CHEMISTRY
JEE-MAIN (August-Attempt)
26 August (Shift-1) Paper
Solution

SECTION - A

Q.1 Which one of the following complexes is violet in colour :

(1) $[Fe(CN)_5NOS]^{4-}$ (2) $Fe_4[Fe(CN)_6]_3 \cdot H_2O$

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

Sol. 1

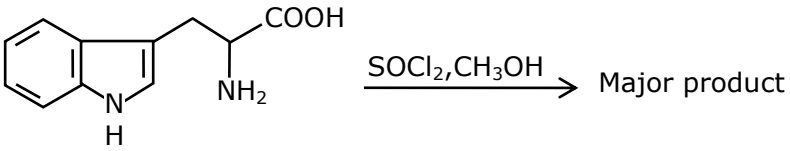
(1) $[Fe(CN)_6]^{4-} \rightarrow$ Pale yellow solution

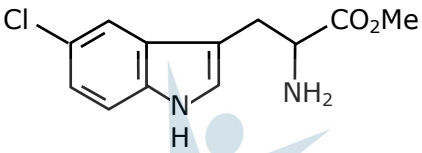
(2) $[Fe(SCN)^6]^{4-} \rightarrow$ Blood red colour

(3) $Fe_4[Fe(CN_6)]_3.H_2O \rightarrow$ Prussian blue

(4) $[Fe(CN)_5NOS]^{4-} \rightarrow$ Violet colour

Q.2 The major product formed in the following reaction is :



(1)


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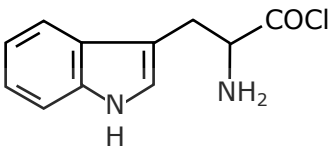

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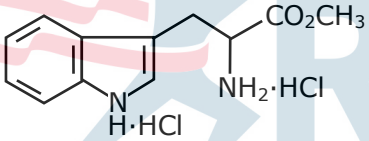

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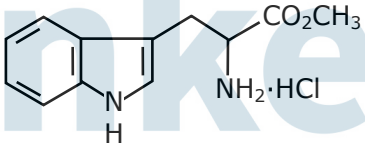
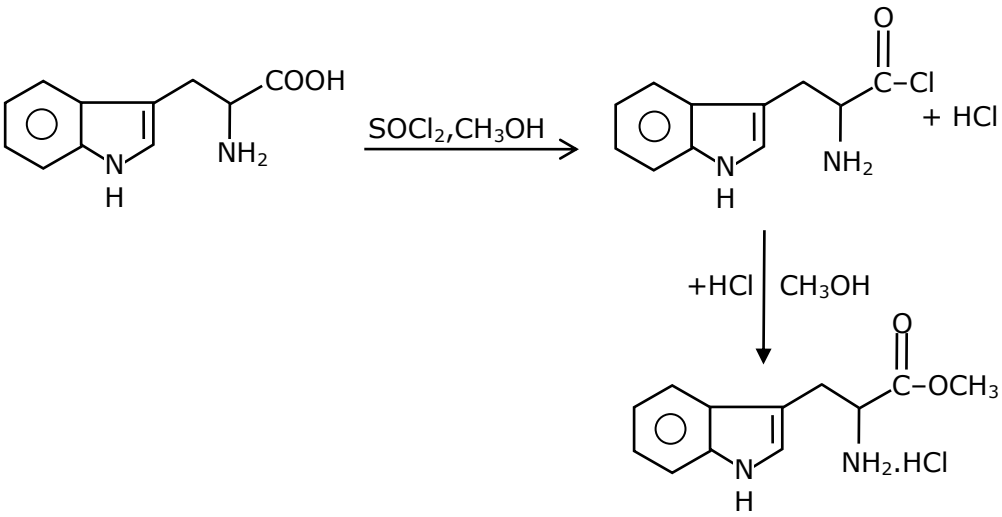


Sol. 4



Q.3 The correct sequential addition of regents in the preparation of 3-nitrobenzoic acid from benzene is :

