FINAL JEE–MAIN EXAMINATION – APRIL, 2023

(Held On Tuesday 11ᵗʰ April, 2023) **TIME : 3 : 00 PM to 6 : 00 PM**

CHEMISTRY	TEST PAPER WITH SOLUTION

SECTION-A

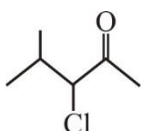**61.** Which hydride among the following is less stable?
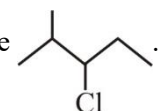
(1) BeH_2 (2) NH_3

(3) HF (4) LiH

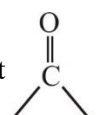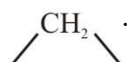**Official Ans. by NTA (1)**

Allen Ans. (1)

Solution : BeH_2 is hypovalent

62. Given below are two statements, one is labelled as Assertion A and the other is labelled as Reason R.

Assertion A :

can be subjected to

Wolff-Kishner reduction to give .

Reason R : Wolff-Kishner reduction is used to convert into .

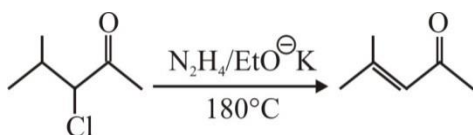In the light of the above statements, choose the correct answer from the options given below :

(1) Both A and R are true but R is NOT the correct explanation of A.

(2) A is true but R is false.

(3) A is false but R is true.

(4) Both A and R are true and R is the correct explanation of A.

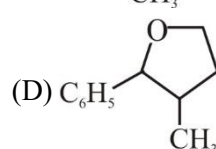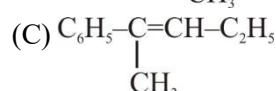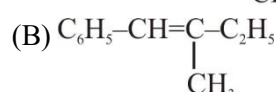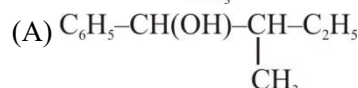**Official Ans. by NTA (3)**

Allen Ans. (3)

Solution :

Wolff-Kishner reduction is not suitable for base sensitive group.

63. The major product formed in the following reaction is:

$$C_6H_5-CH(OH)-CH-CH_2-CHO \xrightarrow[\Delta]{Zn(Hg)/HCl} \text{Major Products}$$
(with CH_3 branch)

(A) $C_6H_5-CH(OH)-CH-C_2H_5$ (with CH_3)

(B) $C_6H_5-CH=C-C_2H_5$ (with CH_3)

(C) $C_6H_5-C=CH-C_2H_5$ (with CH_3)

(D)
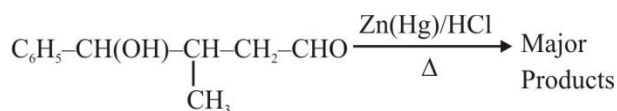
Choose the correct answer from the options given below :

(1) A only

(2) B only

(3) C only

(4) D only

Official Ans. by NTA (2)

Allen Ans. (2)

Solution :

$$C_6H_5-\overset{OH}{\underset{}{CH}}-\overset{CH_3}{\underset{}{CH}}-CH_2-\overset{O}{\overset{\parallel}{C}}-H$$

$\downarrow$ Zn(Hg)/HCl, Δ

$$C_6H_5-\overset{\oplus}{CH}-\overset{H}{\underset{CH_3}{C}}-CH_2-CH_3$$

$\downarrow -H^{\oplus}$

$$C_6H_5-CH=\overset{}{\underset{CH_3}{C}}-CH_2-CH_3$$
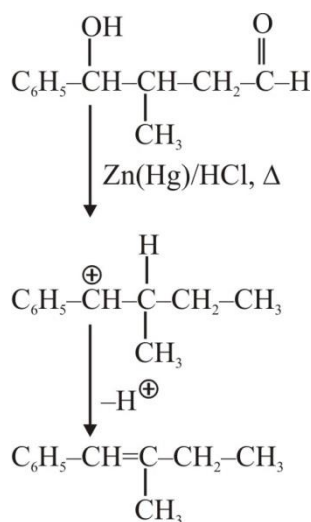
64. Which of the following compounds is an example of Freon?

(1) $C_2Cl_2F_2$

(2) C_2HF_3

(3) $C_2H_2F_2$

(4) C_2F_4

Official Ans. by NTA (1)

Allen Ans. (1)

Solution : Freons are chlorofluoro carbon.

