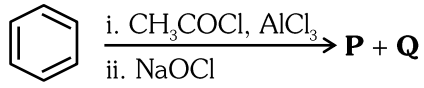
## CHEMISTRY

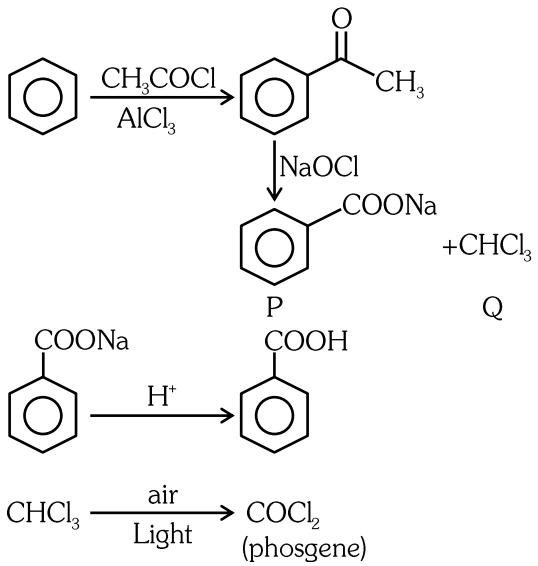
**46.** For the following reaction sequence, choose the correct option




(1) If **P** is the sodium salt of a carboxylic acid, **Q** is a primary alcohol.
(2) **P** and **Q** are aromatic compounds.
(3) If **P** gives a carboxylic acid on acidification, **Q** gives a poisonous gas on exposure to air and light.
(4) Both **P** and **Q** are carbonyl compounds.

**Ans. (3)**

**Sol.**




**47.** Given below are two statements:

**Statement-I :** $[Fe(ox)_3]^{3-}$ is chiral.

**Statement-II :** *trans*–$[Cr(H_2O)_2(ox)_2]^-$ is chiral.

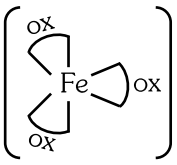
(Given : $oxH_2$ = HOOC – COOH)

In light of the above statements, choose the ***most appropriate*** answer from the options given below:

(1) Both **Statement-I** and **Statement-II** are correct.
(2) Both **Statement-I** and **Statement-II** are incorrect.
(3) **Statement-I** is correct but **Statement-II** is incorrect
(4) **Statement-I** is incorrect but **Statement-II** is correct.

**Ans. (3)**

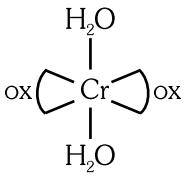
**Sol.** $[Fe(ox)_3]^{3-}$

S-I 

$\Rightarrow [M(AA)_3]$

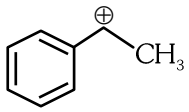
$\Rightarrow$ optically active so chiral

S-II trans – $[Cr(H_2O)_2(ox)_2]^-$



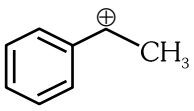

Plane of symmetry is present, so it is not optically active i.e. not chiral

**48.** The following carbocation is stabilized by the interaction of the empty p orbital with




(1) filled σ and filled π orbitals
(2) empty σ and empty $\pi^*$ orbitals
(3) empty $\sigma^*$ and filled π orbitals
(4) empty $\sigma^*$ and empty $\pi^*$ orbitals

**Ans. (1)**

**Sol.** 


Filled σ and filled π orbitals.

**49.** In potash alum, the ratio of $K^+$ and $SO_4^{2-}$ ions is

(1) 1 : 2 (2) 2 : 1

(3) 2 : 3 (4) 3 : 2

**Ans. (1)**

**Sol.** Potash Alum : $K_2SO_4.Al_2(SO_4)_3.24H_2O$

$K^+ : SO_4^{-2}$

$2 : 4 \Rightarrow (1 : 2)$

**50.** The correct statement about peptides and proteins is

(1) Tertiary structure of proteins has two or more polypeptide subunits

(2) Only the proteins having a quaternary structure are biologically active.

(3) In β-pleated sheet structures, peptide chains are held together by intermolecular hydrogen bonds.

(4) In α-helices, the polypeptide chain is twisted into a left-handed screw (helix) through intramolecular hydrogen bonds.

**Ans. (3)**

**Sol.** In β-pleated sheet structures, peptide chains are held together by intermolecular hydrogen bonds. (NCERT Biomolecules)

**51.** The numbers 17.0145 and 21.0235 were rounded to three figures after the decimal point. The resulting numbers, respectively, are

(1) 17.014 and 21.023

(2) 17.015 and 21.023

(3) 17.014 and 21.024

(4) 17.015 and 21.024

**Ans. (3)**

**Sol.** 17.0145 → Right most digit to be removed is 5 and preceding number is even

∴ it remains unchanged

17.014

21.0235 → Right most digit to be removed is 5 and preceding number is odd

∴ it is increased by 1

21.024

**52.** The correct order of solubility of the given salts in water at 298 K is

| Salt | $K_{sp}$ at 298 K |
|---|---|
| AgBr | $5.0 \times 10^{-13}$ |
| $Zn(OH)_2$ | $1.0 \times 10^{-15}$ |
| $Hg_2Cl_2$ | $1.3 \times 10^{-18}$ |

(1) $Hg_2Cl_2 > Zn(OH)_2 > AgBr$

(2) $AgBr > Zn(OH)_2 > Hg_2Cl_2$

(3) $Hg_2Cl_2 > AgBr > Zn(OH)_2$

(4) $Zn(OH)_2 > AgBr > Hg_2Cl_2$

**Ans. (4)**

**Sol.** Salt $\Rightarrow AgBr(s) \rightarrow Ag^+(aq.) + Br(aq.)$

$K_{sp} = S^2 \Rightarrow S_1 = \sqrt{K_{sp}} = \sqrt{5 \times 10^{-13}} = \sqrt{50 \times 10^{-14}}$

