

01 Solid State

1. For bcc lattice,

$$\text{Edge length (a)} = \frac{4}{\sqrt{3}} r$$

$$\text{Body diagonal} = 4r$$

$$\therefore \frac{\text{Edge length}}{\text{Body diagonal}} = \frac{4r}{\sqrt{3} \times 4r} = \frac{1}{\sqrt{3}} = \frac{1}{1.732}$$

6. A ccp structure has 4 atoms per unit cell. There is one octahedral void for each atom. Hence, the number of octahedral voids in ccp structure is $1 \times 4 = 4$.

9. Pure crystalline solids have sharp melting points. They melt at one constant temperature due to the presence of uniform orderly arrangement of constituent particles.

13. Edge length, $a = 4.05 \text{ \AA} = 4.05 \times 10^{-8} \text{ cm}$

$$\text{Density} = \frac{Z \times M}{a^3 \times N_0} \text{ g cm}^{-3}$$

$$2.7 \text{ g cm}^{-3} = \frac{Z \times 26.98}{(4.05 \times 10^{-8})^3 \times 6.022 \times 10^{23}}$$

$$Z = \frac{2.7 \times (4.05 \times 10^{-8})^3 \times 6.022 \times 10^{23}}{26.98}$$

$$Z = 4$$

\therefore The unit cell has fcc structure as it has 4 atoms per unit cell.

$$\text{For fcc unit cell, } 4r = \sqrt{2} a$$

$$\begin{aligned} \text{Radius of Al atom } r &= \frac{\sqrt{2}}{4} a = \frac{1.414}{4} \times 4.05 \text{ \AA} \\ &= 1.432 \text{ \AA} \end{aligned}$$

17. Density = $\frac{Z \times M}{a^3 \times N_0}$ of g cm^{-3}

$$\therefore 8.55 \text{ g cm}^{-3} = \frac{2 \times 93 \text{ g mol}^{-1}}{a^3 \times 6.022 \times 10^{23}}$$

$$\dots (\text{1u} = 1 \text{ g mol}^{-1})$$

$$a^3 = \frac{2 \times 93}{8.55 \times 6.022 \times 10^{23}}$$

$$\therefore a = \sqrt[3]{3.612 \times 10^{-23}}$$

$$\therefore a = 3.305 \times 10^{-8} \text{ cm}$$

$$\begin{aligned} \text{Atomic radius} &= \frac{\sqrt{3} a}{4} = \frac{\sqrt{3}}{4} \times 3.305 \times 10^{-8} \text{ cm} \\ &= 1.43 \times 10^{-8} \text{ cm} = 1.43 \text{ \AA} \end{aligned}$$

19. Density = $\frac{Z \times M}{a^3 \times N_0} \text{ g cm}^{-3}$

$$= \frac{2 \times 52 \text{ g mol}^{-1}}{(289 \times 10^{-10} \text{ cm})^3 \times 6.022 \times 10^{23} \text{ mol}^{-1}}$$

$$= 7.15 \text{ g cm}^{-3}$$

Thus, the density of bcc unit cell of Cr is 7.15 g cm^{-3} .

02 Solutions

1. Number of moles of O_2 (n_A) = $\frac{W_A}{M_A} = \frac{16}{32} = 0.5$

Number of moles of H_2 (n_B) = $\frac{W_B}{M_B} = \frac{4}{2} = 2.0$

$n_A + n_B = 0.5 + 2.0 = 2.5$

\therefore Mole fraction of O_2 (x_{O_2}) = $\frac{n_A}{n_A + n_B} = \frac{0.5}{2.5} = 0.2$

3. Let molecular weight of solute be M_B .
For two isotonic, non-electrolytic solutions:
 $C_1 = C_2$

\therefore
$$\frac{\text{Mass of Urea}}{\text{Molecular weight of urea}} \times \text{Volume of urea solution (L)}$$

