FINAL JEE–MAIN EXAMINATION – April, 2023
Held On Monday 10th April, 2023
TIME : 03:00 PM to 06:00 PM

SECTION – A

Solid State **Easy**

61. The correct relationships between unit cell edge length ' a ' and radius of sphere ' r ' for face-centred and body-centred cubic structures respectively are:

(1) $2\sqrt{2}r = a$ and $\sqrt{3}r = 4a$ (2) $r = 2\sqrt{2}a$ and $4r = \sqrt{3}a$

(3) $r = 2\sqrt{2}a$ and $\sqrt{3}r = 4a$ (4) $2\sqrt{2}r = a$ and $4r = \sqrt{3}a$

Sol. **4**

FCC BCC

$\sqrt{2}a = 4r$ $\sqrt{3}a = 4r$

$a = \frac{4r}{\sqrt{2}} \times \frac{\sqrt{2}}{\sqrt{2}}$

$a = 2\sqrt{2}r$

Chemistry in Everyday life **Medium**

62. The reaction used for preparation of soap from fat is :

(1) an addition reaction (2) an oxidation reaction

(3) alkaline hydrolysis reaction (4) reduction reaction

Sol. **3**

The process of making is soap is saponification.

Ester + Base ⟶ Alcohol + Soap

In saponification, triglycerides are combine with strong base and form fatty acid so this is alkaline Hydrolysis reaction.

Mole **Easy**

63. Match List I with List II

LIST I		LIST II	
A	16 g of CH_4 (g)	I.	Weight 28 g
B	1 g of H_2 (g)	II	60.2×10^{23} electrons
C	1 mole of N_2 (g)	III	Weight 32 g
D	0.5 mol of SO_2 (g)	IV	Occupies 11.4 L volume at STP

Choose the correct answer from the options given below:

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

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

Sol. **1**

16g CH_4 = mole = 1

e– = 60.0×10^{23}

19Hz = 0.5mole = 11.4(L) STP

1 mole N_2 = 2rg

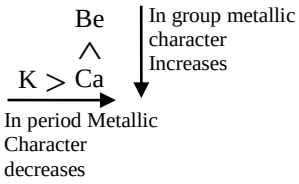
0.5 mol SO_2 = weights 32g.

Periodic Table **Medium**

64. The correct order of metallic character is =

(1) K>Be>Ca (2) Be>Ca>K (3) K>Ca>Be (4) Ca>K>Be

Sol. **3**



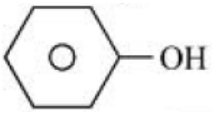
So K > Ca > Be

Metallic character decreases

GOC **Medium**

65. The correct order for acidity of the following hydroxyl compound is :

A. CH_3OH B. $(CH_3)_3COH$

C. 

D. 

E. 

Choose the correct answer from the options given below:

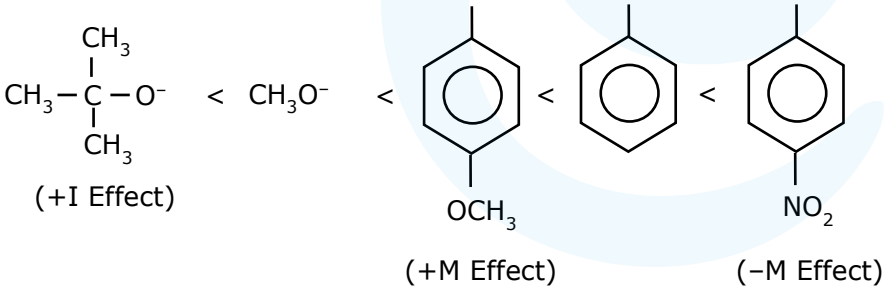
(1) E > C > D > A > B (2) D > E > C > A > B

(3) E > D > C > B > A (4) C > E > D > B > A

Sol. **1**

Acidity $\propto$ stability of conjugate base

Stability order



Activity $\rightarrow$ E > C > D > A > B

Coordination Compound **Medium**

66. Match List I with List II

LIST I Complex		**LIST II Crystal Field splitting energy (Δ_0)**	
A	$[Ti(H_2O)_6]^{2+}$	I.	– 1.2
B	$[V(H_2O)_6]^{2+}$	II	– 0.6
C	$[Mn(H_2O)_6]^{3+}$	III	0
D	$[Fe(H_2O)_6]^{3+}$	IV	– 0.8