$= 7.1 \times 10^{-7} M$

Salt $\Rightarrow Zn(OH)_2(s) \rightarrow Zn^{+2}(aq.) + 2OH^-(aq.)$

$K_{sp} = 4S^3 \Rightarrow S_2 = \left(\frac{K_{sp}}{4}\right)^{1/3} = \left(\frac{1.0 \times 10^{-15}}{4}\right)^{1/3}$

$S_2 = (250 \times 10^{-18})^{1/3} = 6.3 \times 10^{-6} M$

Salt $\Rightarrow Hg_2Cl_2(s) \rightarrow Hg_2^{+2}(aq.) + 2Cl^-(aq.)$

$K_{sp} = 4S^3 \Rightarrow S_3 = \left(\frac{K_{sp}}{4}\right)^{1/3} = \left(\frac{1.3 \times 10^{-18}}{4}\right)^{1/3}$

$S_3 = (325 \times 10^{-21})^{1/3} = 6.9 \times 10^{-7} M$

∴ Order of solubility $\Rightarrow Zn(OH)_2 > AgBr > Hg_2Cl_2$

**53.** Among the following options, the correct trend in the electron gain enthalpy is

(1) F > Cl > Br > I

(2) Br > Cl > F > I

(3) Cl > F > Br > I

(4) I > Br > Cl > F

**Ans. (3)**

**Sol.** Electron Gain Enthalpy order of Halogen :

Cl > F > Br > I

**54.** **Assertion A:**

For an ideal solution formed by mixing liquids **P** and **Q**, $\Delta_{mix} H = 0$ and $\Delta_{mix} V = 0$

**Reason R:**

No interactions occur between **P** and **Q**

In the light of the above statements, choose the ***most appropriate*** answer from the options given below.

(1) Both **A** and **R** are correct and **R** is the correct explanation of **A**

(2) Both **A** and **R** are correct but **R** is **NOT** the correct explanation of **A**

(3) **A** is correct but **R** is not correct

(4) **A** is not correct but **R** is correct

**Ans.** **(3)**

**Sol.** If the intermolecular attractive forces between the P–P and Q–Q are nearly equal to those between P–Q, this leads to the formation of ideal solution.

As interactions remains nearly same, therefore $\Delta H_{mix} = 0$ and $\Delta V_{mix} = 0$. Hence, Assertion is correct and Reason is incorrect.

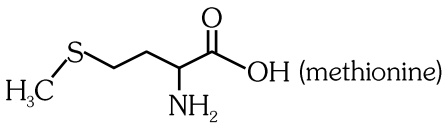
**55.** The amino acid that gives a red-blood colour on treating its sodium fusion extract with sodium nitroprusside is

(1) leucine (2) threonine

(3) methionine (4) serine

**Ans.** **(3)**

**Sol.**




Contains both sulphur and nitrogen

$\therefore$ Its sodium fusion extract gives red blood colour with sodium nitroprusside.

**56.** The standard electrode potential ($E^\circ$) for the half-cell reaction $Fe^{3+} + e^- \rightarrow Fe^{2+}$ at 298 K is

(Given : $E^\circ(Fe^{3+}/Fe) = -0.04$ V and

$E^\circ(Fe^{2+}/Fe) = -0.44$ V at 298 K)

(1) +0.40 V (2) +0.76 V

(3) –0.48 V (4) +0.92 V

**Ans.** **(2)**

**Sol.** $Fe^{+3} + 3e^- \rightarrow Fe$ ...(1)

$Fe^{+2} + 2e^- \rightarrow Fe$ ...(2)

$Fe^{+3} + e^- \rightarrow Fe^{+2}$ ...(3)

Eq. (3) = Eq. (1) – Eq. (2)

$\Delta G_3^0 = \Delta G_1^0 - \Delta G_2^0$

$-nFE_3^0 = -nFE_1^0 - (-nFE_2^0)$

$-(1)FE_3^0 = -3FE_1^0 - (-2FE_2^0)$

$E_3^0 = 3E_1^0 - 2E_2^0$

$= 3(-0.04) - 2(-0.44)$

$= -0.12 + 0.88$

$= +0.76$ V

**57.** In an acidic medium, 10 mL of 0.25 M oxalic acid is titrated with $KMnO_4$ solution. If the volume of $KMnO_4$ solution required to reach end point is 10 mL, the strength of the $KMnO_4$ solution is

(1) 0.10 M

(2) 0.20 M

(3) 0.25 M

(4) 0.15 M

**Ans.** **(1)**

**Sol.** Equivalents of oxalic acid = Equivalents of $KMnO_4$

Normalilty $\times$ volume = Normality $\times$ volume

$N_1V_1 = N_2V_2$

$M_1 \times v.f \times V_1 = M_2 \times v.f \times V_2$

$0.25 \times 2 \times 10 = M_2 \times 5 \times 10$

$M_2 = 0.10$ M

**58.** According to crystal field theory, the correct order of ligands with respect to their decreasing order of field strength is

(1) $CO > NH_3 > H_2O > Cl^-$

(2) $CO > H_2O > NH_3 > Cl^-$

(3) $Cl^- > H_2O > NH_3 > CO$

(4) $Cl^- > NH_3 > H_2O > CO$

**Ans. (1)**

**Sol.** Spectrochemical series for strength of ligands.

$CO > NH_3 > H_2O > Cl^-$

**59.** Two moles of an ideal gas undergo free expansion from 10 L to 100 L at 300 K. The values of $\Delta S_{System}$ and $\Delta S_{Surroundings}$ are (R is universal gas constant)