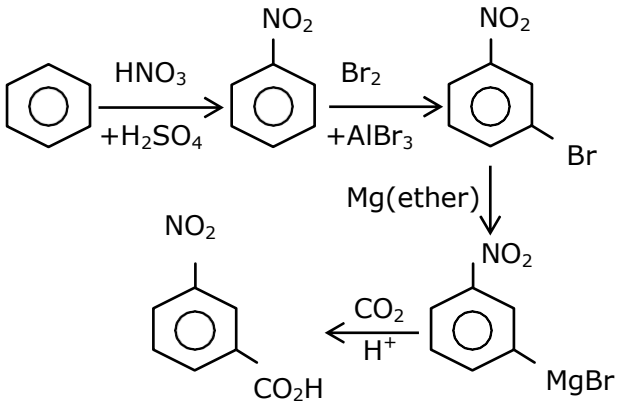
(1) $Br_2/AlBr_3$,NaCN, H_3O^+,HNO_3/H_2SO_4

(2) HNO_3/H_2SO_4,$Br_2/AlBr_3$,Mg/ether,CO_2, H_3O^+

(3) $Br_2/AlBr_3$,HNO_3/H_2SO_4,Mg/ether,CO_2, $H3O^+$

(4) $Br_2/AlBr_3$,HNO_3/H_2SO_4,NaCN,H_3O^+

Sol. 2



3- nitrobenzoic acid

Q.4 Given below are two statements :

Statements I : Frenkel defects are vacancy as well as interstitial defects.

Statements II : Frenkel defect leads of colour in ionic solids due to presence of F-centers.

Choose the most appropriate answer for the statements from the options given below :

(1) Statement I is false but statements II is true.

(2) Both Statement I and statements II are true.

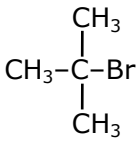
(3) Both Statement I and statements II are false.

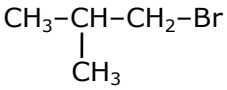
(4) Statement I is true but statements II is false.

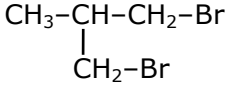
Sol. 4

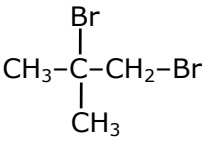
Theory based.

Q.5 Excess of isobutane on reactions with Br_2 in presence of light at 125ºC gives which one of the following, as the major product ?

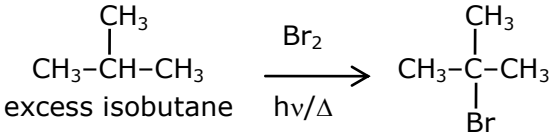
(1) 

(2) 

(3) 

(4) 

Sol. **1**



Q.6 Given below are two statements.
Statements I : The choice of reducing agents for metals extraction can be made by using Ellingham diagram, a plot of ΔG vs temperature .
Statements II : The value of ΔS increases from left to right in Ellingham diagram.
In the light of above statements, choose the most appropriate from the options given below :
(1) Both Statement I and statements II are false.
(2) Both Statement I and statements II are true.
(3) Statement I is false but statements II is true.
(4) Statement I is true but statements II is false.

Sol. **4**

Given statement-I is true as in a number of processes, one element is used to reduce the oxide of another metal. Any element will reduce the oxide of other metal which lie above it in the Ellingham diagram because the free energy change will become more negative. Given statement-II is false as the value of ΔS is decreases from left to right in Ellingham diagram.