Choose the correct answer from the options given below:

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

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

Sol. **1**

$\left[Ti(H_2O)_6\right]^{+2}$ $\left[V(H_2O)_6\right]^{+2}$ $\left[Mn(H_2O)_6\right]^{+3}$ $\left[Fe(H_2O)_6\right]^{3+}$

↓

Ti^{+2} V^{+2} Mn^{+3} Fe^{+3}

↓ ↓ ↓ ↓

$3d^2$ $3d^3$ $3d^4$ $3d^5$

$CFSE = -0.4 \times t_{2g} + 0.6 \times eg + xp$

$= -0.4 \times 2 + 0.6 \times 0 + xp$

(A) $= -0.8 \rightarrow Ti^{+2}$

(B) $V^{+2} \rightarrow 3d^3$

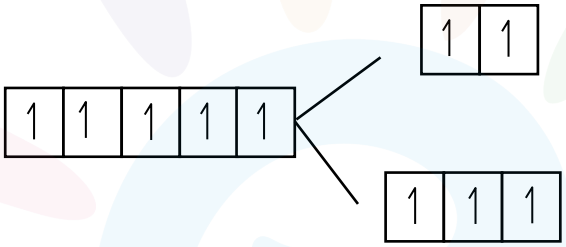
$CFSE = -0.4 \times t_{2g} + 0.6 \times eg + xp$

$= -0.4 \times 3 + 0.6 \times 0 + xp$

$= -1.2$

(C)

$Mn^{+3} \rightarrow 3d^4$



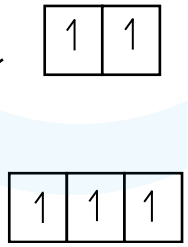
$CFSE = -0.4 \times t_{2g} + 0.6 \times eg + xp$

$-0.4 \times 3 + 0.6 \times 1 + xp$

$= -1.2 + 0.6 = 0.6$

(D)

$Fe(H_2O)_6]^{+3} \rightarrow Fe^{+3} \rightarrow 3d^5$



$CFSE = -0.4 \times t_{2g} + 0.6 \times eg + xp$

$= -0.4 \times 3 + 0.6 \times 2$

$= -1.2 + 1.2$

$= 0$

Qualitative analysis **Medium**

67. In Carius tube, an organic compound ' X ' is treated with sodium peroxide to form a mineral acid ' Y '.The solution of $BaCl_2$ is added to ' Y ' to form a precipitate ' Z '.' Z ' is used for the quantitative estimation of an extra element. ' X ' could be

(1) Chloroxylenol

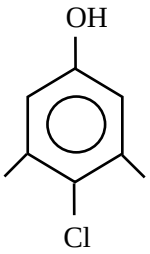
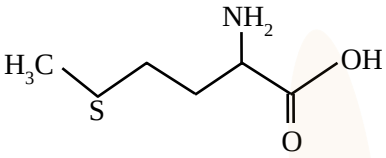
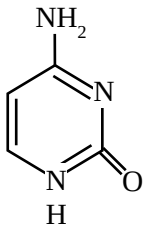
(2) Methionine

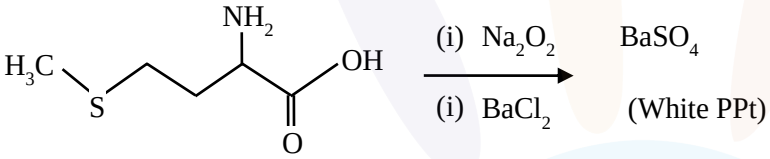
(3) A nucleotide

(4) Cytosine

Sol. 2

Carious method is used for quantitative analysis of sulfur

Chloroxylenol	Methionine		Cylosine
		Nucleotide Phosphate+ Sugar+ Nitrogeneous base	