(1) $\Delta S_{System} = 0$; $\Delta S_{Surroundings} = 0$

(2) $\Delta S_{System} = 4.606R$; $\Delta S_{Surroundings} = -4.606R$

(3) $\Delta S_{System} = 0$; $\Delta S_{Surroundings} = 4.606\ R$

(4) $\Delta S_{System} = 4.606R$; $\Delta S_{Surroundings} = 0$

**Ans. (4)**

**Sol.** It is isothermal free expansion from 10 lt to 100lt at 300 K, 2 mole gas is taken.

$$\Delta S_{Sys} = nR\ell n\frac{V_2}{V_1}$$

$$= 2R\ell n\frac{100}{10}$$

$$= 2R\ell n\ 10$$

$$= 2R \times 2.303$$

$$= +4.606R$$

as $dT = 0$, $\Delta U = 0$

$P_{ext} = 0$ (as free expansion)

$W_{PV} = 0$

First law $\Delta U = Q + W$

$0 = Q + 0$

$Q = 0$

As no heat is exchanged between system and surrounding

$$\Delta S_{surr..} = -\frac{Q_{sys}}{T}$$

$$\Delta S_{surr.} = 0$$

**60.** $2A \xrightarrow{k} B$ is a zero-order reaction, where $k = 1.0\ mol\ L^{-1}\ min^{-1}$. If the initial concentration of A is 2 M, then the time taken to complete 75% of the reaction will be

(1) 1.5 min (2) 0.75 min

(3) 1.0 min (4) 2.0 min

**Ans. (2)**

**Sol.** $2A \xrightarrow{k} B$

$Rate = K[A]^0$

$$\frac{1}{2}\left[-\frac{d[A]}{dt}\right] = K$$

$$\frac{-d[A]}{dt} = 2K$$

$\therefore [A]_0 - [A]_t = 2Kt$

$[2] - [0.025\ (2)] = 2(1)t_{75\%}$

$t_{75\%} = 0.75$ min

**61.** Given below are two statements : one is labelled as **Assertion A** and the other is labelled as **Reason R**.

**Assertion A :** Generally,3d transition metals have high melting points.

**Reason R :** Involvement of 3d-electrons in addition to 4s-electrons in the interatomic metallic bonding.

In light of the above statements, choose the ***most appropriate*** answer from the options given below:

(1) Both **A** and **R** are correct and **R** is the correct explanation of **A**

(2) Both **A** and **R** are correct and **R** is **NOT** the correct explanation of **A**

(3) **A** is correct but **R** is not correct

(4) **A** is not correct but **R** is correct

**Ans. (1)**

**Sol.** In d-block metals, unpaired electrons of (n–1) d subshell also participate in metallic bonding along with ns that's why interatomic metallic bonding is comparatively strong hence their melting point are high

**62.** For a salt **XY**, which is a strong electrolyte, the plot of $\Lambda_m$ versus $\sqrt{c}$ has a slope of –90.0 S cm$^2$ mol$^{-3/2}$ L$^{1/2}$ at 298 K. At 0.01 M concentration of **XY**, the values of $\Lambda_m$ is 145.S cm$^2$ mol$^{-1}$. The limiting molar conductivity of $\mathbf{Y^-}$ ion ($\lambda^0_{Y^-}$, in S cm$^2$ mol$^{-1}$) at 298 K will be

(Given $\lambda^0_{X^+}$ =74.0 S cm$^2$ mol$^{-1}$)

(1) 80.0 (2) 100.0

(3) 90.0 (4) 76.0

**Sol.** For XY, Debye Huckel Onsager equation,

$\Lambda_M = \Lambda_M^0 - A\sqrt{c}$

slope of $\Lambda_M$ vs $\sqrt{c}$ is $-A = -90$

$A = 90$

At C = 0.01 M, $\Lambda_M = 145$

$\therefore 145 = \Lambda_M^0 - 90 \times \sqrt{10^{-2}}$

$145 = \Lambda_M^0 - 9$

$\Lambda_M^0 = 154$ Scm$^2$mol$^{-1}$

$\Lambda_M^0(XY) = \Lambda_M^0(X^+) + \Lambda_M^0(Y^-)$

$154 = 74 + \Lambda_M^0(Y^-)$

$\Lambda_M^0(Y^-) = 154 - 74 = 80$ Scm$^2$ mol$^{-1}$

**Ans. (1)**

**63.** The amount of carbon dioxide evolved upon complete combustion of 116 g of n-butane is

**(Given :** atomic mass in amu H = 1, C = 12 and O = 16)

(1) 352 g (2) 322 g

(3) 176 g (4) 362 g

**Ans. (1)**

**Sol.** n-butane is $C_4H_{10}$

$n_{C_4H_{10}} = \frac{116}{58} = 2$mol.

$C_4H_{10} + \frac{13}{2}O_2 \rightarrow 4CO_2 + 5H_2O$

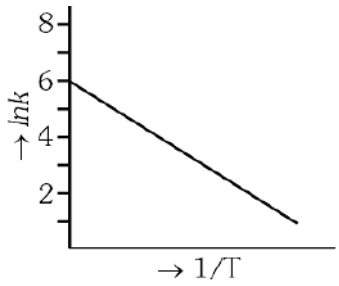
1mol $C_4H_{10}$ gives 4mol of $CO_2$

2mol $C_4H_{10}$ gives 8 mol of $CO_2$

$W_{CO_2} = 8 \times 44$

= 352 g

**64.** For an elementary chemical reaction, the Arrhenius plot is given below.




If the energy of activation is 6.64 kJ mol$^{-1}$ and R = 8.3 J K$^{-1}$ mol$^{-1}$, the temperature at which the rate constant becomes $e^2$ min$^{-1}$, is

(1) 125 K (2) 150 K

(3) 200 K (4) 250 K

**Ans. (3)**

**Sol.** $\ell n\, k = \ell n\, A - \frac{E_a}{RT}$

$\ell n\, A = 6$ (from graph)

$k = e^2$, T = ?

