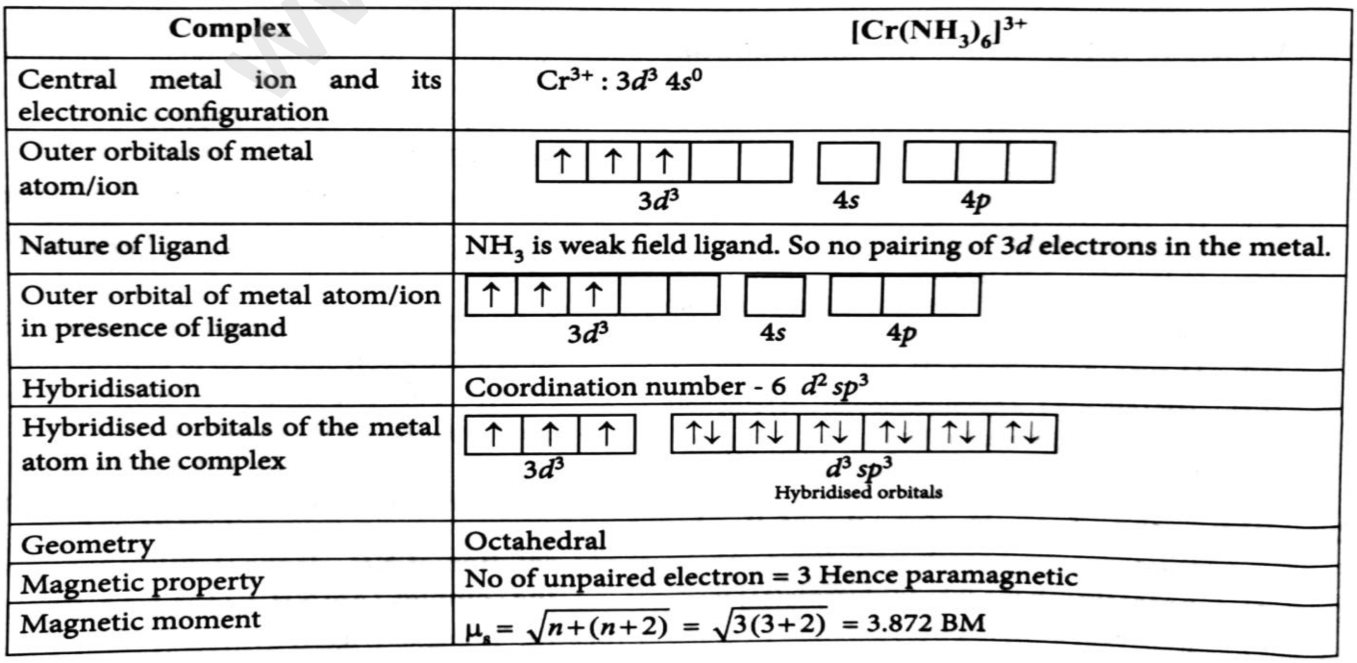
1. Basicity differences

As we from Ce^{3+} to Lu^{3+} , the basic character of Ln^{3+} ions decrease. Due to the decrease in the size of Ln^{3+} ions, the ionic character of Ln OH^-bond decreases (covalent character increases) which results in the decrease in the basicity.