Q.7 What are the products formed in sequence when excess of CO_2 is passed in slaked lime ?
(1) $CaCO_3$, $Ca(HCO_3)_2$ (2) $Ca(HCO_3)_2$, $CaCO_3$
(3) CaO, $CaCO_3$ (4) CaO, $Ca(HCO_3)_2$

Sol. **1**

$Ca(OH)_2 + CO_2 \longrightarrow CaCO_3\downarrow + H_2O$
$CaCO_3\downarrow + CO_2 + H_2O \rightarrow Ca(HCO_3)_2$

Q.8 The polymer formed on heating Novolac with formaldehyde is :
(1) Polyester (2) Melamine
(3) Nylon 6, 6 (4) Bakelite

Sol. **4**

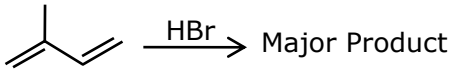
Novolac + formaldehyde $\rightarrow$ Bakelite

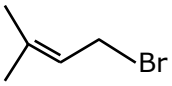
Q.9 The incorrect statements is :
(1) F_2 is stronger oxidizing agent than Cl_2 in aqueous solution.
(2) Cl_2 is more reactive than ClF.
(3) On hydrolysis ClF forms HOCl and HF.
(4) F_2 is more reactive than ClF.

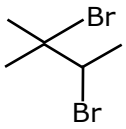
Sol. **2**

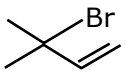
(i) Reactivity order :
F_2 > ClF (inter halogen) > Cl_2
(ii) $ClF + H_2O \rightarrow HOCl + HF$
(iii) Oxidizing power in aqueous solution
$F_2 > Cl_2 > Br_2 > I_2$

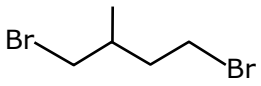
Q.10 The major product formed in the following reactions is :



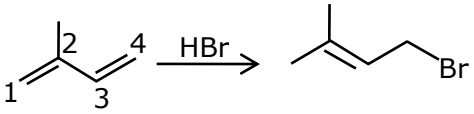
(1) 

(2) 

(3) 

(4) 

Sol. **1**



excess

1,4addition product
(major product)

Q.11 Which one of the following, methods is most suitable for preparing deionized water ?

(1) Calgon's method (2) Clark's method

(3) Synthetic resin method (4) Permutit method

Sol. **3**

Pure demineralised (de-ionized) water free from all soluble mineral salts is obtained by passing water successively through a cation exchange (in the H^+ form) and an anion exchange (in the OH^- form) resins.

Q.12 Which one of the following when dissolved in water gives coloured solution in nitrogen atmosphere ?

(1) AgCl (2) $CuCl_2$ (3) Cu_2Cl_2 (4) $ZnCl_2$

Sol. **1**

(1) $CuCl_2 + nH_2O \rightarrow Cu^{+2}_{(aq.)}$

blue colour

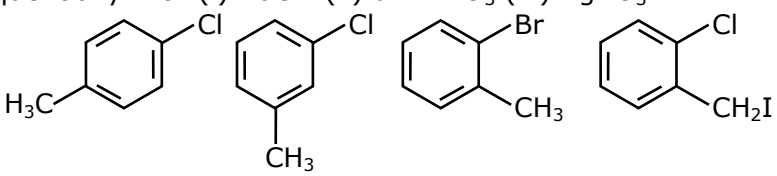
(2) $AgCl + nH_2O \rightarrow$ Insoluble

(3) $ZnCl_2 + nH_2O \rightarrow Zn^{+2}_{(aq.)}$

Colourless

(4) $Cu_2Cl_2 + nH_2O \rightarrow$ Insoluble

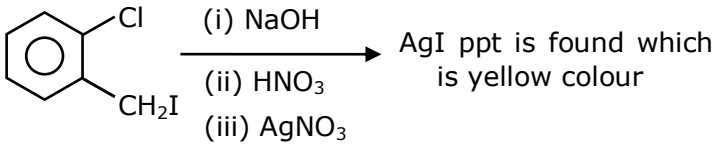
Q.13 Among the following compounds I-IV, which one forms a yellow precipitate on reacting sequentially with (i) NaOH (ii) dil. HNO_3 (iii) $AgNO_3$?