=
$$\frac{\text{Mass of solute}}{\text{Molecular mass of solute}} \times \text{Volume of solution (L)}$$

\therefore
$$\frac{8.6}{60 \times 1} = \frac{50}{M_B \times 1}$$

Therefore, $M_B = 349$ g/mol

4.
$$\frac{p_A^0 - p_T}{p_A^0} = \frac{W_B M_A}{M_B W_A}; \frac{p_A^0 - p_T}{19} = \frac{100 \times 18}{342 \times 1000}$$

The vapour pressure lowering = $p_A^0 - p_T$
= $\frac{19 \times 100 \times 18}{342 \times 1000} = 0.1$ mm Hg

5. Molarity = $\frac{\text{number of moles of solute}}{\text{Volume of solution in L}}$
= $\frac{n_{H_3PO_4}}{V_{\text{Litres}}} = \frac{49}{98} \times \frac{1}{2.0} = 0.25$ M

7. Molarity of solution
= $\frac{\text{Number of moles of } CH_3OH}{\text{Volume of solution in L}}$
 $2.0 = \frac{\text{Mass of } CH_3OH}{\text{Molar mass of } CH_3OH} \times \frac{1}{V_{\text{Litres}}}$
 $2 = \frac{\text{Mass of } CH_3OH}{32} \times \frac{1}{0.150}$
 \therefore Mass of $CH_3OH = 2 \times 32 \times 0.150 = 0.3 \times 32 = 9.6$ g

8. In isotonic solutions, there is no net movement of solvent molecules from one side of the semipermeable membrane to the other.

9. 0.8 moles of solute are present in 1000 mL
 \therefore 0.1 moles of solute are present in x mL

\therefore
$$\frac{0.8}{0.1} = \frac{1000}{x}$$

\therefore
$$x = \frac{1000}{8} = 125$$
 mL

10. Two volatile liquids A and B form an ideal solution.

\therefore
$$p_T = p_A + p_B = x_A p_A^0 + x_B p_B^0$$

$x_B = 0.2; x_A = 1 - x_B = 1 - 0.2 = 0.8,$

$p_A^0 = 70$ torr and $p_T = 84$ torr

(1 torr = 1mm of Hg)

Now $p_T = 0.8 \times 70 + 0.2 \times p_B^0$

\therefore $84 = (0.8 \times 70) + 0.2 \times p_B^0$

$84 - (0.8 \times 70) = 0.2 \times p_B^0$

\therefore
$$p_B^0 = \frac{84 - (0.8 \times 70)}{0.2} = \frac{84 - 56}{0.2} = \frac{28}{0.2} = 140$$
 torr

12. Mass of water (in g) = 1 g;
Molar mass of water = 18 g

Number of moles of water = $\frac{1}{18} = 0.0555$

Molarity = $\frac{\text{Number of moles}}{\text{Volume in mL}} \times 1000$
= $\frac{0.055}{1} \times 1000$
= 55.55 M i.e. mol/litre

13. T = Temperature = $27^\circ C = 27 + 273 = 200$ K

$$\pi = \frac{W_B}{M_B} \times \frac{1}{V} RT$$

\therefore
$$1.23 \text{ atm} = \frac{0.6 \text{ g}}{M_B} \times \frac{1}{0.1}$$

$\times 0.082 \text{ L-atm K}^{-1} \text{ mole}^{-1} \times 300 \text{ K}$

\therefore
$$M_B = \frac{0.6}{0.1} \times \frac{1}{1.23} \times 0.0821 \times 300 \text{ g/mole}$$

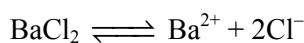


$$\begin{aligned}\therefore M_B &= \frac{6}{12.3} \times 0.821 \times 300 \\ &= \frac{1 \times 82.1 \times 3}{2.05} = 40 \times 05 \times 3\end{aligned}$$

Therefore, $M_B = 120.15$ g/mol

The molecular mass of solute is (approximately) 120 g/mol.