2. Similarities among lanthanoids:

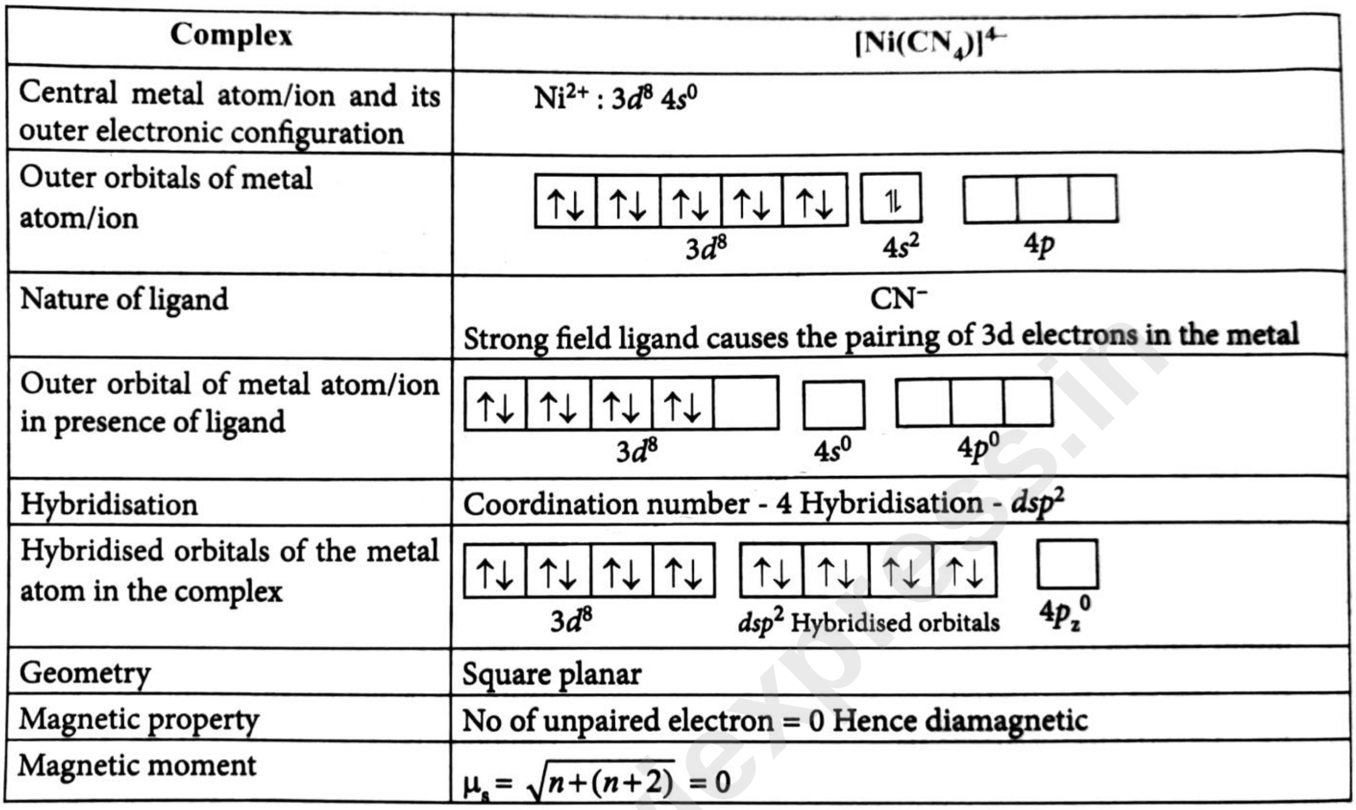
In the complete f - series only 10 pm decrease in atomic radii and 20 pm decrease in ionic radii is observed because of this very small change in radii of lanthanoids, their chemical properties are quite similar.

Or



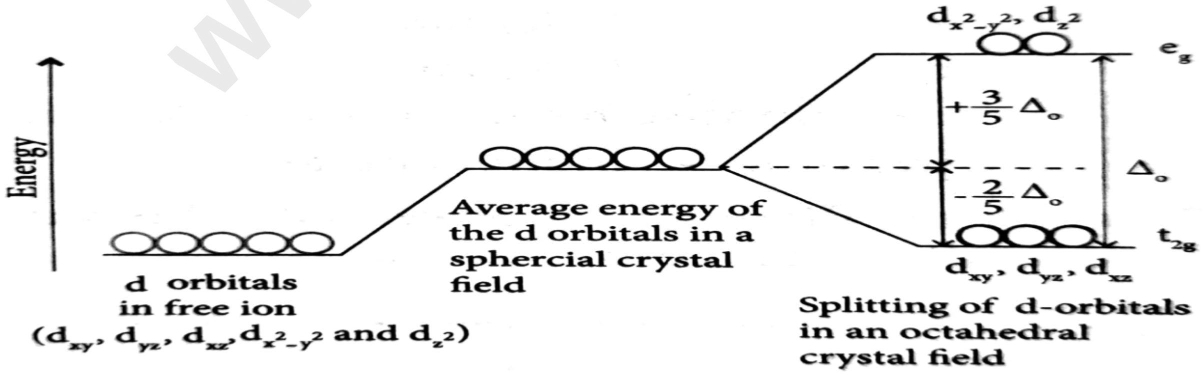
Complex	$[Cr(NH_3)_6]^{3+}$
Central metal ion and its electronic configuration	Cr^{3+} : $3d^3\ 4s^0$
Outer orbitals of metal atom/ion	↑ ↑ ↑ ☐ ☐ ☐ ☐ ☐ ☐ $3d^3$ 4s 4p
Nature of ligand	NH_3 is weak field ligand. So no pairing of 3d electrons in the metal.
Outer orbital of metal atom/ion in presence of ligand	↑ ↑ ↑ ☐ ☐ ☐ ☐ ☐ ☐ $3d^3$ 4s 4p
Hybridisation	Coordination number - 6 d^2sp^3
Hybridised orbitals of the metal atom in the complex	↑ ↑ ↑ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ↑↓ $3d^3$ d^3sp^3 Hybridised orbitals
Geometry	Octahedral
Magnetic property	No of unpaired electron = 3 Hence paramagnetic
Magnetic moment	$\mu_s = \sqrt{n+(n+2)} = \sqrt{3(3+2)}$ = 3.872 BM