I II III IV

(1) III (2) IV (3) II (4) I

Sol. 2

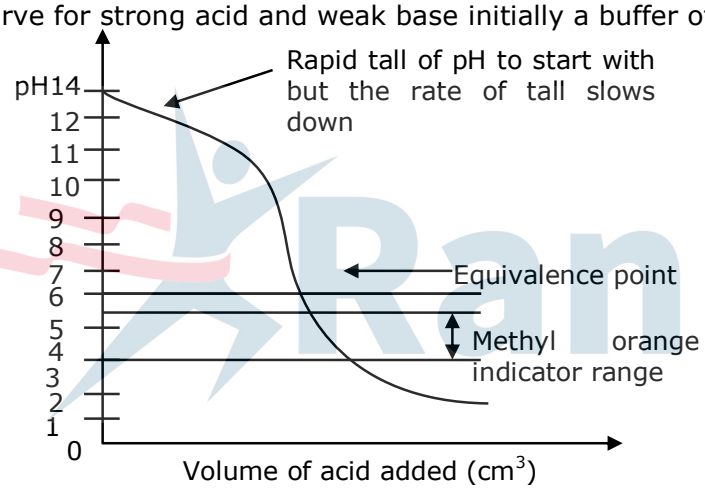


Other compounds halide can't be removed because corresponding C^+ is highly unstable.

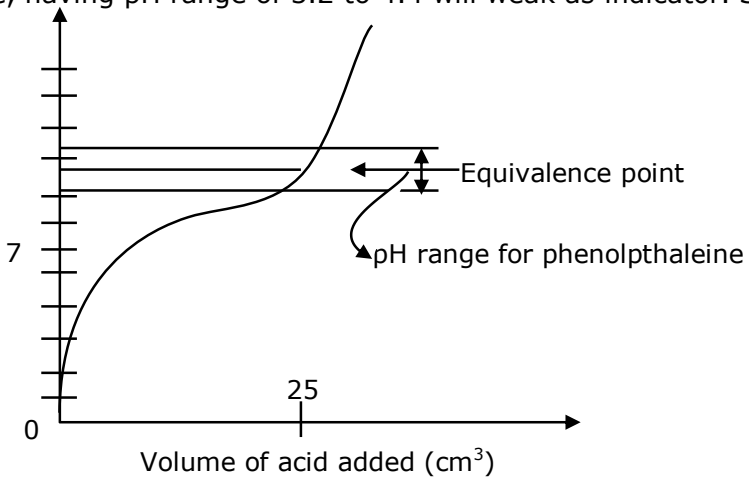
Q.14 Given below are two statements :
Statements I : In the titration between strong acid and weak base methyl orange is suitable as an indicator.
Statement II : For titration of acetic acid with NaOH phenolphthalein is not a suitable indicator.
In the light of the above statements, choose the most appropriate answer from the options given below :
(1) Statement I is true but statements II is false.
(2) Both Statement I and statements II are false.
(3) Statement I is false but statements II is true.
(4) Both Statement I and statements II are true.

Sol. 1

Titration curve for strong acid and weak base initially a buffer of weak base and conjugate acid is :



Formed, thus pH falls slowly and after equivalence point, so the pH falls sharply so methyl arrange, having pH range of 3.2 to 4.4 will weak as indicator. So statement-I is correct.



Titration curve for weak acid and strong base (NaOH) Initially weak acid will form a buffer so pH increases slowly but after equivalence point. It rises sharply covering range of phenolphthalein so it will be suitable indicator so statement-II is false.

Q.15 Which one of the following is correct for the adsorption of a gas at a given temperature on a solid surface ?

(1) $\Delta H < 0, \Delta S > 0$ (2) $\Delta H > 0, \Delta S < 0$

(3) $\Delta H < 0, \Delta S < 0$ (4) $\Delta H > 0, \Delta S > 0$

Sol. 3

(i) Adsorption of gas at metal surface is an exothermic process so $\Delta H < 0$

(ii) As the adsorption of gas on metal surface reduces the free movement of gas molecules thus restricting its randomness hence $\Delta S < 0$

Q.16 Given below are two statements :

Statements I : The limiting molar conductivity of KCl (strong electrolyte) is higher compared to that of CH_3COOH (weak electrolyte)

Statement II : Molar conductivity decreases with decrease in concentration of electrolyte In the light of the above statements, choose the most appropriate answer from the options given below :

(1) Statement I is false but statements II is true.