14. BaCl_2 dissociates in solution to form three ions.



$$i = \frac{N_{\text{observed}}}{N_{\text{theoretical}}} = \frac{3}{1} = 3$$

where, N_{observed} = number of solute particles present in solution

$N_{\text{theoretical}}$ = theoretical number of solute particles assuming non-electrolyte behaviour.

$$\begin{aligned}15. \text{ Molality} &= \frac{\text{Number of moles of solute}}{\text{Mass of solvent in g}} \times 1000 \\ &= \frac{\text{Mass of solute}}{\text{Molar mass of solute}} \times \frac{1000}{\text{Mass of solvent in g}} \\ &= \frac{0.850}{17} \times \frac{1000}{100} = 0.5 \text{ mol kg}^{-1}.\end{aligned}$$

16. During osmosis, the solvent molecules gradually move into concentrated solution which results in increase in the volume.

17. $\Delta T_b = K_b \times m$, (where ΔT_b = elevation of boiling point, m = molality of the solution and K_b = molal elevation of boiling point constant). Therefore, $K_b = \frac{\Delta T_b}{m}$

18. If π is the osmotic pressure of a dilute solution then, $\pi V = nRT$; where n = moles of solute

$$\therefore \pi = \frac{nRT}{V}$$

$$\therefore \text{At constant } T: \pi \propto \frac{1}{V} \text{ and } \pi V = \text{constant}$$

At constant V : $\pi \propto T$

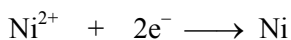
$$\therefore \pi \propto V, \text{ when } T \text{ is constant is incorrect.}$$

$$19. \Delta T_f = K_f \frac{W_B}{M_B W_A}$$

$$\begin{aligned}\therefore W_B &= \frac{\Delta T_f M_B W_A}{K_f} = \frac{1.05 \times 9000 \times 0.1}{4.9} \\ &= 192.85 \text{ g}\end{aligned}$$

03 Electrochemistry

1. The electrode reaction is:



$$1 \text{ mole} \quad 2 \times 96500 \text{ C}$$

Quantity of electric charge passed

$$= 9.65 \times 3 \times 60 \times 60 = 104220 \text{ C}$$

Number of moles of $\text{Ni}(\text{NO}_3)_2$ decomposed or

$$\text{nickel deposited} = \frac{1 \times 104220}{2 \times 96500} = 0.54$$

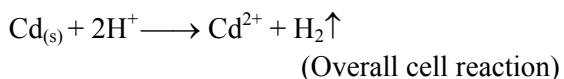
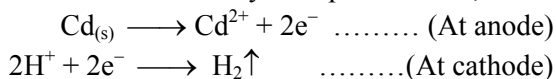
Number of moles of $\text{Ni}(\text{NO}_3)_2$ present before electrolysis = $0.5 \times 2 = 1.0$ mole

Number of moles of $\text{Ni}(\text{NO}_3)_2$ present after electrolysis = $(1.0 - 0.54) = 0.46$ mole

Since 0.46 moles of $\text{Ni}(\text{NO}_3)_2$ is present in 0.5 litre,

$$\text{Molarity of the solution} = 2 \times 0.46 = 0.92 \text{ M}$$

3. The cell reaction may be represented as,



4. Cell constant (G^*) = $\kappa \cdot R$
 $= 2.768 \times 10^{-3} \times 82.4 = 228.1 \times 10^{-3}$
 $= 0.2281 \text{ cm}^{-1}$

5. Specific conductance (κ) = $G \cdot \frac{l}{a}$
 $= \frac{1}{R} \cdot \frac{l}{a}$
 $= \frac{1}{1000} \times 8.76$
 $= 8.76 \times 10^{-3} \text{ ohm}^{-1} \text{ cm}^{-1}$

6. The e.m.f. of Daniel cell is given by the expression:

$$E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{0.0591}{2} \log_{10} \frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]}$$

From this equation, it can be predicted that, the e.m.f. of Daniel cell increases as the concentration of copper sulphate solution increases.