$\ell n\, e^2 = 6 - \frac{6.64 \times 1000}{8.3 \times T}$

$2 = 6 - \frac{6640}{8.3 \times T}$

$\frac{6640}{8.3 \times T} = 4$

T = 200 K

**65.** Given below are two statements:

**Statement-I :** Heating NaCl with conentrated $H_2SO_4$ and $MnO_2$ results in oxidation of Mn.

**Statement-II :** Heating NaI with concentrated $H_2SO_4$ and $MnO_2$ results in reduction of Mn.

In light of the above statements, choose the ***most appropriate*** answer from the options given below:

(1) Both **Statement-I** and **Statement-II** are correct.

(2) Both **Statement-I** and **Statement-II** are incorrect.

(3) **Statement-I** is correct but **Statement-II** is incorrect.

(4) **Statement-I** is incorrect but **Statement-II** is correct.

**Ans. (4)**

**Sol.** Heating NaCl with concentrated $H_2SO_4$ and $MnO_2$ reduces Mn, not oxidises it

**S-(I)**

$$4NaCl + \overset{+4}{Mn}O_2 + 4\,H_2SO_4 \rightarrow \overset{+2}{Mn}Cl_2 + 4\,NaHSO_4 + 2H_2O + Cl_2$$

**i.e. statement is wrong.**

**S-(II)**

$$2NaI + \overset{+4}{Mn}O_2 + 4H_2SO_4 \rightarrow I_2(\uparrow) + \overset{+2}{Mn}SO_4 + Na_2SO_4 + 2H_2O$$

Heating NaI with conc. $H_2SO_4$ and $MnO_2$ reduce Mn.

**statement is correct.**

**66.** Among the species given below, the spin only magnetic moment is highest for

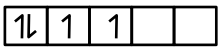
(Given : Atomic number of Ti = 22, Mn = 25, Fe = 26 and Co = 27)

(1) $[Mn(CN)_6]^{3-}$ (2) $[Fe(CN)_6]^{3-}$

(3) $[Co(NH_3)_6]^{3+}$ (4) $[Ti(H_2O)_6]^{3+}$

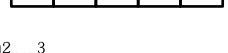
**Ans. (1)**

**Sol.** [1] $[Mn(CN)_6]^{-3} \Rightarrow d^2sp^3$

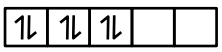
$\Rightarrow Mn^{+3} = 3d^4 \Rightarrow$  $\Rightarrow n = 2$

$\Rightarrow$ Maximum no. of unpaired $e^-$ so highest spin only magnetic moment.

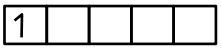
(2) $[Fe(CN)_6]^{3-} \Rightarrow d^2sp^3$

$\Rightarrow Fe^{+3} = 3d^5 \Rightarrow$  $\Rightarrow n = 1$

(3) $[Co(NH)_6]^{3+} \Rightarrow d^2sp^3$

$\Rightarrow Co^{+3} = 3d^6 \Rightarrow$  $\Rightarrow n = 0$

(4) $[Ti(H_2O)_6]^{3+} \Rightarrow d^2sp^3$

$\Rightarrow Ti^{+3} = 3d^1 \Rightarrow$  $\Rightarrow n = 1$

**67.** The lanthanide ion having four unpaired electrons is (Given : Atomic number of Ce = 58, Nd = 60, Tb = 65 and Ho = 67)

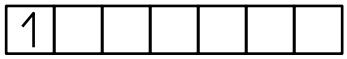
(1) $Nd^{3+}$ (2) $Ce^{3+}$

(3) $Tb^{3+}$ (4) $Ho^{3+}$

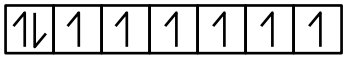
**Ans. (4)**

**Sol.** (1) $Nd^{+3} \Rightarrow 4f^3 \Rightarrow$ 

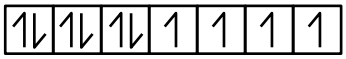
$\Rightarrow n = 3$

(2) $Ce^{+3} \Rightarrow 4f^1 \Rightarrow$ 

$\Rightarrow n = 1$

(3) $Tb^{+3} \Rightarrow 4f^8 \Rightarrow$ 

$\Rightarrow n = 6$

(4) $Ho^{+3} \Rightarrow 4f^{10} \Rightarrow$ 

$\Rightarrow n = 4$

**68.** The formula of tetraammineaquachloridocobalt(III) chloride is

(1) $[Co(NH_3)_4Cl_2] \times H_2O$ (2) $[Co(NH_3)_4]Cl_3 \times H_2O$

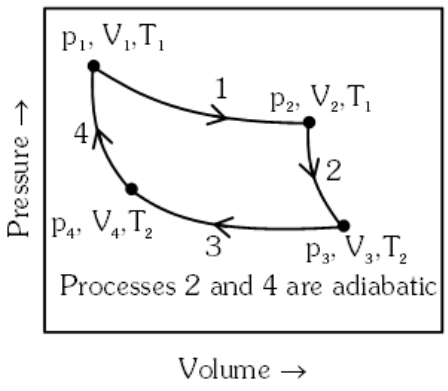
(3) $[Co(NH_3)_4(H_2O)Cl]Cl$ (4) $[Co(NH_3)_4(H_2O)Cl]Cl_2$

**Ans. (4)**

**Sol.** $[Co(NH_3)_4(H_2O)Cl]Cl_2$

Ammine — Aqua — Chlorido

**69.** Consider the reversible processes for 1.0 mol of an ideal gas as shown in the figure.




$w_1$, $w_2$, $w_3$ and $w_4$ represent work done (in calories) in the processes 1, 2, 3 and 4, respectively; $\Delta U_2$ and $\Delta U_4$ are changes in the internal energy for the processes 2 and 4, respectively.