(2) Both Statement I and statements II are true.

(3) Both Statement I and statements II are false.

(4) Statement I is true but statements II is false.

Sol. 3

Ion	H^+	K^+	Cl^-	CH_3COO^-
$\Lambda^{\infty}_{mScm^2/mole}$	349.8	73.5	76.3	40.9

So, $\Lambda^{\infty}_{mCH_3COOH} = \Lambda^{\infty}_{m(H^+)} + \Lambda^{\infty}_{mCH_3COO^-}$

$= 349.8 + 40.9$

$= 390.7\ Scm^2/mole$

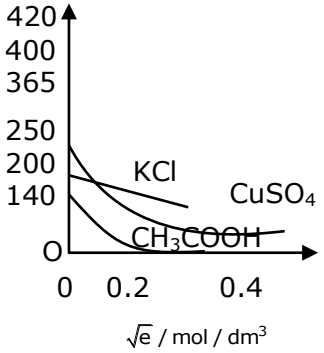
$\Lambda^{\infty}_{mKCl} = \Lambda^{\infty}_{m(K^+)} + \Lambda^{\infty}_{m(Cl^-)}$

$= 73.5 + 76.3 = 149.3\ Scm^2/mole$

So statement-I is wrong or False.

As the concentration decreases, the dilution increases which increases the degree of dissociation, thus increasing the no. of ions, which increases the molar conductance.

So statement-II is false.



Q.17 Given below are two statements :
Statements I : According to Bohr's model of an atom, qualitatively the megnitude of velocity of electron increases with decrease in positive charges on the nucleus as there is no strong hold on the electron by the nucleus.
Statement II : According to Bohr's model of an atom, qualitatively the megnitude of velocity of electron increases with decrease in principal quantum number.
In the light of the above statements, choose the most appropriate answer from the options given below :
(1) Both Statement I and statements II are false.
(2) Both Statement I and statements II are true.
(3) Statement I is true but statements II is false.
(4) Statement I is false but statements II is true.

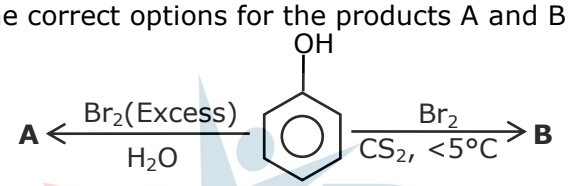
Sol. **4**

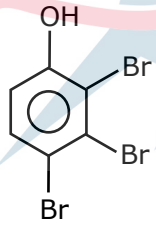
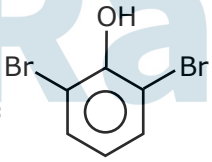
Velocity of electron in Bohr's atom is given by

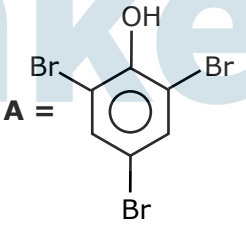
$V \propto \frac{Z}{n}$

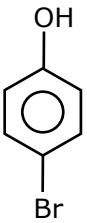
Z = atomic number of atom, corresponds to +ve charge so as Z increase velocity increases so statement-I is wrong.
and as 'n' decreases velocity increases so statement-II is correct.