(i). Based on VB theory explain why $[Cr(NH_3)_6]^{3+}$ is paramagnetic, while $[Ni(CN)_4]^{2-}$ is diamagnetic.



Complex	$[Ni(CN_4)]^{4-}$
Central metal atom/ion and its outer electronic configuration	Ni^{2+} : $3d^8$ $4s^0$
Outer orbitals of metal atom/ion	↑↓ ↑↓ ↑↓ ↑↓ ↑↓ ($3d^8$) ⇅ ($4s^2$) ☐☐☐ ($4p$)
Nature of ligand	CN^- Strong field ligand causes the pairing of 3d electrons in the metal
Outer orbital of metal atom/ion in presence of ligand	↑↓ ↑↓ ↑↓ ↑↓ ☐ ($3d^8$) ☐ ($4s^0$) ☐☐☐ ($4p^0$)
Hybridisation	Coordination number - 4 Hybridisation - dsp^2
Hybridised orbitals of the metal atom in the complex	↑↓ ↑↓ ↑↓ ↑↓ ($3d^8$) ↑↓ ↑↓ ↑↓ ↑↓ (dsp^2 Hybridised orbitals) ☐ ($4p_z^0$)
Geometry	Square planar
Magnetic property	No of unpaired electron = 0 Hence diamagnetic
Magnetic moment	$\mu_s = \sqrt{n+(n+2)} = 0$

(ii). In an octahedral crystal field, draw the figure to show splitting of d orbitals.



36.(i)

(i). It is prepared from chromate ore.

- The ore is concentrated by gravity separation.
- It is then mixed with excess sodium carbonate and lime and roasted in a reverberatory furnace.

$$4FeCr_2O + 8\ Na_2CO_3 + 7\ O_2 \xrightarrow{900 - 1000^0C} 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2\uparrow$$

- The roasted mass is treated with water to separate soluble sodium chromate from insoluble iron oxide.
- The yellow solution of sodium chromate is treated with concentrated sulphuric acid which converts sodium chromate into sodium dichromate.

$$2Na_2CrO_4 + H_2SO_4 \longrightarrow Na_2CrO_7 + Na_2SO_4 + H_2O$$

- The above solution is concentrated to remove less soluble sodium sulphate. The resulting solution is filtered and further concentrated.
- It is cooled to get the crystals of $Na_2SO_4.2H_2O$.
- The saturated solution of sodium dichromate in water is mixed with KCl and then concentrated to get crystals of NaCl.
- It is filtered while hot and the filtrate is cooled to obtain $K_2Cr_2O_7$ crystals.

Or

(i). The tendency of an element to form a cation by loosing electrons is known as electropositive or metallic character. This character depends on the ionisation energy. Generally on descending a group the ionisation energy decreases and hence the metallic character increases.

In p-block, the elements present **in lower left part** are **metals** while the elements in the **upper right part are non metals**.

Elements of **group 13** have metallic character except the first element **boron which is a metalloid**, having properties intermediate between the metal and nonmetals.

The atomic radius of boron is very small and it has relatively high nuclear charge and these properties are responsible for its nonmetallic character.

In the subsequent groups the non-metallic character increases. In group 14 elements, carbon is a nonmetal while silicon and germanium are metalloids. In group 15, **nitrogen and phosphorus are non metals** and **arsenic & antimony are metalloids.** In group **16**, **oxygen, sulphur and selenium are non metals** and tellurium is a metalloid. All the elements of group **17 and 18 are non metals**.

37.(i) **Explain pseudo first order reaction with an example.**

Second order reaction can be altered to a first order reaction by taking one of the reactant in large excess, such reaction is called pseudo first order reaction

Acid hydrolysis of an ester,

$$CH_3COOCH_{3\,(aq)} + H_2O \rightarrow CH_3COOH_{(aq)} + CH_3OH$$

If the reaction is carried out with the large excess of water, there is no significant change in the concentration of water during hydrolysis. i.e.,concentration of water remains almost a constant.

