FINAL JEE–MAIN EXAMINATION – APRIL, 2023

(Held On Monday 10th April, 2023)   **TIME : 9 : 00 AM to 12 : 00 NOON**

CHEMISTRY	TEST PAPER WITH SOLUTIONS

SECTION-A

61. Using column chromatography, mixture of two compounds 'A' and 'B' was separated. 'A' eluted first, this indicates 'B' has

(1) low R_f, weaker adsorption

(2) high R_f, stronger adsorption

(3) high R_f, weaker adsorption

(4) low R_f, stronger adsorption

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. If any component eluted second then it means that its R_f value is low and its adsorption is stronger

$$R_f = \frac{\text{distance covered by substance from base line}}{\text{total distance covered by solvent from base line}}$$

62. Prolonged heating is avoided during the preparation of ferrous ammonium sulphate to

(1) prevent oxidation

(2) prevent reduction

(3) prevent hydrolysis

(4) prevent breaking

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Prolonged heating will cause oxidation of Fe^{+2} to Fe^{+3}.

63. Lime reacts exothermally with water to give 'A' which has low solubility in water. Aqueous solution of 'A' is often used for the test of CO_2, a test in which insoluble B is formed. If B is further reacted with CO_2 then soluble compound is formed 'A' is

(1) Quick lime   (2) Slaked lime

(3) Lime water   (4) White lime

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. $CaO + H_2O \rightarrow Ca(OH)_2$

                A (less soluble)

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

                B (insoluble)

$\underset{\text{B}}{CaCO_3} + H_2O + CO_2 \rightarrow \underset{\text{Soluble}}{Ca(HCO_3)_2}$

64. The pair from the following pairs having both compounds with net non-zero dipole moment is

(1) Benzene, anisidine

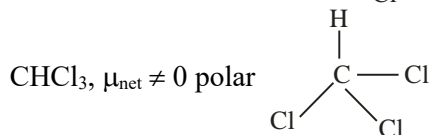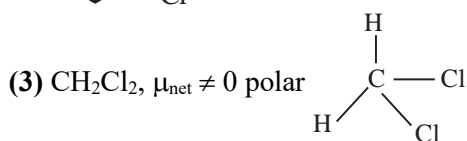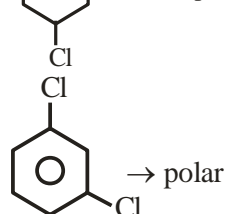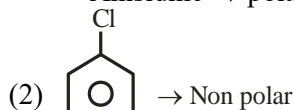(2) 1,4-Dichlorobenzene, 1,3-Dichlorobenzene

(3) CH_2Cl_2, $CHCl_3$

(4) cis-butene, trans-butene

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. (1) Benzene $\rightarrow$ non polar

        Anisidine $\rightarrow$ polar

(2) $\rightarrow$ Non polar

 $\rightarrow$ polar

(3) CH_2Cl_2, $\mu_{net} \neq 0$ polar

$CHCl_3$, $\mu_{net} \neq 0$ polar

(4) $\Rightarrow$ polar

 $\Rightarrow$ non polar
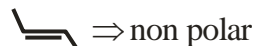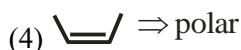
65. Match List-I with List-II

List-I	List-II
Industry	**Waste Generated**
(A) Steel plants	(I) Gypsum
(B) Thermal power plants	(II) Fly ash
(C) Fertilizer industries	(III) Slag
(D) Paper mils	(IV) Bio-degradable Wastes

Choose the correct answer from the options given below:

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

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

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

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

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Steel plant produces slag from blast furnace. Thermal power plant produces fly ash, Fertilizer industries produces gypsum. Paper mills produces bio degradable waste
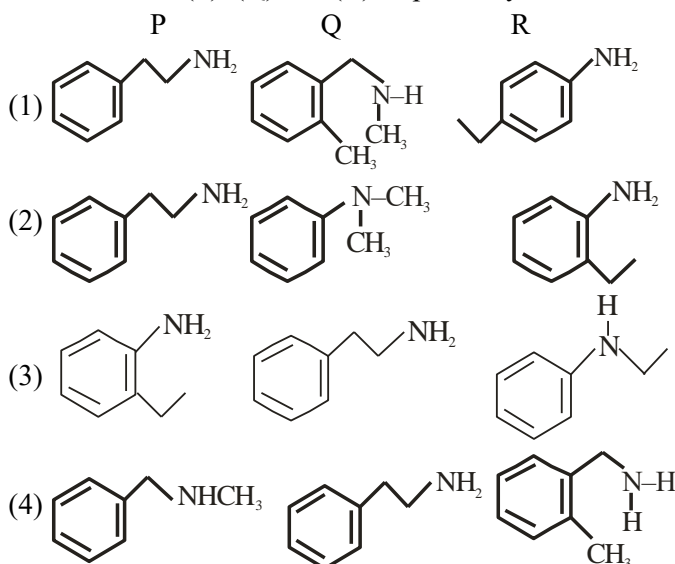
66. Isomeric amines with molecular formula $C_8H_{11}N$ give the following tests