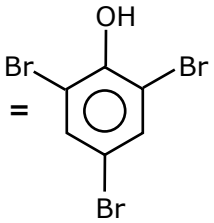
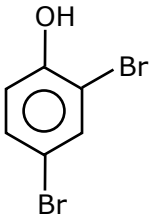
Q.18 The correct options for the products A and B of the following reactions are :



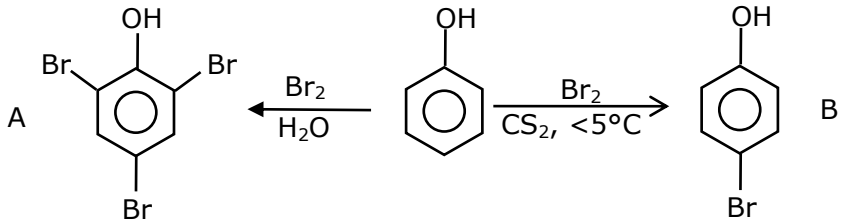
(1) **A =**  **, B =** 

(2) **A =**  **, B =** 

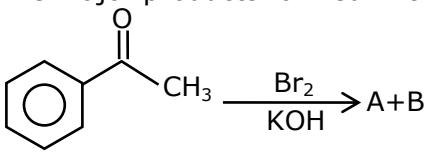
(3) **A =**  **, B =** 

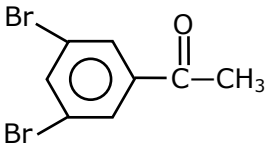
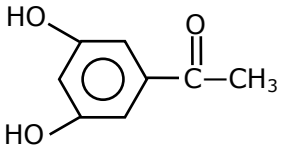
(4) **A =**  **, B =** 

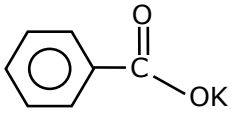
Sol. **2**

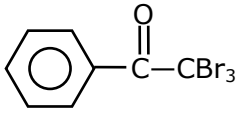
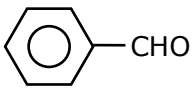


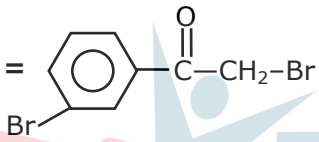
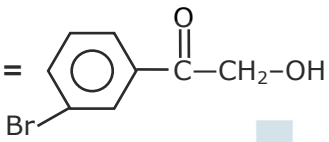
Q.19 The major products formed in the following reaction sequence A and B are :



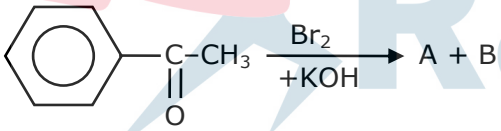
(1) **A =**  **, B =** 

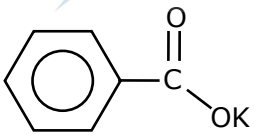
(2) **A =**  **, B =** $CHBr_3$

(3) **A =**  **, B =** 

(4) **A =**  **, B =** 

Sol. **2**



(1)  , B = $CHBr_3$

Q.20 The conversion of hydroxyapatite occure due to presence of F^- ions in water. The correct formula of hydroxyapatite is :

(1) $[3Ca_3(PO_4)_2 \cdot CaF_2]$ (2) $[Ca_3(PO_4)_2 \cdot CaF_2]$

(3) $[3Ca(OH)_2 \cdot CaF_2]$ (4) $[3Ca_3(PO_4)_2 \cdot Ca(OH)_2]$

Sol. **4**

The $F^{\ominus}$ ions make the enamel on teeth much harder by converting hydroxyapatite, $[3(Ca_3(PO_4)_2].Ca(OH)_2]$, the enamel on the surface of the teeth into much harder fluroappatite. $[3Ca_3(PO_4)_2.CaF_2]$

SECTION-B

Q.1 Of the following four aqueous solutions, total number of those solutions whose freezing points is lower than that of 0.10 M C_2H_5OH is _____ (Integer answer)

(1) 0.10 M $Ba_3(PO_4)_2$ (2) 0.10 M Na_2SO_4

(3) 0.10 M KCl (4) 0.10 M Li_3PO_4

Sol. 4

As 0.1 M C_2H_5OH is non-dissociative and rest all salt given are electrolyte so in each case effective molarity > 0.1 so each will have lower freezing point.