65. For a chemical reaction A + B → Product, the order is 1 with respect to A and B.

Rate mol L^{-1} s^{-1}	[A] mol L^{-1}	[B] mol L^{-1}
0.10	20	0.5
0.40	x	0.5
0.80	40	y

What is the value of x and y?

(1) 80 and 2

(2) 40 and 4

(3) 160 and 4

(4) 80 and 4

Official Ans. by NTA (1)

Allen Ans. (1)

Solution :

$r = K[A]^1[B]^1$

$0.1 = K(20)^1 (0.5)^1$ \qquad …(i)

$0.40 = K(x)^1 (0.5)^1$ \qquad …(ii)

$0.80 = K(40)^1 (y)^1$ \qquad …(iii)

From (i) and (ii)

$x = 80$

From (i) and (iii)

$y = 2$

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

Assertion A : $[CoCl(NH_3)_5]^{2+}$ absorbs at lower wavelength of light with respect to $[Co(NH_3)_5(H_2O)]^{3+}$

Reason R : It is because the wavelength of the light absorbed depends on the oxidation state of the metal ion.

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 and R is the correct explanation of A.

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

Official Ans. by NTA (1)

Allen Ans. (1)

Solution : Since H_2O is strong field ligand compared to chloride and Co^{3+} ion is present.

∴ CFSE is higher for $[Co(NH_3)_5H_2O]^{+3}$, hence it will absorb at lower wavelength.

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

Assertion A : A solution of the product obtained by heating a mole of glycine with a mole of chlorine in presence of red phosphorous generates chiral carbon atom.

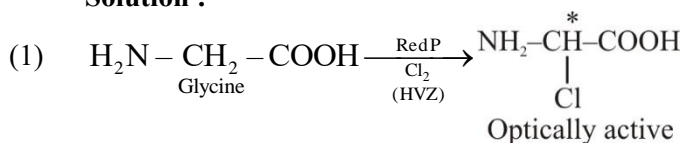**Reason R :** A molecule with 2 chiral carbons is always optically active.

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 and R is the correct explanation of A.

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

Official Ans. by NTA (2)

Allen Ans. (2)

Solution :

(1) $\underset{\text{Glycine}}{H_2N-CH_2-COOH} \xrightarrow[\substack{Cl_2 \\ (HVZ)}]{Red\,P} \underset{\substack{| \\ Cl \\ \text{Optically active}}}{NH_2-\overset{*}{C}H-COOH}$

(2) Meso compound are optically inactive.

68.

$$H_3C–CH_2–\underset{\underset{OH}{|}}{CH}–CH_3 \xrightarrow[\text{(iii) D}_2\text{O}]{\substack{\text{(i) NaI, H}_3\text{PO}_4 \\ \text{(ii) Mg, Dry ether}}} \underset{\text{Product}}{[X]}$$
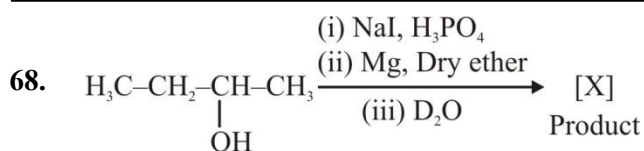
Product [X] formed in the above reaction is :

(1) $H_3C–CH_2–\underset{\underset{D}{|}}{CH}–CH_3$

(2) $H_3C–CH_2–\underset{\underset{OH}{|}}{\overset{\overset{H}{|}}{C}}–CH_3$

(3) $H_3C—CH_2—CH=CH_2$

(4) $H_3C—CH=CH—CH_3$

Official Ans. by NTA (1)

Allen Ans. (1)