(use $R = 2$ cal $K^{-1}$ $mol^{-1}$)

The correct option is

(1) $w_1 + w_3 = -2T_1 \ln\frac{V_2}{V_1} - 2T_2 \ln\frac{V_4}{V_3}$

(2) $w_2 + w_4 = \Delta U_2 - \Delta U_4$

(3) $w_1 + w_2 = 2T_1 \ln\frac{V_2}{V_1}$

(4) $w_1 + w_2 + w_3 + w_4 = 0$

**Ans. (1)**

**Sol.** Process-1 is Isothermal reversible process

$$w_1 = -nRT\ \ell n\left(\frac{V_f}{V_i}\right)$$

$$= -1 \times 2 \times T_1\ \ell n\left(\frac{V_2}{V_1}\right)$$

$$= -2T_1\ \ell n\left(\frac{V_2}{V_1}\right)$$

Process-3 is Isothermal reversible process

$$w_3 = -nRT\ \ell n\left(\frac{V_f}{V_i}\right)$$

$$= -1 \times 2 \times T_2\ \ell n\left(\frac{V_4}{V_3}\right)$$

$$= -2T_2\ \ell n\left(\frac{V_4}{V_3}\right)$$

$$w_1 + w_3 = -2T_1\ \ell n\left(\frac{V_2}{V_1}\right) - 2T_2 \ell n\left(\frac{V_4}{V_3}\right)$$

Process-2 is Reversible adiabatic process (expansion)

$$w_2 = \Delta U_2 = nC_V\,\Delta T$$
$$= 1 \times C_V\,(T_2 - T_1)$$
$$= C_V\,(T_2 - T_1)$$

Process-4 is Reversible adiabatic process (compression)

$w_4 = \Delta U_4 = nC_V \Delta T$

$= 1 \times C_V (T_1 - T_2)$

$= -C_V (T_2 - T_1)$

$w_2 + w_4 = \Delta U_2 + \Delta U_4$

$= 0$

**70.** Given below are two statements : One is labelled as **Assertion A** and the other is labelled as **Reason R**.

**Assertion A :** The first ionization enthalpy of O is lower than that of N and F.

**Reason R :** The loss of an electron from O leads to stable half-filled p orbital.

In light of the above statements, choose the ***most appropriate*** answer from the options given below:

(1) Both **A** and **R** are correct and **R** is the correct explanation of **A**.

(2) Both **A** and **R** are correct and **R** is **NOT** the correct explanation of **A**.

(3) **A** is correct but **R** is not correct.

(4) **A** is not correct but **R** is correct.

**Ans. (1)**

**Sol.** $IP_1$ :- O < N < F

First IP of O is lower than both N and F.

**Reason :** After removal of electron O becomes $2p^3$ (half-filled)

**71.** Consider the following statements about the solutions formed by mixing two liquids.

A. An ideal solution thus formed obeys Raoult's law throughout the composition range.

B. Mixture of chloroform and acetone shows, negative deviation from Raoult's law.

C. Mixture of aniline and phenol shows positive deviation from Raoult's law.

(1) A and B only

(2) B and C only

(3) A only

(4) A and C only

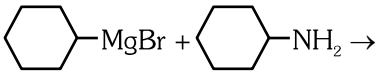
**Ans. (1)**

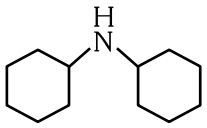
**Sol.** (A) is correct. Raoult's law is obeyed by ideal solution throughout the composition Range.

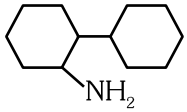
(B) is correct. They together form a solution showing negative deviation from Raoult's law

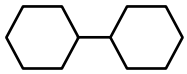
(C) is incorrect. They together form a solution showing negative deviation from Raoult's law

**72.** One of the products formed in the following reaction is




(1) 


(2) 


(3) 

(4) 

**Ans. (4)**

**Sol.** 


**73.** The correct statement is

(1) Boron has a maximum covalency of four.

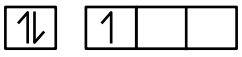
(2) Beryllium has three valence orbitals.

(3) Magnesium has a maximum covalency of four.

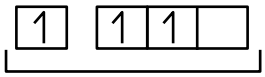
(4) Aluminimum has five valence orbitals.

**Ans. (1)**

**Sol.** B = [He] $2s^2\ 2p^1$

GS : 

2s 2p

$I^{st}$ ES :  Ex. $BF_4^-$

One + three ⇒ 4 orbitals

4 orbital can participate in bonding.

**74.** A protein undergoes reversible thermal denaturation from its initial state **N** to denatured state **D** according to **N** $\rightleftharpoons$ **D**. At 60 °C, the concentrations of both **N** and **D** are equal at equilibrium, and the standard enthalpy change of denaturation is 666 kJ $mol^{-1}$. The standard entropy change ($\Delta S°$ in kJ $K^{-1}$ $mol^{-1}$) of the protein upon denaturation at 60°C is closest to

(1) 2.0 (2) 2000.0

(3) 333.0 (4) 11.1

**Ans. (1)**

**Sol.** $N \rightleftharpoons D$

$$K = \frac{[D]}{[N]}$$

K = 1 {as [D] = [N] at equilibrium}

Now, $\Delta G° = -2.303\ RT \log K$

$\Delta G° = 0$ {as K = 1}

Now, $\Delta G° = \Delta H° - T\Delta S°$

$0 = 666 - 333\ \Delta S°$

$$\Delta S° = \frac{666}{333}$$

$\Delta S° = 2$ kJ $K^{-1}mol^{-1}$

**75.** Match the species in **List-I** with their geometry in **List-II**

| | List-I | | List-II |
|---|---|---|---|
| A. | $PCl_5$ | I. | Tetrahedral |
| B. | $BrF_5$ | II. | Square Planar |
| C. | $BF_4^-$ | III. | Trigonal bipyramidal |
| D. | $[Ni(CN)_4]^{2-}$ | IV. | Square pyramidal |