7. Molar conductivity

$$= \frac{1000}{\text{Molar concentration} \times \text{Resistivity}}$$

$$\therefore \Lambda_m = \frac{1000}{MX}$$

8. Acetic acid is a weak electrolyte.
11. Zn is stronger reducing agent than Fe and hence can be more easily oxidized than Fe. Hence, zinc becomes the anode, where oxidation occurs and Fe becomes cathode, where reduction of Fe^{2+} to Fe occurs.
13. At infinite dilution, ions are far apart and do not interact with each other.
14. In galvanic cell, the solutions are connected by a salt bridge which is represented by a double vertical line.
15. $\text{Na}^+ + \text{e}^- \rightarrow \text{Na}$
 $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$
 3 Faraday of electricity (i.e., 3 moles of electrons) would deposit 3 moles of Na and 1 mole of Al. Therefore, amount of Na and Al deposited = 1 mole : 0.33 mole
19. Electrolysis of fused lead bromide involves:
 $\text{PbBr}_2 \longrightarrow \text{Pb}^{2+} + 2\text{Br}^-$
 The Pb^{2+} ions migrate towards the cathode and get reduced to metallic lead while Br^- ions migrate towards anode and get oxidised to bromine.
20. Cell constant = $\kappa \times R$
 $= \kappa \times \frac{1}{G}$
 If $\kappa = G$, then cell constant is equal to 1.

04 Chemical Kinetics

1. The unit of rate constant ($\text{L mol}^{-1} \text{s}^{-1}$) indicates second order reaction.

2. The concentration of products increases with time and at the end of the reaction, it becomes constant.

3. The rate law is $\text{Rate} = k[\text{A}]^x [\text{B}]^y$
To calculate the values of exponents x and y , substitute value for each data series in above rate law

$$1.15 \times 10^{-4} \text{ M min}^{-1} = k(0.50 \text{ M})^x (0.02 \text{ M})^y \quad \dots\text{(i)}$$

$$2.30 \times 10^{-4} \text{ M min}^{-1} = k(0.50 \text{ M})^x (0.04 \text{ M})^y \quad \dots\text{(ii)}$$

$$2.30 \times 10^{-6} \text{ M min}^{-1} = k(0.01 \text{ M})^x (1.00 \text{ M})^y \quad \dots\text{(iii)}$$

$$0.92 \times 10^{-5} \text{ M min}^{-1} = k(0.02 \text{ M})^x (1.00 \text{ M})^y \quad \dots\text{(iv)}$$

Dividing equation (i) by (ii),

$$\frac{1.15 \times 10^{-4} \text{ M min}^{-1}}{2.30 \times 10^{-4} \text{ M min}^{-1}} = \frac{k(0.50 \text{ M})^x (0.02 \text{ M})^y}{k(0.50 \text{ M})^x (0.04 \text{ M})^y}$$

$$\frac{1.15}{2.30} = \frac{(0.02)^y}{(0.04)^y}$$

$$\therefore \frac{1}{2} = \left(\frac{1}{2}\right)^y \quad \therefore y = 1$$

Dividing equation (iii) by (iv),

$$\frac{2.30 \times 10^{-6} \text{ M min}^{-1}}{0.92 \times 10^{-5} \text{ M min}^{-1}} = \frac{k(0.01 \text{ M})^x (1.00 \text{ M})^y}{k(0.02 \text{ M})^x (1.00 \text{ M})^y}$$

$$\frac{0.23}{0.92} = \frac{(0.01)^x}{(0.02)^x} \quad \therefore \frac{1}{4} = \left(\frac{1}{2}\right)^x$$

$$\therefore \left(\frac{1}{2}\right)^2 = \left(\frac{1}{2}\right)^x$$

$$\therefore x = 2$$

Thus, $\text{Rate} = k[\text{A}]^2 [\text{B}]^1$

$$\therefore 0.92 \times 10^{-5} \text{ M min}^{-1} = k(0.02 \text{ M})^2 (1.0 \text{ M})^1$$

$$k = \frac{0.92 \times 10^{-5} \text{ M min}^{-1}}{4 \times 10^{-4} \text{ M}^3} = 2.3 \times 10^{-2} \text{ M}^{-2} \text{ min}^{-1}$$