Solution :

$$H_3C–CH_2–\underset{\underset{OH}{|}}{CH}–CH_3 \xrightarrow{\text{NaI, H}_3\text{PO}_4} H_3C–CH_2–\underset{\underset{I}{|}}{CH}–CH_3$$

$$H_3C–CH_2–\underset{\underset{MgI}{|}}{CH}–CH_3 \xleftarrow{\text{Mg dry ether}}$$

$$\xrightarrow{\text{D}_2\text{O}} H_3C–CH_2–\underset{\underset{D}{|}}{CH}–CH_3$$
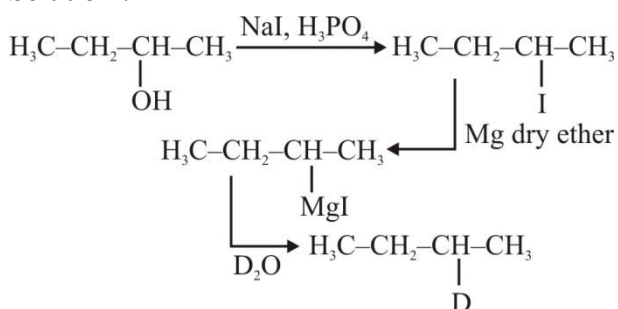
69. Given below are two statements :

Statements I : Ethene at 333 to 343K and 6-7 atm pressure in the presence of AlEt$_3$ and TiCl$_4$ undergoes addition polymerization to give LDP.

Statement II : Caprolactam at 533-543K in H_2O through step growth polymerizes to give Nylon 6.

In the light of the above Statements, chose the correct answer from the options given below :

(1) Both Statement I and Statement II are true.

(2) Statement I is false but Statement II is true.

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

(4) Both Statement I and Statement II are false.

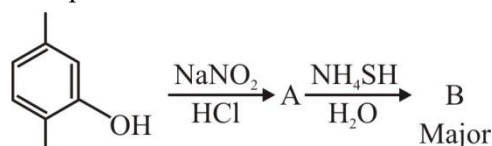**Official Ans. by NTA (2)**

Allen Ans. (2)

Solution : S$_1$ ⇒ HDPE is formed by TiCl$_4$ & Al(Et)$_3$.

S$_2$ ⇒ Nylon-6 is formed by caprolactam.

70. Compound 'B' is

$$\xrightarrow[\text{HCl}]{\text{NaNO}_2} A \xrightarrow[\text{H}_2\text{O}]{\text{NH}_4\text{SH}} \underset{\text{Major}}{B}$$
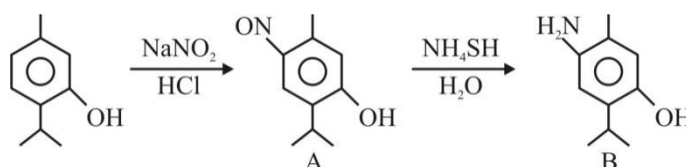
(1)

(2)

(3)

(4)

Official Ans. by NTA (2)

Allen Ans. (2)

Solution :

71. Which one of the following pairs is an example of polar molecular solids?

(1) $SO_2(s)$, $NH_3(s)$

(2) $SO_2(s)$, $CO_2(s)$

(3) $HCl(s)$, $AlN(s)$

(4) $MgO(s)$, $SO_2(s)$

Official Ans. by NTA (1)

Allen Ans. (1)

Solution : SO_2 and NH_3 are polar molecules. They are constituent particles of polar molecular solids.

72. One mole of P_4 reacts with 8 moles of $SOCl_2$ to give 4 moles of A, x mole of SO_2 and 2 moles of B. A, B and x respectively are

(1) PCl_3, S_2Cl_2 and 4

(2) $POCl_3$, S_2Cl_2 and 4

(3) PCl_3, S_2Cl_2 and 2

(4) $POCl_3$, S_2Cl_2 and 2

Official Ans. by NTA (1)

Allen Ans. (1)

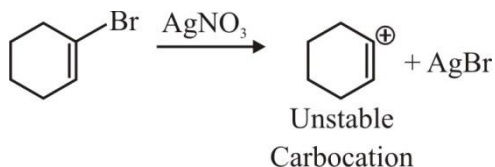**Solution :** $P_4 + 8\ SOCl_2 \rightarrow 4PCl_3 + 2S_2Cl_2 + 4SO_2$

73. Compound from the following that will not produce precipitate on reaction with $AgNO_3$ is :

(1)

(2)

(3)

(4)

Official Ans. by NTA (1)

Allen Ans. (1)

Solution :

Unstable Carbocation

74. A solution is prepared by adding 2g of "X" of 1 mole of water. Mass percent of "X" in the solution is :

(1) 20%

(2) 5%

(3) 2%

(4) 10%

Official Ans. by NTA (4)

Allen Ans. (4)

Solution : Solute (X) = 2 g

Solvent (H_2O) = 1 mole = 18 g

Total mass = 2 + 18 = 20 g

% mass of X = $\dfrac{2}{20} \times 100 = 10\%$

75. Given below are two statements :

Statement-I : In the metallurgy process, sulphide ore is converted to oxide before reduction.