Isomer (P) $\Rightarrow$ Can be prepared by Gabriel phthalimide synthesis

Isomer (Q) $\Rightarrow$ Reacts with Hinsberg's reagent to give solid insoluble in NaOH

Isomer (R) $\Rightarrow$ Reacts with HONO followed by β-naphthol in NaOH to give red dye.

Isomers (P), (Q) and (R) respectively are

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. (P) Gabriel phthalimide synthesis is used for the preparation of aliphatic primary amines. Aromatic primary amines cannot be prepared by this method.

(Q) 2°-amines reacts with Hinsberg's reagent to give solid insoluble in NaOH

(R) Aromatic primary amine react with nitrous acid at low temperature (273 – 298 K) to form diazonium salts, which form Red dye with β-Naphthol

67. Given below are two statements

Statement I : Aqueous solution of $K_2Cr_2O_7$ is preferred as a primary standard in volumetric analysis over $Na_2Cr_2O_7$ aqueous solution

Statement II : $K_2Cr_2O_7$ has a higher solubility in water than $Na_2Cr_2O_7$

In the light of the above statements, choose the correct answer from the options given below:

(1) Both Statement I and Statement II are true

(2) Both Statement I and Statement II are false

(3) Both Statement I is true but Statement II is false

(4) Both Statement I is false but Statement II is true

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. (1) $K_2Cr_2O_7$ is used as primary standard. The concentration $Na_2Cr_2O_7$ changes in aq. solution.

(2) It is less soluble than $Na_2Cr_2O_7$.

68. The one that does not stabilize 2° and 3° structures of proteins is

(1) H-bonding   (2) –S-S-linkage

(3) –O-O-linkage   (4) van der Waals forces

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. 2° and 3° structure of proteins are stabilized by hydrogen bonding, disulphide linkages, Van der Waals force of attraction and electrostatic force of attraction.

69. Given below are two reactions, involved in the commercial production of dihydrogen (H_2).

The two reactions are carried out at temperature "T_1" and "T_2" respectively

$$C(s) + H_2O(g) \xrightarrow{T_1} CO(g) + H_2(g)$$

$$CO(g) + H_2O(g) \xrightarrow[\text{Catalyst}]{T_2} CO_2(g) + H_2(g)$$
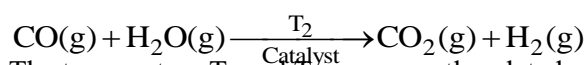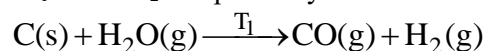
The temperature T_1 and T_2 are correctly related as

(1) $T_1 > T_2$

(2) $T_1 = T_2$

(3) $T_1 = 100\ K$, $T_2 = 1270\ K$

(4) $T_1 < T_2$

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. $T_1 = 1270\ K$ $T_2 = 673\ K$

$T_1 > T_2$ on the basis of data

70. Which of the following statements are correct?

(A) The M^{3+}/M^{2+} reduction potential for iron is greater than manganese

(B) The higher oxidation states of first row d-block elements get stabilized by oxide ion.

(C) Aqueous solution of Cr^{2+} can liberate hydrogen from dilute acid.