4. The slope of the graph of

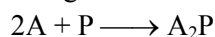
$$\log k \text{ versus } \frac{1}{T} = \frac{-E_a}{2.303R}$$

$$\therefore \frac{E_a}{2.303R} = 5000 \text{ K}$$

$$\therefore E_a = 5000 \text{ K} \times 2.303 \times 8.314 \text{ J K}^{-1} \text{ mol}^{-1} \\ = 95,735.71 \text{ J/mol} = 95.735 \text{ kJ/mol.}$$

5. A catalyst decreases the energy of activation of the forward as well as reverse reaction. It thus accelerates the rate of reaction. Thus, the reaction goes to completion faster.

6. The given reaction is



$$\text{The rate of disappearance of A} = -\frac{\Delta[\text{A}]}{\Delta t}$$

$$\text{The rate of disappearance of P} = -\frac{\Delta[\text{P}]}{\Delta t}$$

$$\text{The rate of formation of A}_2\text{P} = \frac{\Delta[\text{A}_2\text{P}]}{\Delta t}$$

The average rate of the reaction

$$= -\frac{1}{2} \frac{\Delta[\text{A}]}{\Delta t} = -\frac{\Delta[\text{P}]}{\Delta t} = \frac{\Delta[\text{A}_2\text{P}]}{\Delta t}$$

$$\therefore -\frac{\Delta[\text{A}]}{\Delta t} = +2 \frac{\Delta[\text{A}_2\text{P}]}{\Delta t}$$

$$7. \text{ For a first order reaction, } k = \frac{0.693}{t_{1/2}}$$

$$\therefore k = \frac{0.693}{693 \text{ s}} = 0.001 \text{ s}^{-1}$$

$$8. \text{ Rate} = 0.3 \text{ M s}^{-1} = k[\text{A}]^2$$

$$0.3 \text{ M s}^{-1} = k(0.2 \text{ M})^2 \quad \dots\text{(i)}$$

When concentration is increased 3 times,

$$\text{Rate} = k(3 \times 0.2 \text{ M})^2 \\ = 9k(0.2 \text{ M})^2 \quad \dots\text{(ii)}$$

Substituting (i) in the expression (ii),

$$\text{Rate} = 9 \times 0.3 \text{ M s}^{-1} = 2.7 \text{ M s}^{-1}$$

10. For the given first order reaction,

$$[\text{A}]_0 = 100, [\text{A}]_t = 100 - 85 = 15, \\ t = 79.0 \text{ min}$$

$$k = \frac{2.303}{t} \log_{10} \frac{[\text{A}]_0}{[\text{A}]_t} = \frac{2.303}{79.0 \text{ min}} \log_{10} \frac{100}{15}$$

$$= 2.40 \times 10^{-2} \text{ per min}$$

11. Metals 'Q' and 'S' can be used as a catalyst for the given reaction (under identical reaction conditions) since these metals lower the activation energy of the reaction.