$k\ [H_2O] = k'$

rate = k $[CH_3COOCH_3]$

Thus it follows first order kinetics

(ii). Decomposition of hydrogen peroxide catalysed by I^-

$$2H_2O_{2(aq)} \rightarrow 2H_2O_{(i)} + O_{2(g)}$$

It is experimentally found that the reaction is first order with respect to both

H_2O & I^- which indicates that I^- is also involved in the reaction.
The mechanism involves the following steps

Step : 1

$H_2O_{2(aq)} + I^{-1}_{(aq)} \rightarrow H_2O_{(i)} + OI^{-1}_{(aq)}$

Step : 2

$H_2O_{2(aq)} + OI^{-1}_{(aq)} \rightarrow H_2O_{(i)} + I^{-1}_{(aq)} + O_{2(g)}$

Overall reaction is

$2H_2O_{2(aq)} \rightarrow 2H_2O_{(i)} + O_{2(g)}$

These two reactions are elementary reactions. Adding equation (1) and (2) gives the overall reaction.

Step 1 is the rate determining step, since it involves both **H_2O_2 &** I^-, the overall reaction is bimolecular

(iii). **Average rate**

It is defined as change in concentration of a reaction or product of a chemical in a given interval of time

Average rate = $\frac{Change\ in\ comcentration\ of\ reactants\ or\ products}{time\ intrerval}$

Instantaneous rate

The rate of the reaction, at a particular instant during the reaction is called the instantaneous rate

Or

(i).

Distinguish between hexagonal close packing and cubic close packing

Hexagonal Close packing	**Cubic Close packing**
'ABA' arrangement is known as the hexagonal close packed (hcp) arrangement.	**'ABC' arrangement** is known as the hexagonal cubic close packing. (ccp) arrangement.
The spheres of the third layer is exactly aligned as first layer	The spheres of the third layer is not aligned with those of either the first or second layer.
The hexagonal close packing is based on hexagonal unit cells with sides of equal length	The cubic close packing is based on the face centered cubic unit cell.
Tetrahedral voids of the second layer are covered by the sphere of the third layer	octahedral voids of the second layer are covered by the sphere of the third layer
The unit cell of hexagonal close packing **has 6 spheres**.	The unit cell of cubic close packing has **4 spheres**
This type is found in metals like **Mg,Zn,**	This type is found in metals like **Cu, Ag**,

38.(i). **.**

- In diborane **two BH_2** units are linked by two bridged hydrogens.
- It has **eight B-H bonds.**
- Diborane has only **12 valance electrons** and are not sufficient to form normal covalent bonds.
- The four terminal B-H bonds are normal covalent bonds (**two centre - two electron bond or 2c-2e bond**).
- The remaining four electrons have to used for the bridged bonds. i.e. **two three centred B-H-B** bonds utilise two electrons each.
- In diborne, the boron is sp_3 hybridised. Three of the four sp_3 hybridised orbitals contains single electron and the fourth orbital is empty.
- Two of the half filled hybridised orbitals of each boron overlap with the two hydrogens to form four terminal 2c-2e bonds, leaving one empty and one half filled hybridised orbitals on each boron.
- The Three centre - two electron bonds), B-H-B bond formation involves overlapping the half filled hybridised orbital of one boron, the empty hybridised orbital of the other boron and the half filled 1s orbital of hydrogen

Or

(ii). The crude metal is refined by electrolysis. It is carried out in an electrolytic cell containing aqueous solution of the salts of the metal of interest. The rods of impure metal are used as anode and thin strips of pure metal are used as cathode. The metal of interest dissolves from the anode, pass into the solution while the same amount of metal ions from the solution will be deposited at the cathode. During electrolysis, the less electropositive impurities in the anode, settle down at the bottom and are removed as anode mud.

electrolytic refining of silver

Cathode : Pure silver
Anode : Impure silver rods
Electrolyte : Acidified aqueous solution of silver nitrate.
When a current is passed through the electrodes the following reactions will take place

Reaction at anode : $2Ag\ (s) \rightarrow Ag^{+}\ (aq) + 1e^{-}$

Reaction at cathode $Ag^{+}\ (aq) + 1e^{-} \rightarrow 2Ag\ (s)$
During electrolysis, at the anode the silver atoms lose electrons and enter the solution. The positively charged silver cations migrate towards the cathode and get discharged by gaining electrons and deposited on the cathode.