Choose the **correct** answer from the options given below :

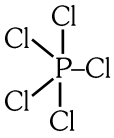
(1) A-IV, B-III, C-I, D-II

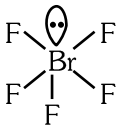
(2) A-III, B-IV, C-I, D-II

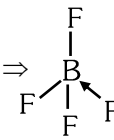
(3) A-III, B-I, C-II, D-IV

(4) A-III, B-II, C-I, D-IV

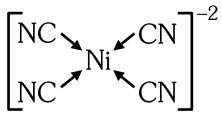
**Ans. (2)**

**Sol.** (A) $PCl_5 \Rightarrow$  Trigonal bi pyramidal $(sp^3d)$

(B) $BrF_5 \Rightarrow$  Square pyramidal $(sp^3d^2)$ 1lp

(C) $BF_4^- \Rightarrow$  Tetrahedral $(sp^3)$

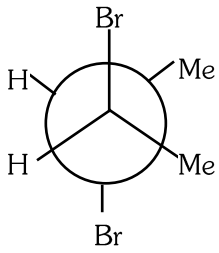
(D) $[Ni(CN)_4]^{-2}$ $dsp^2 \Rightarrow$ square planar



**76.** Given below are two statements :

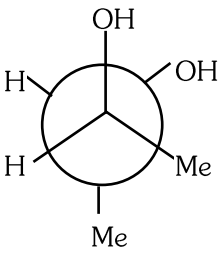
**Statement-I :**

*trans*-But-2-ene upon treatment with $Br_2$ in $CCl_4$ gives the following product



**Statement-II:**

*cis*-But-2-ene upon treatment with alkaline $KMnO_4$ gives the following product




In the light of the above statements, choose the ***most appropriate*** answer from the options given below**.**

(1) Both **Statement-I** and **Statement-II** are correct

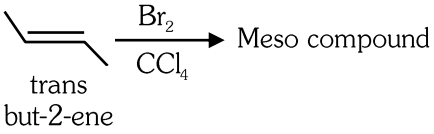
(2) Both **Statement-I** and **Statement-II** are incorrect

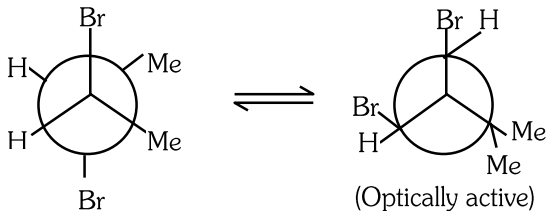
(3) **Statement-I** is correct but **Statement-II** is incorrect

(4 **Statement-I** is incorrect but **Statement-II** is correct

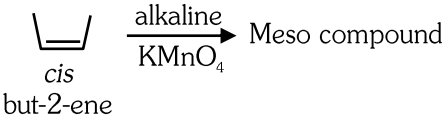
**Ans. (4)**

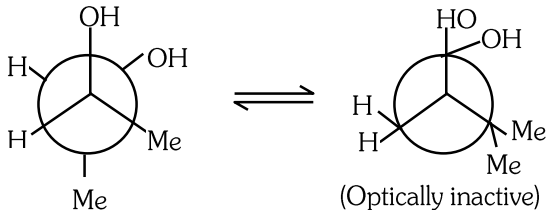
**Sol.**



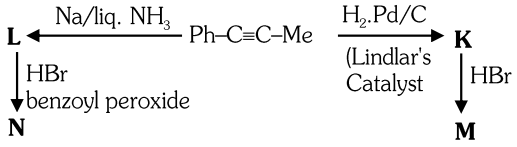

∴ Statements-I is incorrect.




∴ Statements-II is correct.

**77.** Consider the following reaction sequences and choose the correct option




(1) **K** and **L** are geometrical isomers.

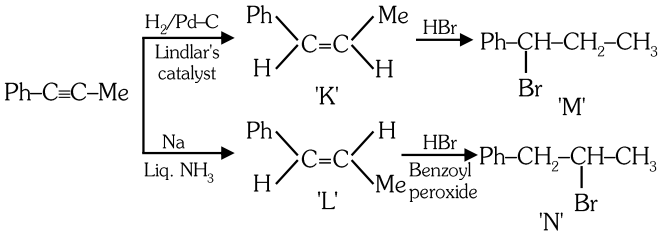
(2) **K** and **L** are enantiomers

(3) **M**and **N** are geometrical isomers.

(4) **M** and **N** are stereoisomers

**Ans. (1)**

**Sol.**




K & L are geometrical isomers.

**78.** The complex which has *facial* and *meridional* isomers is

(Given: py = pyridine and en = $H_2N–CH_2–CH_2–NH_2$)

(1) $[Cr(py)_3(Cl)_3]$

(2) $[Cr(H_2O)_6]^{3+}$

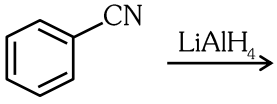
(3) $[Co(NH_3)_4(H_2O)_2]^{3+}$

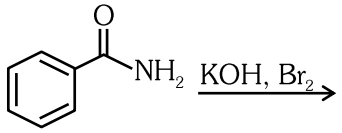
(4) $[Ni(en)_2(H_2O)_2]^{2+}$

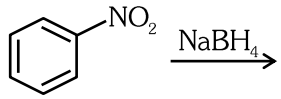
**Ans. (1)**

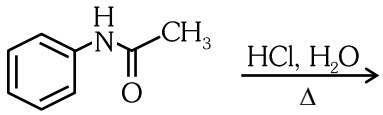
**Sol.** $[Cr(Py]_3Cl_3] \Rightarrow [Ma_3b_3] \Rightarrow$ It shows facial, meridional isomers.