13. Given that, $\frac{d[Z]}{dt} = 0.05 \text{ mol L}^{-1} \text{ min}^{-1}$
 Rate = $-\frac{1}{2} \frac{d[X]}{dt} = \frac{-d[Y]}{dt} = \frac{d[Z]}{dt}$
 $\therefore -\frac{d[X]}{dt} = 2 \frac{d[Z]}{dt} = 2 \times 0.05 \text{ mol L}^{-1} \text{ min}^{-1}$
 $= 0.1 \text{ mol L}^{-1} \text{ min}^{-1}$
15. For a first order reaction, Rate = $k[A]$
 $1.0 \times 10^{-2} \text{ mol L}^{-1} \text{ min}^{-1} = k(0.2 \text{ mol L}^{-1})$
 $\therefore k = 0.05 \text{ min}^{-1}$
 The expression for half-life period ($t_{1/2}$) is,
 $t_{1/2} = 0.693/k = 0.693/0.05 \text{ min}^{-1} = 13.86 \text{ s}$
16. From experiments 1 and 2, it is observed that when the concentration of B is unchanged and the concentration of A is doubled, the rate of the reaction is doubled. Also from experiments 2 and 3, it is observed that when the concentration of A is unchanged and the concentration of B is doubled, the rate of the reaction is doubled. Thus, the rate of the reaction is directly proportional to the concentration of A and B. Hence, the rate law is rate = $k[A][B]$. From experiments 1 and 3, it is observed that when the concentration of A and B is doubled, the rate of the reaction increases by four times.
17. The rate law is useful in estimating the concentration of reactants and products at any point of time during the course of reaction.
19. The integrated rate law for first order reaction is $k = \frac{2.303}{t} \log_{10} \frac{[A]_0}{[A]_t}$
 After two third life, concentration of A that decreases during time t from the beginning of reaction is $\frac{2}{3}[A]_0$
 $\therefore [A]_t = [A]_0 - \frac{2}{3}[A]_0 = \left(1 - \frac{2}{3}\right)[A]_0$
 Substituting this value in the integrated rate law,
 $k = \frac{2.303}{t} \log \frac{[A]_0}{\left(1 - \frac{2}{3}\right)[A]_0}$
 Using $k = 10^{-3} \text{ s}^{-1}$,
 $t = \frac{2.303}{10^{-3} \text{ s}^{-1}} \log 3 = 1.0988 \times 10^3 \text{ s} = 1098.8 \text{ s}$
 $\approx 1100 \text{ s}$

20. For first order reaction, the integrated rate law is,

$$k = \frac{2.303}{t} \log_{10} \frac{[A]_0}{[A]_t}$$

The reaction is 20% complete in 10 min.

- $\therefore [A]_0 = 100 \text{ M}, [A]_t = 100 - 20 = 80 \text{ M}$
 and $t = 10 \text{ min}$

$$k = \frac{2.303}{10 \text{ min}} \log_{10} \frac{100}{80} = 0.0223 \text{ min}^{-1}$$

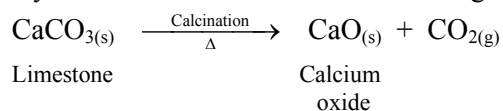
05 | Surface Chemistry

6. Soap is an associated colloid while nylon, starch and polystyrene are macromolecules that form macromolecular colloids in suitable solvents.
13. Traces of electrolytes are essential for stabilising the sols. Hence, for sol destruction, addition of excess of electrolytes is required.

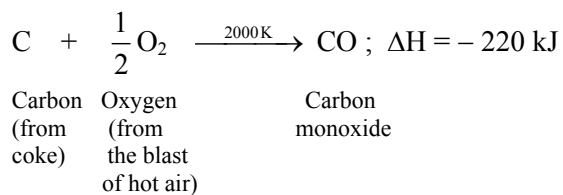
06

General Principles and Processes of Isolation of Elements

- Flux is added during smelting and not during roasting.
- Sulphide ores are converted into their oxides by roasting.
- Hydrated oxide and carbonate ores are generally calcined to give oxides.



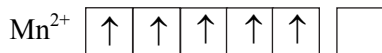
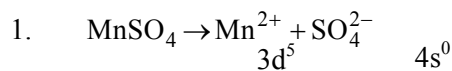
- Xanthates which are collectors, help in enhancing non-wettability of the ore particles by water.
- Addition of cryolite and fluorspar not only makes alumina a good conductor of electricity, but also lowers the fusion temperature of mix to around 1140 K.
- In iron metallurgy, coke reacts with the hot air blown through tuyers and forms carbon monoxide, the reaction is highly exothermic and takes place in the zone of combustion of the blast furnace.