(D) Magnetic moment of V^{2+} is observed between 4.4-5.2 BM

Choose the correct answer from the options given below:

(1) (B), (C) only   (C), (D) only

(2) (A), (B), (D) only   (A), (B) only
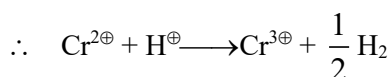
Official Ans. by NTA (1)

Allen Ans. (1)

Sol. (A) The M^{3+}/M^{2+} reduction potential for manganese is greater than iron

(B) $E^0_{Fe^{+3}/Fe^{+2}} = +0.77$

$E^0_{Mn^{+3}/Mn^{+2}} = +1.57$

(C) $E^0_{Cr^{+3}/Cr^{+2}} = -0.26$

$\therefore \quad Cr^{2\oplus} + H^{\oplus} \longrightarrow Cr^{3\oplus} + \dfrac{1}{2}H_2$

(D) $V^{2\oplus} = 3$ unpaired electron

Magnetic Moment = 3.87 B.M

71. Which of the following is used as a stabilizer during the concentration of sulphide ores?

(1) Pine oils

(2) Xanthates

(3) Fatty acids

(4) Cresols

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. Cresol is used as stabilizer.

72. The octahedral diamagnetic low spin complex among the following is

(1) $[NiCl_4]^{2-}$ (2) $[CoCl_6]^{3-}$

(3) $[CoF_6]^{3-}$ (4) $[Co(NH_3)_6]^{3+}$

Official Ans. by NTA (4)

Allen Ans. (4)
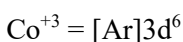
Sol. (1) Paramagnetic, High Spin & Tetrahedral

(2) Paramagnetic, High Spin & Octahedral

(3) Paramagnetic, High Spin & Octahedral
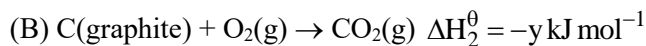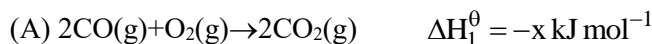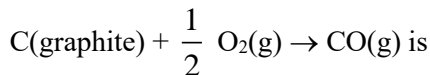
(4) Diamagnetic, Low Spin & Octahedral

$[Co(NH_3)_6]^{3+}$, CN = 6 (Octahedral)

NH$_3$ = SFL

Co^{+3} = [Ar]3d^6

Diamagnetic & Low spin complex

73. Given

(A) $2CO(g)+O_2(g) \rightarrow 2CO_2(g) \quad \Delta H^\theta_1 = -x\,kJ\,mol^{-1}$

(B) $C(graphite) + O_2(g) \rightarrow CO_2(g) \quad \Delta H^\theta_2 = -y\,kJ\,mol^{-1}$

The ΔH^θ for the reaction

$C(graphite) + \dfrac{1}{2}O_2(g) \rightarrow CO(g)$ is

(1) $\dfrac{x-2y}{2}$ (3) $\dfrac{x+2y}{2}$

(3) $\dfrac{2x-y}{2}$ (4) $2y - x$

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Target equation

$C(graphite) + \dfrac{1}{2}O_{2(g)} \rightarrow CO_{(g)}$ …..(i) ΔH

$C(graphite) + O_{2(g)} \rightarrow CO_{2(g)}$.(ii) $\Delta H_1 = -y$ kJ/mole

$CO_{2(g)} \rightarrow CO_{(g)} + \dfrac{1}{2}O_{2(g)}$ …(iii) $\Delta H_2 = \dfrac{x}{2}$ kJ/mole
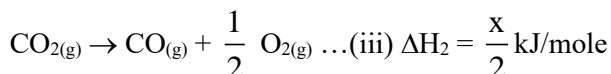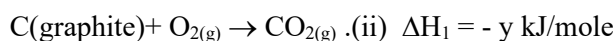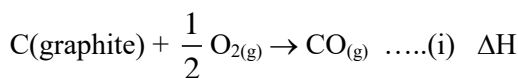
eq. (i) = eq.(ii) + eq (iii)

$\therefore \Delta H = \dfrac{x}{2} - y = \dfrac{x-2y}{2}$

74. The compound which does not exist is

(1) NaO_2

(2) $(NH_4)_2BeF_4$

(3) BeH_2

(4) $PbEt_4$

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Sodium superoxide is not stable

75. Match List I with List II

List-I	List-II
Polymer	**Type/Class**
(A) Nylon-2-Nylon-6	(I) Thermosetting Polymer
(B) Buna-N	(II) Biodegradable polymer
(C) Urea-formaldehyde	(III) Synthetic rubber resin
(D) Dacron	(IV) Polyester

Choose the correct answer from the options given below:

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

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

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

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

Official Ans. by NTA (4)

Allen Ans. (4)

Sol.