**79.** Identify the reactions which give aniline as the major product·

A. 

B. 

C. 

D. 

Choose the correct answer from the options given below.

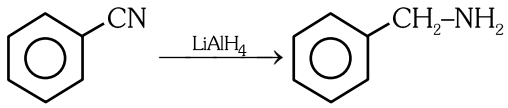
(1) A and B only

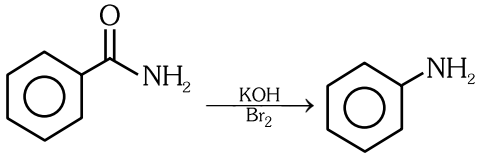
(2) B and D only

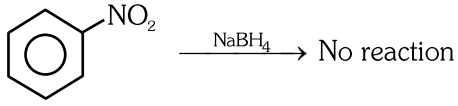
(3) A and C only

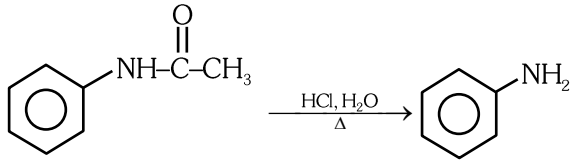
(4) C and D only

**Ans. (2)**

**Sol.** A. 

B. 

C. 

D. 

**80.** Match the vitamins in **List-I** with their sources in **List-II**

| | **List-I** | | **List-II** |
|---|---|---|---|
| A. | vitamin A | I. | meat |
| B. | vitamin $B_{12}$ | II. | sunflower oil |
| C. | vitamin E | III. | green leafy vegetables |
| D. | vitamin K | IV. | carrots |

Choose the correct answer from the options given below.

(1) A-II, B-III, C-IV, D-I

(2) A-IV, B-I, C-II, D-III

(3) A-IV, B-II, C-I, D-III

(4) A-III, B-I, C-IV, D-II

**Ans. (2)**

**Sol.** (A) Vitamin A Carrots

(B) Vitamin $B_{12}$ Meat

(B) Vitamin E Sunflower oil

(D) Vitamin K Green leafy vegetables.

**81.** The correct decreasing order of oxidation state of the underlined atom in each molecule is

(1) $\underline{P}_4O_{10} > \underline{S}O_3 > H_2\underline{O}$

(2) $\underline{N}_2O_5 > \underline{Al}_2O_3 > H_2\underline{S}$

(3) $\underline{Pb}O_2 > \underline{N}_2O_3 > \underline{S}O_3$

(4) $\underline{P}_4O_6 > \underline{Cl}_2O_7 > \underline{Al}H_3$

**Ans. (2)**

**Sol.** $\underline{N}_2O_5 \Rightarrow 2x + 5(-2) = 0$

$2x = 10$

$x = +5$

$\underline{Al}_2O_3 \Rightarrow 2x + 3(-2) = 0$

$2x = 6$

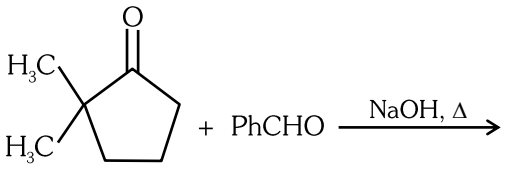
$x = +3$

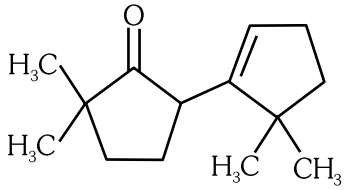
$H_2\underline{S} \Rightarrow 2(+1) + x = 0$

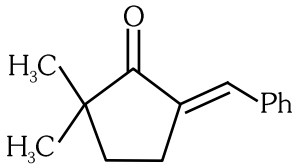
$x = -2$

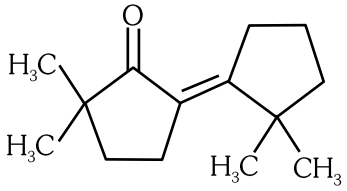
$N_2O_5 > Al_2O_3 > H_2S$

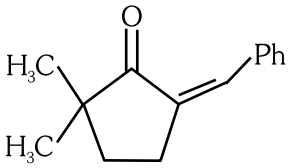
**82.** The compound that **CANNOT** be obtained from the aldol condensation reaction shown below, is



(1) 

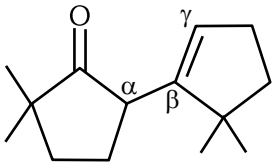
(2) 

(3) 

(4) 

**Ans. (1)**

**Sol.** Aldol condensation product should be α,β-unsaturated carbonyl compound



(cannot be formed)

**83.** Among the following, the compound having conjugated double bonds is

(1) hepta-1,3-diene

(2) hepta-1,4-diene

(3) hepta-1,5-diene

(4) hepta-1,6-diene

**Ans. (1)**

**Sol.** $\overset{1}{C}H_2=\overset{2}{C}H-\overset{3}{C}H=\overset{4}{C}H-\overset{5}{C}H_2-\overset{6}{C}H_2-CH_3$

Hepta–1,3–diene

**84.** Given below are two statements:

**Statement-I :** Oxidation of *p*-nitrotoluene with acidic $KMnO_4$ gives an acid that is stronger than benzoic acid.

**Statement-II :** Reduction of p-nitrotoluene with Sn/HCl followed by neutralization gives an amine that is more basic than aniline.

In light of the above statements, choose the ***most appropriate*** answer from the options given below.