So Methionine is correct answer

S-block **Medium**

68. Number of water molecules in washing soda and soda ash respectively are:

(1) 1 and 0 (2) 1 and 10 (3) 10 and 0 (4) 10 and 1

Sol. **3**

Washing Soda $\rightarrow Na_2CO_3.\underline{10}H_2O$

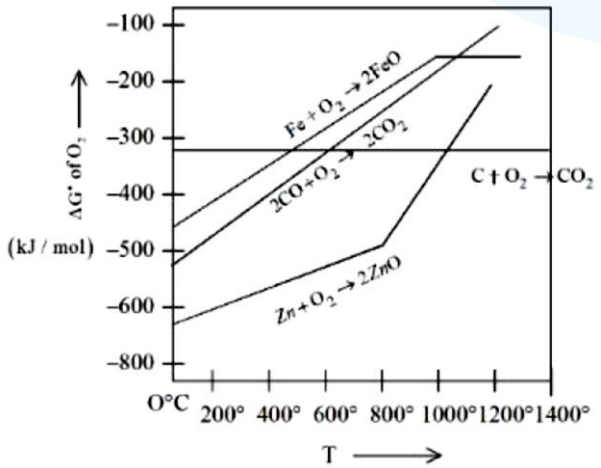
0.2

Soda Ash $\rightarrow Na_2CO_3$

No. of water = 10 + 0 = (10)

Metallurgy **Medium**

69. Gibbs energy vs T plot for the formation of oxides is given below.



For the given diagram, the correct statement is –

(1) At 600 ^{o}C, C can reduce ZnO (2) At 600 ^{o}C, C can reduce FeO

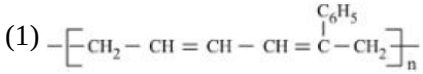
(3) At 600 ^{o}C, CO cannot reduce FeO (4) At 600 ^{o}C, CO can reduce ZnO

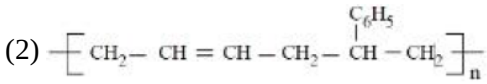
Sol. **2**

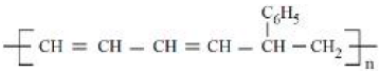
$FeO + C \longrightarrow Fe + CO_2$

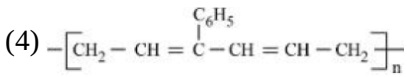
At 600°C ΔG of Reaction is –Ve

70. Buna–S can be represented as:

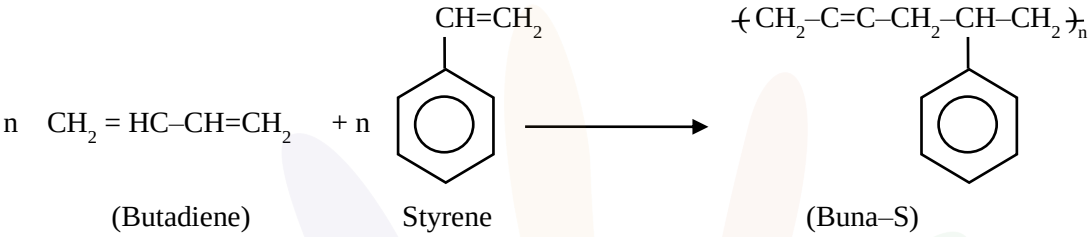
(1) 

(2) 

(3) 

(4) 

Sol. 2



(Butadiene) Styrene (Buna–S)

Hydrogen Medium

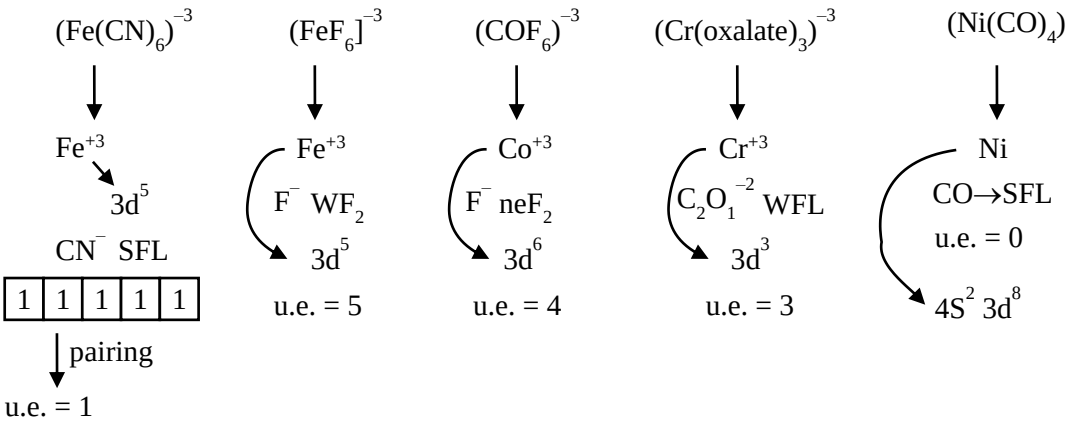
71. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**
Assertion A : Physical properties of isotopes of hydrogen are different.
Reason : Mass difference between isotopes of hydrogen is very large.
In the light of the above statements, choose the correct answer from the options given below:
(1) Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**
(2) A is false but **R** is true
(3) A is true but **R** is false
(4) Both **A** and **R** are true and **R** is the correct explanation of **A**