(A) Nylon-2-nylon-6

Biodegradable polymer and polyamides (II)

(B) Buna-N $\rightarrow$ Butadiene acrylonitrile rubber $\rightarrow$ synthetic rubber (III)

(C) Urea-formaldehyde resin $\rightarrow$ Thermosetting polymer (I)

(D) Dacron $\rightarrow$ Polyester polymer of ethylene glycol and terephthalic acid (IV)

76. The number of molecules and moles in 2.8375 litres of O_2 at STP are respectively

(1) 7.527×10^{22} and 0.250 mol

(2) 1.505×10^{23} and 0.250 mol

(3) 7.527×10^{23} and 0.125 mol

(4) 7.527×10^{22} and 0.125 mol

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. Number of moles of $O_2 = \dfrac{2.8375}{22.7} = 0.125$

$\Rightarrow$ Number of molecules $= 0.125\ N_A$

$= 7.525 \times 10^{22}$

77. The enthalpy change for the adsorption process and micelle formation respectively are

(1) $\Delta H_{ads} < 0$ and $\Delta H_{mic} > 0$

(2) $\Delta H_{ads} < 0$ and $\Delta H_{mic} < 0$

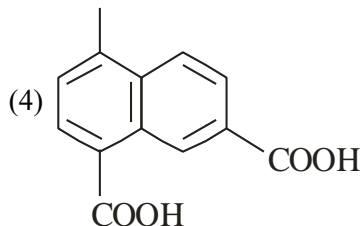(3) $\Delta H_{ads} > 0$ and $\Delta H_{mic} < 0$

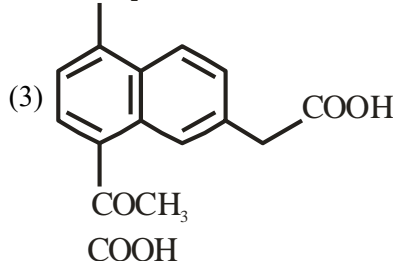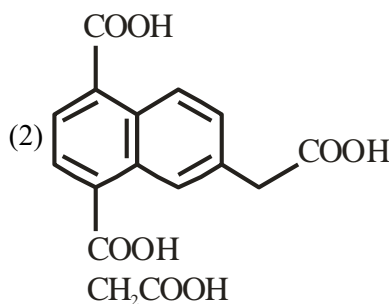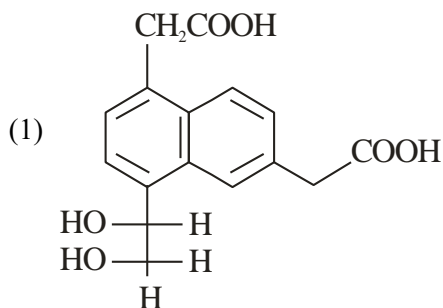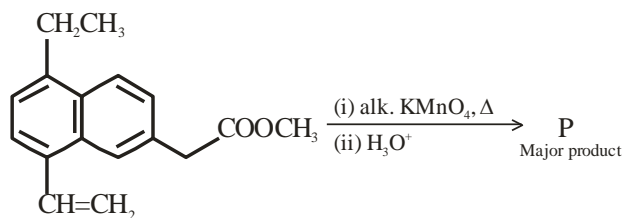(4) $\Delta H_{ads} > 0$ and $\Delta H_{mic} > 0$

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Adsorption is exothermic process due to decrease in surface energy

Micelle formation is endothermic

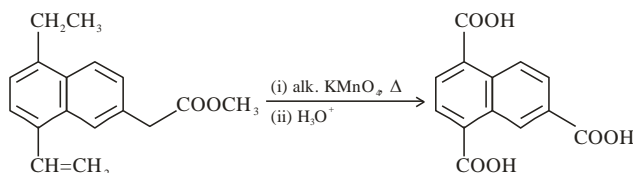**78.** The major product 'P' formed in the given reaction is

Official Ans. by NTA (4)

Allen Ans. (4)

Sol.

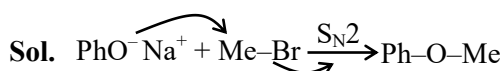$KMnO_4$ oxidises benzylic carbon containing atleast one α-hydrogen atom to –COOH.