07 | p-Block Elements

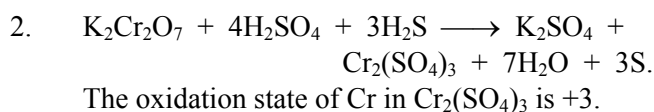
5. $2\text{KI}_{(\text{aq})} + \text{H}_2\text{O} + \text{O}_{3(\text{g})} \longrightarrow 2\text{KOH}_{(\text{aq})} + \text{I}_{2(\text{s})} + \text{O}_{2(\text{g})}$
Potassium iodide Water Ozone Potassium hydroxide Iodine Dioxygen
6. Interhalogen compounds are more reactive than halogens due to weaker X – X' bonds.
8. $[\text{Fe}(\text{H}_2\text{O})_6]^{2+} + \text{NO} \longrightarrow [\text{Fe}(\text{H}_2\text{O})_5(\text{NO})]^{2+} + \text{H}_2\text{O}$
Pentaaquanitrosyl iron (II) ion (Brown complex)
9. Arsenic reacts with hot concentrated sulphuric acid to form arsenic acid (H_3AsO_4).
14. Ozone bleaches the litmus paper. It has a pungent odour. In solid state, it has violet-black colour.
17. $2\text{NaN}_3 \xrightarrow{\Delta} 2\text{Na} + 3\text{N}_2$
Sodium azide Dinitrogen
- $\therefore 2 \text{ mol NaN}_3 \equiv 3 \text{ mol N}_2$
 $\therefore 4 \text{ mol NaN}_3 \equiv 6 \text{ mol N}_2$

08 | d and f-Block Elements



Due to presence of unpaired electrons, it will form coloured salt.

ScCl_3 , TiO_2 and ZnSO_4 contain the ions Sc^{3+} , Ti^{4+} and Zn^{2+} respectively; all of these have no unpaired electrons and thus are colourless.

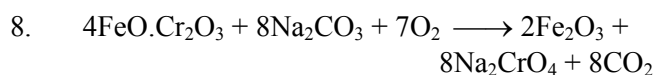


3. $3d^5$ configuration contains maximum number of unpaired electrons (i.e., 5). Hence, it shows the highest paramagnetic character.

4. Terbium is a lanthanoid as it belongs to 4f-series and has configuration $[\text{Xe}]4f^9 5d^0 6s^2$. Curium, Thorium and Uranium belong to 5f-series (actinoids).

6. Due to lanthanoid contraction, the size is similar for Zr – Hf, Nb – Ta and Mo – W. This effect is not observed in Sc – Y because an effect similar to lanthanoid contraction is not present.

7. Fe^{3+} ion has $[\text{Ar}]3d^5$ configuration. Hence, number of unpaired electron is 5.
 Magnetic moment = $\sqrt{5(5+2)} = 5.92$ B.M.



10.

No	Ion	Electronic configuration	No. of unpaired electrons
i.	Cu^{+2}	d^9	1
ii.	Ni^{+2}	d^8	2
iii.	Co^{+3}	d^6	4
iv.	Ti^{+2}	d^2	2

$$\mu = \sqrt{n(n+2)} \text{ (magnetic moment)}$$

$$\mu \propto \sqrt{n}$$

Cu^{+2} has only 1 unpaired electron, so its magnetic moment is the least.

11. Due to variable oxidation states, transition elements can form unstable intermediate which then decomposes to form products with regeneration of catalysts.