Sol. Correct – (4)
The Physical properties of isotope of Hydrogen are different due to Large mass difference

Coordination Compound Medium

72. The correct order of the number of unpaired electrons in the given complexes is
A. $[Fe(CN)_6]^{3-}$
B. $[FeF_6]^{3-}$
C. $[Co\ F_6]^{3-}$
D. $[Cr(oxalate)_3]^{3-}$
E. $[Ni(CO)_4]$
Choose the correct answer from the options given below:
(1) E < A < D < C < B
(2) A < E < C < B < D
(3) A < E < D < C < B
(4) E < A < B < D < C

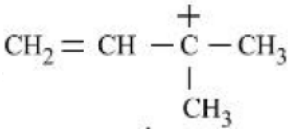
Sol. 1

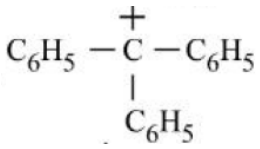


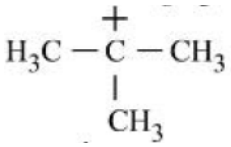
Topic : GOC

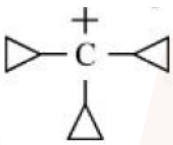
Medium

73. The decreasing order of hydride affinity for following **carbonations** is:

A. 

B. 

C. 

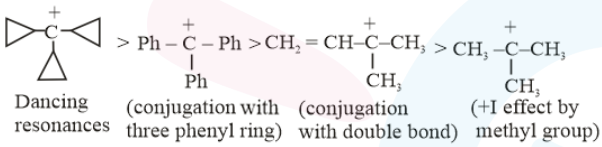
D. 

Choose the correct answer from the options given below:

(1) C, A, D, B (2) A, C, B, D (3) A, C, D, B (4) C, A, B, D

Sol. 4

Stability of carbocation $\propto \frac{1}{\text{Hydride affinity}}$



Chapter: carbonyl

Level : Med.

74. Incorrect method of preparation for alcohols from the following is:

(1) Ozonolysis of alkene.

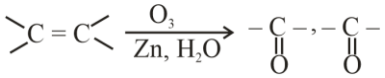
(2) Hydroboration-oxidation of alkene.

(3) Reaction of alkyl halide with aqueous NaOH.

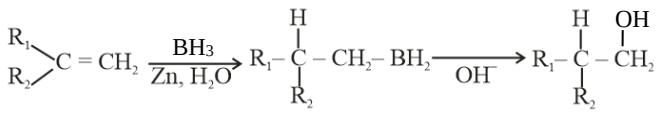
(4) Reaction of Ketone with RMgBr followed by hydrolysis.

Sol. 1

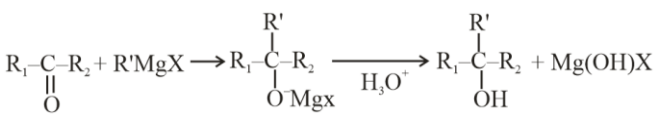
1) Ozonolysis of alkene–



2) Hydroboration – oxidation of alkene

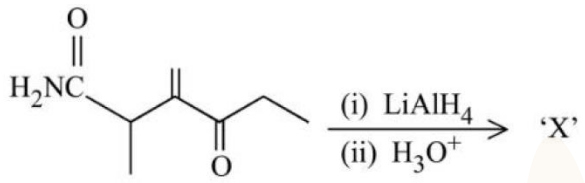


3) $R-X+NaOH \longrightarrow R-OH+NaX$

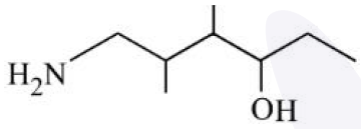


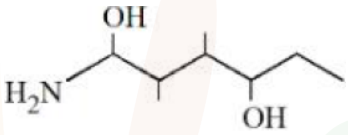
{Chap – Aldehyele, ketone, SO - Med}

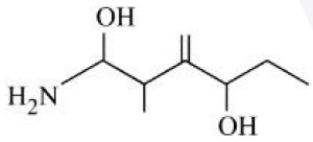
75. In the reaction given below:

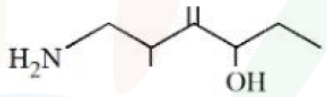


The product 'X' is:

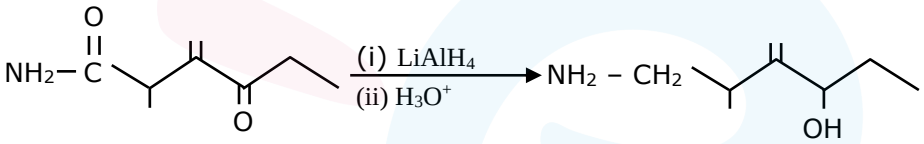
(1) 

(2) 

(3) 

(4) 

Sol. 4



s-block Medium

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

Assertion A : The energy required to form Mg^{2+} from Mg is much higher than that required to produce Mg^{+}

Reason R: Mg^{2+} is small ion and carry more charge than Mg^{+}

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

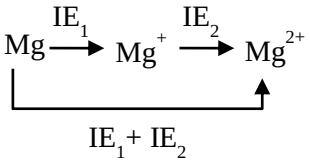
(1) Both **A** and **R** are true and **R** is the correct explanation of **A**

(2) **A** is true but **R** is false

(3) **A** is false but **R** is true

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

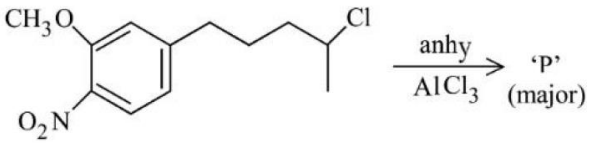
Sol. Correct – (1)

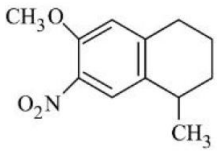
(A) - 

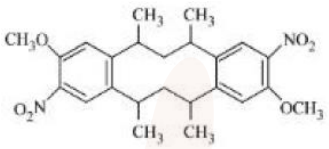
In formation of Mg^{2+} $IE_1 + IE_2$ is required while in formation of Mg^{+} IE_1 is required

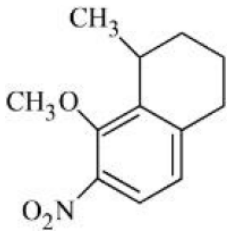
(R) Mg^{2+} is small ion and carry more change than $Mg^{\oplus}$

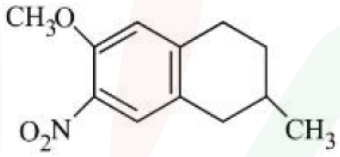
77. The major product 'P' formed in the given reaction is:



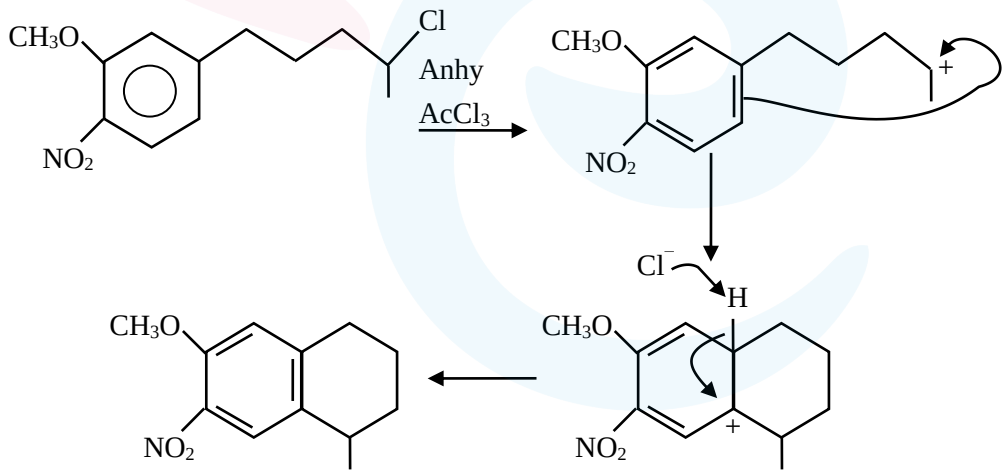
(1) 