Q.2 The following data was obtained for chemical reaction given below at 975 K.

$$2NO_{(g)} + 2H_{2_{(g)}} \rightarrow N_{2_{(g)}} + 2H_2O_{(g)}$$

	[NO] Mol L^{-1}	[H_2] Mol L^{-1}	Rate Mol L^{-1} s^{-1}
(1)	8×10^{-5}	8×10^{-5}	7×10^{-9}
(2)	24×10^{-5}	8×10^{-5}	2.1×10^{-8}
(3)	24×10^{-5}	32×10^{-5}	8.4×10^{-8}

The order of the reaction with respect to NO is _____ (Integer answer)

Sol. 1

$7 \times 10^{-9} = K \times (8 \times 10^{-5})^x (8 \times 10^{-5})y$ .....(1)

$2.1 \times 10^{-8} = K \times (24 \times 10^{-5})^x (8 \times 10^{-5})y$ .....(2)

$$\frac{1}{3} = \left(\frac{1}{3}\right)^x \Rightarrow x = 1$$

Q.3 The Born-Haber cycle for KCl is evaluated with the following data :

$\Delta_f \overset{\ominus}{H}$ for KCl = –436.7 kJ mol^{-1}; $\Delta_{sub} \overset{\ominus}{H}$ for K = 89.2 kJ mol^{-1}

$\Delta_{ionization} \overset{\ominus}{H}$ for K = 419.0 kJ mol^{-1}; $\Delta_{electron\,gain} \overset{\ominus}{H}$ for $Cl_{(g)}$ = –348.6 kJ mol^{-1}

$\Delta_{bond} \overset{\ominus}{H}$ for Cl_2 = 243.0 kJ mol^{-1}

the magnitude of lattice enthalpy of KCl in kJ mol^{-1} is _____ (Nearest integer)

Sol. 718

$$\Delta_f H^{\ominus}_{K:Cl} = \Delta_{sub} H^{\ominus}_{(K)} + \Delta_{ionization} H^{\ominus}_{(K)} + \frac{1}{2}\Delta_{bond} H^{\ominus}_{(Cl_2)} + \Delta_{electron\ gain} H^{\ominus}_{(Cl)} + \Delta_{lattice} H^{\ominus}_{(KCl)}$$

$$\Rightarrow -436.7 = 89.2 + 419.0 + \frac{1}{2}(243.0) + \{-348.6\} + \Delta_{lattice} H^{\ominus}_{(KCl)}$$

$$\Rightarrow \Delta_{lattice} H^{\ominus}_{(KCl)} = -717.8 \text{kJ mol}^{-1}$$

The magnitude of lattice enthalpy of KCl in kJ mol^{-1} is 718 (Nearest integer).

Q.4 The number of 4f electrons in the ground state electronic configuration Gd^{2+} is _____ (Atomic number of Gd = 64)

Sol. **7**

The electronic configuration of
$_{64}Gd$: [Xe] $4f^7\ 5d^1\ 6s^2$
So the electronic configuration of
$_{64}Gd^{2+}$: [Xe] $4f^7\ 5d^1\ 6s^0$
i.e. the number of 4f electrons in the ground state electronic configuration of Gd^{2+} is 7.

Q.5 The ratio of number of water molecules in Mohr's salt and potash alum is _____ $\times 10^{-1}$.

Sol. **5**

Mohr's salt : $(NH_4)_2\ Fe(SO_4)_2.6H_2O$
The number of water molecules in Mohr's salt = 6
Potash alum : $KAl(SO_4)_2.12H_2O$
The number of water molecules in potash alum = 12
So ratio of number of water molecules in Mohr's salt and potash alum $= \frac{6}{12}$

$$= \frac{1}{2}$$
$$= 0.5$$
$$= 5 \times 10^{-1}$$

Q.6 These are physical properties of an elements.
(1) Sublimation enthalpy
(2) Ionisation enthalpy
(3) Hydration enthalpy
(4) Electron gain enthalpy
The total number of above properties that affect the reduction potential is _____ (Integer answer)

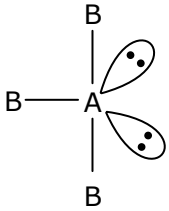
Sol. **3**

Sublimation enthalpy, ionisation enthalpy and hydration enthalpy affect the reduction potential.