12. Cr has highest melting point and boiling point due to the presence of maximum number of unpaired electrons.

13. The removal of second electron disrupts its stable $3d^5$ (Cr^+) electronic configuration.

14. Electronic configuration of chromium:
 $\text{Cr} : [\text{Ar}]3d^5 4s^1$; $\text{Cr}^{2+} : [\text{Ar}]3d^4 4s^0$.

15. In alkaline medium, KMnO_4 oxidizes iodides to iodates. In acidic medium, KMnO_4 oxidizes iodides to free iodine.

16. Along a period from left to right, density increases due to decrease in metallic radius along with increase in atomic mass. Cu has maximum atomic mass.

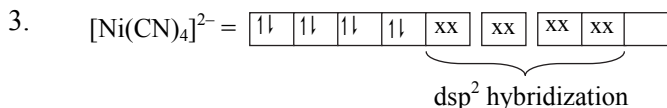
17. Interstitial compounds have lower densities compared to parent transition metals.

20. Earlier members of lanthanoids are quite reactive, similar to calcium. But as atomic number increases, they behave more like aluminium.

09

Coordination Compounds

1. Since in the given square planar complex, all the four ligands are different, three geometrical isomers are possible.



$[\text{Ni}(\text{CN})_4]^{2-}$ involves dsp^2 hybridisation, $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ involves sp^3d^2 hybridisation. $[\text{CoF}_6]^{3-}$ involves sp^3d^2 hybridisation and $[\text{Fe}(\text{CN})_6]^{3-}$ involves d^2sp^3 hybridisation.

4. Since no precipitate of AgCl with AgNO_3 is obtained, all the chloride ions are in the coordination sphere. $\text{PtCl}_4 \cdot 2\text{NH}_3$ gives zero ions in the solution. Hence, all the ligands are present in the coordination sphere. Thus, the structure is $[\text{Pt}(\text{NH}_3)_2\text{Cl}_4]$. $\text{PtCl}_4 \cdot 2\text{KCl}$ gives 3 moles of ions in solution.

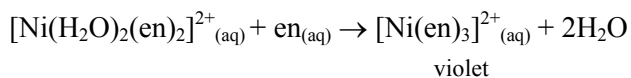
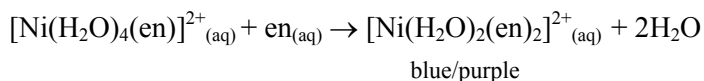
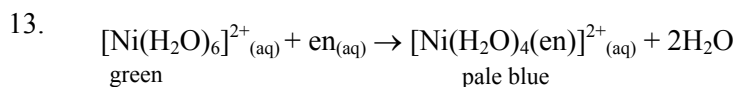
$\text{K}_2[\text{PtCl}_6] \rightleftharpoons 2\text{K}^+ + [\text{PtCl}_6]^{2-}$. Hence, the structure is $\text{K}_2[\text{PtCl}_6]$.

8. In homoleptic complexes, a metal is attached to one kind of donor atoms or groups.

$\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ is not a complex but it is a double salt known as Carnallite.

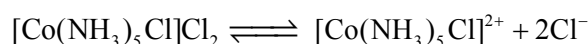
11. Linkage isomerism is shown by the coordination compounds containing ambidentate ligands. Ambidentate ligands are the ligands which have two or more donor atoms capable of forming coordinate bonds; however only one donor atom is utilized during complex formation.

NO_2 and SCN are ambidentate ligands whereas ethylenediamine (en) is bidentate ligand and NH_3 and Cl are monodentate ligands.



15. d^5 high spin octahedral contains five unpaired electrons.

18. $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ will dissociate to give $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$ and two Cl^- ions.



19. According to Lewis theory, the ligands are basic in nature as they donate pairs of electrons.

20. Magnetic moment = $\sqrt{n(n+2)}$ (where n = number of unpaired electrons)

$\therefore 3.87 = \sqrt{n(n+2)}$

$\therefore n = 3$

Hence, the complex must contain three unpaired electrons. Among the given complexes, only $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ ($\text{Cr}^{3+} = d^3$) contains three unpaired electrons.