(2) 

(3) 

(4) 

Sol. 1



78. Ferric chloride is applied to stop bleeding because -

(1) Blood absorbs $FeCl_3$ and forms a complex.

(2) $FeCl_3$ reacts with the constituents of blood which is a positively charged sol.

(3) Fe^{3+} ions coagulate blood which is a negatively charged sol.

(4) Cl^- ions cause coagulation of blood.

Sol. 3

Fe^{3+} coagulation negatively charged sol blood.

Environmental Chemistry **Easy**

79. The delicate balance of CO_2 and O_2 is NOT disturbed by

(1) Burning of Coal (2) Deforestation (3) Burning of petroleum (4) Respiration

Sol. Correct – (4)

The balance of carbon dioxide and oxygen in atmosphere is mainly maintained by the oxygen released and carbon dioxide consumed during photosynthesis by plants.

80. Given below are two statements: one is labelled as **Assertion A** and the other is labelled as **Reason R**
Assertion A : 3.1500 g of hydrated oxalic acid dissolved in water to make 250.0 mL solution will result in 0.1M oxalic acid solution.
Reason R : Molar mass of hydrated oxalic acid is 126 g mol^{-1}
In the light of the above statements, choose the correct answer from the options given below:
(1) **A** is false but **R** is true
(2) **A** is true but **R** is false
(3) Both **A** and **R** are true but **R** is **NOT** the correct explanation of **A**
(4) Both **A** and **R** are true and **R** is the correct explanation of **A**

Sol. **4**
Assertion is correct.
$H_2C_2O_4.2H_2O$

$$M=\frac{3.15\times1000}{126\times250}$$

$$=\frac{12.6}{126}=0.1$$

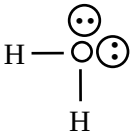
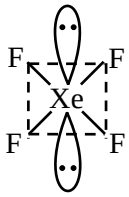
Reason is correct. It is used as a fact in explanation of assertion.

SECTION - B

Chemical bonding **Medium**

81. The number of molecules from the following which contain only two lone pair of electrons is_____
$H_2O, N_2, CO, XeF_4, NH_3, NO, CO_2, F_2$

Sol. **4**

	lp
	2
$:N\equiv N:$	2
$:C\equiv O:$	2
	2
$\ddot{N}H_3$	1
$.N\equiv\ddot{O}$	3

82. The specific conductance of 0.0025M acetic acid is 5×10^{-5} S cm^{-1} at a certain temperature. The dissociation constant of acetic acid is_____ $\times10^{-7}$. (Nearest integer)
Consider limiting molar conductivity of CH_3COOH as 400 S cm^2 mol^{-1}.

Sol. **66**

$\Lambda_m = \frac{k}{C}\times1000$

Given k = 5×10^{-5} S cm^{-1}

C = 0.0025 M

$\Lambda_m = \frac{5\times10^{-5}\times10^3}{0.0025} = \frac{5\times10^{-2}}{2.5\times10^{-3}}$

$= 20\,S\,cm^2mol^{-1}$

$\alpha = \frac{20}{400} = \frac{1}{20}$

$K_a = \frac{C\alpha^2}{1-\alpha} = \frac{0.0025\times\frac{1}{20}\times\frac{1}{20}}{\frac{19}{20}}$

$= \frac{0.0025}{19\times20} = 6.6\times10^{-6}$

$= 66\times10^{-7}$

83. An aqueous solution of volume $300\,cm^3$ contains 0.63 g of protein. The osmotic pressure of the solution at 300 K is 1.29 mbar. The molar mass of the protein is _____ g mol^{-1}
Given : R = 0.083 L bar K^{-1} mol^{-1}