Q.7 AB_3 is an interhalogen T-shaped molecule. The number of lone pairs of electrons on A is _____ . (Integer answer)

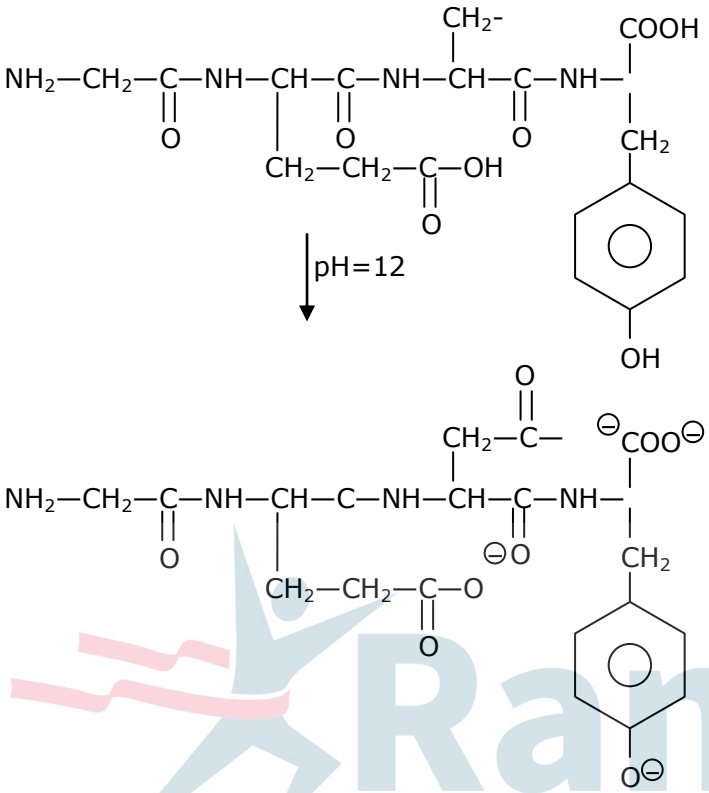
Sol. **2**

T-Shaped molecule means 3 sigma bond and 2 lone pairs of electrons on central atom.



Q.8 The total number of negative charge in the tetrapeptide, Gly-Glu-Asp-Tyr at pH 12.5 will be _____ . (Integer answers)

Sol. 4



Total negative charge produced = 4.

Q.9 An aqueous KCl solution of density 1.20 g mL^{-1} has a molality of 3.30 mol kg^{-1}. The molarity of the solution in mol L^{-1} is _____ . (Nearest integer)

Sol. 3

1000 kg solvent has 3.3 moles of KCl

1000 kg solvent $\rightarrow$ 3.3 × 74.5 gm KCl

$\rightarrow$ 245.85

weight of solution = 1245.85 gm

volume of solution = $\frac{1245.85}{1.2}$ ml

So molarity = $\frac{3.3 \times 1.2}{1245.85}$ × 1000 = 3.17

Q.10 The OH^- concentration in a mixture of 5.0 mL of 0.0504 M NH_4Cl and 2 mL of 0.0210 M NH_3 solution is $x \times 10^{-6}$ M. The value of x is _____. (Nearest integer)

Sol. 3

$\left[NH_4^+\right]$ = 0.0504 & $[NH_3]$ = 0.0210

So, Kb = $\frac{\left[NH_4^+\right]\left[HO^-\right]}{\left[NH_3\right]}$

$[HO^-] = \frac{k_b \times \left[NH_3\right]}{\left[NH_4^+\right]} = 1.8 \times 10^{-5} \times \frac{2}{5} \times \frac{210}{504}$

$= 3 \times 10^{-6}$