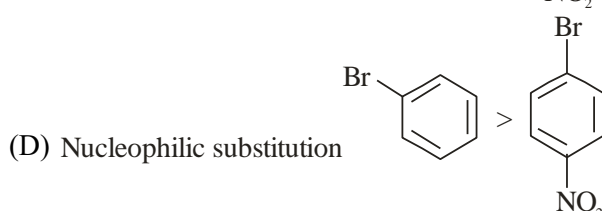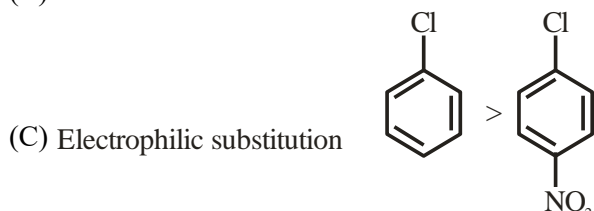**79.** Suitable reaction condition for preparation of Methyl phenyl ether is
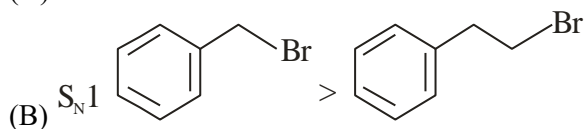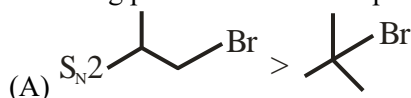
(1) $Ph-Br$, MeO^-Na^+

(2) PhO^-Na^+, $MeOH$

(3) PhO^-Na^+, $MeBr$

(4) Benzene, $MeBr$

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. $PhO^-Na^+ + Me-Br \xrightarrow{S_N2} Ph-O-Me$

80. Identify the correct order of reactivity for the following pairs towards the respective mechanism

(A) S_N2

(B) S_N1

(C) Electrophilic substitution

(D) Nucleophilic substitution

Choose the correct answer from the options given below :

(1) (A), (B) and (D) only

(2) (A), (B), (C) and (D)

(3) (A), (C) and (D) only

(4) (B), (C) and (D) only

Official Ans. by NTA (2)

Allen Ans. (2)

Sol.

All are correct

(A) S_N2 reaction decreases with increase in steric crowding.

(B) S_N1 reaction increases with stability of carbocation.

(C) EAS reaction decreases with decrease in electron density.

(D) Presence of electron withdrawing group at ortho and para-position to a halogen in haloarene increase nucleophilic aryl substitution.

SECTION-B

81. The number of correct statement/s involving equilibria in physical process from the following is

(A) Equilibrium is possible only in a closed system at a given temperature

(B) Both the opposing processes occur at the same rate.

(C) When equilibrium is attained at a given temperature, the value of all its parameters became equal

(D) For dissolution of solids in liquids, the solubility is constant at a given temperature

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. (A) is correct

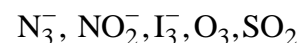(B) for equilibrium $r_f = r_b$

$\Rightarrow$ (B) is correct

(C) at equilibrium the value of parameters become constant of a given temperature and not equal

$\Rightarrow$ (C) is incorrect

(D) for a given solid solute and a liquid solvent solubility depends upon temperature only

$\Rightarrow$ (D) is correct

82. The number of bent-shaped molecule/s from the following is _____

N_3^-, NO_2^-, I_3^-, O_3, SO_2

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. N_3^- linear

NO_2^- bent

I_3^- linear

O_3 bent

SO_2 bent

83. A molecule undergoes two independent first order reactions whose respective half lives are 12 min and 3 min. If both the reactions are occurring then the time taken for the 50% consumption of the reactant is _____ min. (Nearest integer)

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. $\dfrac{1}{t_{1/2}} = \dfrac{1}{3} + \dfrac{1}{12} = \dfrac{4+1}{12} = \dfrac{5}{12}$

$t_{1/2} = \dfrac{12}{5}$ min $= 2.4$

Ans. is 2

84. The number of incorrect statement/s about the black body from the following is _____

(A) Emit or absorb energy in the form of electromagnetic radiation

(B) Frequency distribution of the emitted radiation depends on temperature

(C) At a given temperature, intensity vs frequency curve passes through a maximum value

(D) The maximum of the intensity vs frequency curve is at a higher frequency at higher temperature compared to that at lower temperature

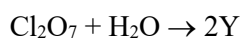**Official Ans. by NTA (0)**

Allen Ans. (0)