Sol. **40535**

$\because \pi = CRT$

$\pi = \frac{n}{V}RT$

$\pi = \frac{\omega}{V}\frac{RT}{M}$

$M = \frac{\omega RT}{\pi\times V}$

$M = \frac{0.63\times0.083\times300}{1.29\times10^{-3}\times300\times10^{-3}}$

M = 40535 gm/moL

p-block **Medium**

84. The difference in the oxidation state of Xe between the oxidised product of Xe formed on complete hydrolysis of XeF_4 and XeF_4 is _____

Sol. **2**

$\overset{+4}{XeF_4} + H_2O \longrightarrow Xe + \overset{+6}{XeO_3} + O_2 + HF$

Difference = 6 – 4 = (2)

85. The number of endothermic process/es from the following is

A. $I_2(g) \rightarrow 2I(g)$

B. $HCl(g) \rightarrow H(g) + Cl(g)$

C. $H_2O(l) \rightarrow H_2O(g)$

D. $C(s) + O_2(g) \rightarrow CO_2(g)$

E. Dissolution of ammonium chloride in water

Sol. **4**

A $\rightarrow$ Endothermic (Atomisation) B $\rightarrow$ Endothermic (Atomisation)

C $\rightarrow$ Endothermic (Vapourisation) D $\rightarrow$ Exothermic (Combustion)

E $\rightarrow$ Endothermic (Dissolution)

86. The number of incorrect statement/s from the following is

A. The successive half lives of zero order reactions decreases with time.

B. A substance appearing as reactant in the chemical equation may not affect the rate of reaction

C. Order and molecularity of a chemical reaction can be a fractional number

D. The rate constant units of zero and second order reaction are mol $L^{-1}s^{-1}$ and $mol^{-1}Ls^{-1}$ respectively.

Sol. **1**

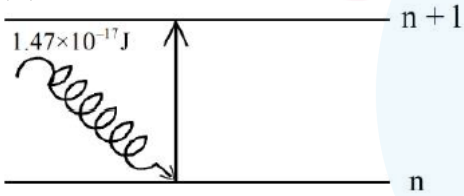
(A) For zero order $t_{1/2} = \frac{[A]_0}{2K}$ as concentration decreases half life decreases (Correct statement)

(B) If order w.r.t. that reactant is zero then it will not affect rate of reaction. (Correct statement)

(C) Order can be fractional but molecularity can not be (Incorrect statement)

(D) For zero order reaction unit is mol $L^{-}s^{-1}$ and for second order reaction unit is $mol^{-1}Ls^{-1}$ (Correct statement)

87.



The electron in the nth orbit of Li^{2+} is excited to (n + 1) orbit using the radiation of energy 1.47×10^{-17} J (as shown in the diagram). The value of n is_____

Given: $R_H = 2.18 \times 10^{-18}$ J

Sol. **1**

$$\Delta E = R_H Z^2 \left(\frac{1}{n_1^2} - \frac{1}{n_2^2}\right)$$

$$1.47 \times 10^{-17} = 2.18 \times 10^{-18} \times 9\left(\frac{1}{n^2} - \frac{1}{(n+1)^2}\right)$$

$$\frac{1.47}{1.96} = \frac{3}{4} = \frac{1}{n^2} - \frac{1}{(n+1)^2}$$

So, n = 1

d-block Medium

88. For a metal ion, the calculated magnetic moment is 4.90BM. This metal ion has_____ number of unpaired electrons.

Sol. **4**

$\mu = 4.90BM.$

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

So, $\boxed{n = 4}$

89. In alkaline medium, the reduction of permanganate anion involves a gain of —— electrons.

Sol. **3**

$$\overset{+7}{MnO_4^-} \longrightarrow \overset{+4}{Mn}$$

(3)

90. $A(g) \rightleftharpoons 2B(g) + C(g)$

For the given reaction, if the initial pressure is 450 mmHg and the pressure at time t is 720 mmHg at a constant temperature T and constant volume V. The fraction of A(g) decomposed under these conditions is $x \times 10^{-1}$. The value of x is _____ (nearest integer)

Sol. **3**

$A(g) \rightleftharpoons 2B(g) + C(g)$

t = 0 450

time t 450 – x 2x x

$P_T = P_A + P_B + P_C$

720 = 450 – x + 2x + x

2x = 270

x = 135

Fraction of A decomposed = $\frac{135}{450} = 0.3 = 3 \times 10^{-1}$

So, x =3