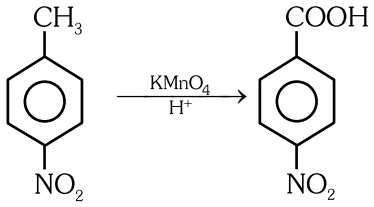
(1) Both **Statement-I** and **Statement-II** are correct

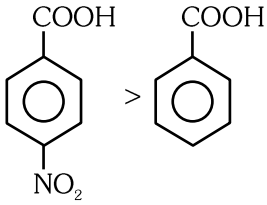
(2) Both **Statement-I** and **Statement-II** are incorrect

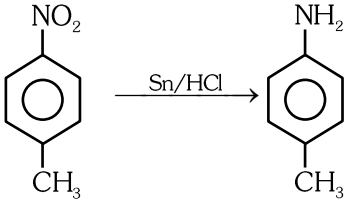
(3) **Statement-I** is correct but **Statement-II** is incorrect

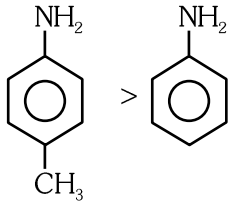
(4) **Statement-I** is incorrect but **Statement-II** is correct

**Ans. (1)**

**Sol.** : 

Acidic strength : 



Basic strength : 

$\therefore$ Both statement I and II are correct

**85.** The green paramagnetic species formed by heating $KMnO_4$ at 513 K is

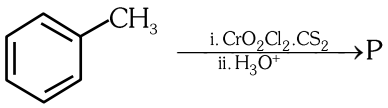
(1) $K_2MnO_4$ (2) $Mn_3O_4$

(3) MnO (4) $KO_2$

**Ans. (1)**

**Sol.** $KMnO_4 \xrightarrow{\Delta} K_2MnO_4 + MnO_2 + O_2$

**86.** Consider the following reaction, and choose the correct option.




(1) On treating compound **P** with saturated $NaHCO_3$ solution, brisk effervescence is observed.

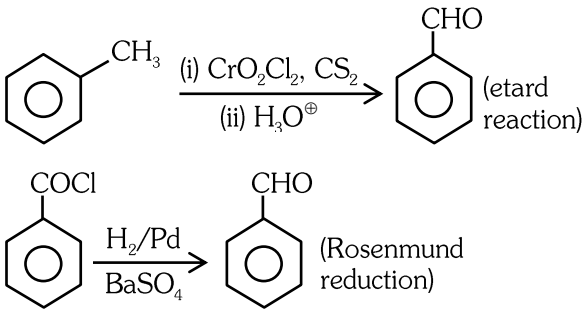
(2) Compound **P** can be prepared by treating benzene with anhydrous $AlCl_3$ and $CH_3COCl$.

(3) On treatment with bromine water, compound **P** gives a white precipitate.

(4) Compound **P** is obtained by the hydrogenation of benzoyl chloride with Pd on $BaSO_4$.

**Ans. (4)**

**Sol.**




**87.** A 1 : 3 electrolyte in an aqueous solution is

(1) $[CoCl_2(NH_3)_4]Cl$

(2) $[CoCl(NH_3)_5]Cl_2$

(3) $[Co(NH_3)_6]Cl_3$

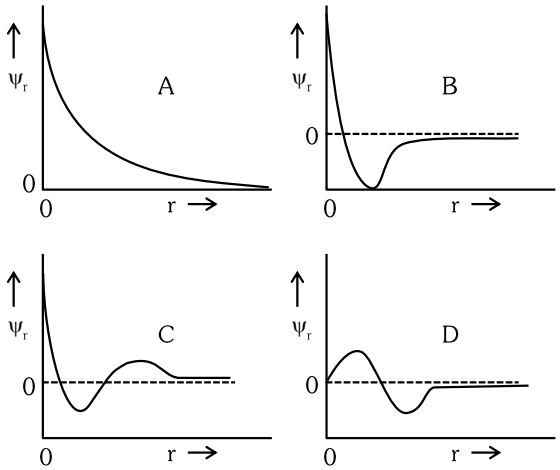
(4) $[Co(NH_3)_3(NO_2)_3]$

**Ans. (3)**

**Sol.** $[Co(NH_3)_6]Cl_3 \Rightarrow [Co(NH_3)_6]^{3+} + 3Cl^-$

1 : 3 electorlyte

**88.** Consider the following schematic plots of orbital wavefunction ($\psi_r$) against distance (r) from the nucleus.




The figure representing two radial nodes in the orbital is

(1) A (2) B

(3) C (4) D

**Ans. (3)**

**Sol.** In figure C, the curve is cutting two times on x-axis. Hence, represents two nodes.

**89.** Arrange the following compounds in the increasing order of polarity

A. $CH_3CH_2OCH_2CH_3$

B. $CH_3CH_2OH$

C. $CH_3COCH_3$

D. $CH_3COOH$

Choose the correct answer from the options given below :

(1) A < B < C < D (2) C < A < D < B

(3) C < A < B < D (4) A < C < B < D

**Ans. (4)**

**Sol.** Increasing order :

$CH_3CH_2OCH_2CH_3 < CH_3COCH_3 < CH_3CH_2OH < CH_3COOH$

**90.** The highest occupied molecular orbital for $Ne_2$ is

(1) $\pi_{2p}$ (2) $\sigma_{2p}$

(3) $\pi^*_{2p}$ (4) $\sigma^*_{2p}$

**Ans. (4)**

**Sol.** $Ne_2 \Rightarrow 20e^-$

$\sigma 1s^2 < \sigma^* 1s^2 < \sigma 2s^2 < \sigma^* 2s^2 < \sigma 2p_z^2$

$< \pi 2p_x^2 = \pi 2p_y^2 < \pi^* 2p_x^2 = \pi^* 2p_y^2 < \sigma^* 2p_z^2$

$\Rightarrow$ Highest Occupied Molecular Orbital (HOMO)