Sol. A blackbody can emit and absorb all the wavelengths in electromagnetic spectrum $\Rightarrow$ (A) is correct
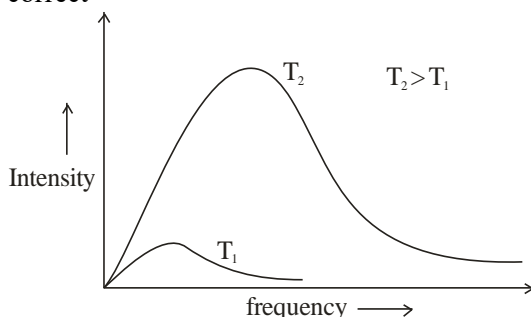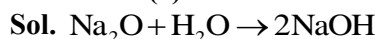

$\Rightarrow$ (B), (C), (D) correct

Ans (0)

85. In the following reactions, the total number of oxygen atoms in X and Y is _____

$Na_2O + H_2O \rightarrow 2X$

$Cl_2O_7 + H_2O \rightarrow 2Y$

Official Ans. by NTA (5)
Allen Ans. (5)
Sol. $Na_2O + H_2O \rightarrow 2NaOH$
$Cl_2O_7 + H_2O \rightarrow 2HClO_4$
$1 + 4 = 5$

86. $FeO_4^{2-} \xrightarrow{+2.2\,V} Fe^{3+} \xrightarrow{+0.70\,V} Fe^{2+} \xrightarrow{-0.45\,V} Fe^0$

$E^{\theta}_{FeO_4^{2-}/Fe^{2+}}$ is $x \times 10^{-3}$ V. The value of x is _____

Official Ans. by NTA (1825)

Allen Ans. (1825)

Sol.

$FeO_4^{2-} \xrightarrow[n=3]{2.2\,V} Fe^{3+} \xrightarrow[n=1]{0.7\,V} Fe^{2+} \xrightarrow{-0.45\,V} Fe$

$E = ?$
$n = 4$
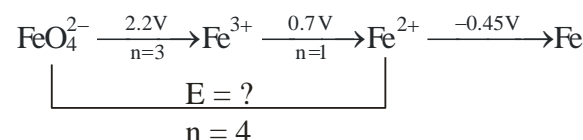
$4 \times E = 3 \times 2.2 + 1 \times 0.7$

$E = \dfrac{7.3}{4} = 1.825$ V $= 1825 \times 10^{-3}$ V

87. If the degree of dissociation of aqueous solution of weak monobasic acid is determined to be 0.3, then the observed freezing point will be _____ % higher than the expected/theoretical freezing point. (Nearest integer)

Official Ans. by NTA (30)

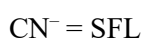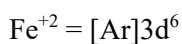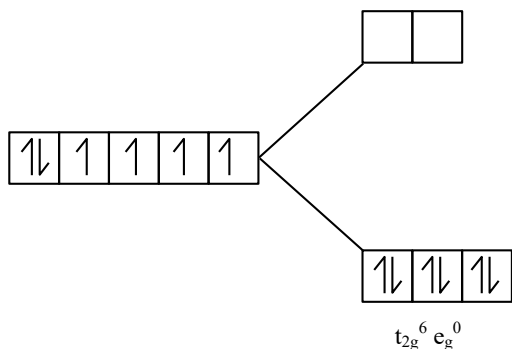**Allen Ans. (30)**

Sol. $i = 1 + \alpha$ (for HA)
$= 1.3$

% increase $= \dfrac{(\Delta T_f)_{obs} - (\Delta T_f)_{cal}}{(\Delta T_f)_{cal}} \times 100$

$= \dfrac{K_f \times i \times m - K_f \times m}{K_f \times m} \times 100$

$= \dfrac{i-1}{1} \times 100 = 30\%$

88. In potassium ferrocyanide, there are _____ pairs of electrons in the t_{2g} set of orbitals

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. $K_4[Fe(CN)_6]$

$$t_{2g}^6 \, e_g^0$$

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

$CN^- = SFL$

t_{2g} contain 6 electron so it become 3 pairs:-

89. At constant temperature a gas is at a pressure of 940.3 mm Hg. The pressure at which its volume decreases by 40% is _____ mm Hg.

(Nearest Integer)
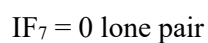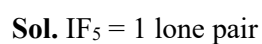
Official Ans. by NTA (1567)

Allen Ans. (1567)

Sol. $P_1V_1 = P_2V_2$

$940.3 \times 100 = P_2 \times 60$

$P_2 = 1567$ mm of Hg

90. The sum of lone pairs present on the central atom of the interhalogen IF_5 and IF_7 is _____

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. $IF_5 = 1$ lone pair

$IF_7 = 0$ lone pair

$1 + 0 = 1$