Statement-II : Oxide ores in general are easier to reduce.

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) Statement I is correct but Statement II is incorrect.

(3) Both Statement I and Statement II are incorrect.

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

Official Ans. by NTA (1)

Allen Ans. (1)

Solution : $2ZnS + 3O_2 \rightarrow 2ZnO + 2SO_2$

Oxides on carbon reduction forms CO_2 while sulphide on carbon reduction gives CS_2.

CO_2 is more volatile compared to CS_2 therefore oxides are easy to reduce.

76. Alkali metal from the following with least melting point is :

(1) Rb

(2) K

(3) Na

(4) Cs

Official Ans. by NTA (4)

Allen Ans. (4)

Solution : On moving down the group in alkali metals melting point decreases.

77. What weight of glucose must be dissolved in 100 g of water to lower the vapour pressure by 0.20 mm Hg?

(Assume dilute solution is being formed)

Given : Vapour pressure of pure water is 54.2 mm Hg at room temperature. Molar mass of glucose is 180 g mol^{-1}.

(1) 4.69 g   (2) 3.59 g

(3) 2.59 g   (4) 3.69 g

Official Ans. by NTA (4)

Allen Ans. (4)

Solution : $\dfrac{P^0 - P_s}{P^0} = \dfrac{n}{N}$ (for dilute solution)

$\dfrac{0.2}{54.2} = \dfrac{n \times 18}{100}$

$n = \dfrac{\frac{100}{271 \times 18}}{}$

$w = \dfrac{100 \times 180}{271 \times 18}$; $w = 3.69g$

78. The magnetic moment is measured in Bohr Magneton (BM).

Spin only magnetic moment of Fe in $[Fe(H_2O)_6]^{3+}$ and $[Fe(CN)_6]^{3-}$ complexes respectively is :

(1) 6.92 B.M. in both

(2) 4.89 B.M. and 6.92 B.M.

(3) 3.87 B.M. and 1.732 B.M.

(4) 5.92 B.M. and 1.732 B.M

Official Ans. by NTA (4)

Allen Ans. (4)

Solution : $[Fe(H_2O)_6]^{3+}$

$Fe^{3+} \Rightarrow [Ar]\ 3d^5\ 4s^0$

No pairing

1	1	1	1	1

∴ Unpaired e$^-$ = 5

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

$= \sqrt{5(5+2)}$

$\mu = \sqrt{35} = 5.92\,\text{B.M.}$

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

$Fe^{3+} \Rightarrow [Ar]\ 3d^5\ 4s^\circ$

1	1	1	1	1
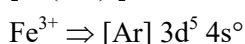
Pairing occur due to strong field ligand CN$^-$

1↓	1↓	1		

∴ Unpaired e$^-$ $\Rightarrow$ 1

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

$= \sqrt{1(1+2)} = \sqrt{3} = 1.732\,\text{B.M.}$

79. Match List I with List II.

	List I		List II	
	Complex		**Colour**	
A.	$Mg(NH_4)PO_4$	I.	Brown
B.	$K_3[Co(NO_2)_6]$	II.	White
C.	$MnO(OH)_2$	III.	Yellow
D.	$Fe_4[Fe(CN)_6]_3$	IV.	blue

Choose the correct answer from the options given below :

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

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

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

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

Official Ans. by NTA (1)

Allen Ans. (1)

Solution : $Mg(NH_4)PO_4 \Rightarrow$ White

$K_3[Co(NO_2)_6] \Rightarrow$ Yellow

$MnO(OH)_2 \Rightarrow$ Brown

$Fe_4[Fe(CN)_6]_3 \Rightarrow$ Blue

80. If Ni^{2+} is replaced by Pt^{2+} in the complex $[NiCl_2Br_2]^{2-}$, which of the following properties are expected to get changed?

A. Geometry

B. Geometrical isomerism

C. Optical isomerism

D. Magnetic properties

(1) A, B and C

(2) A, B and D

(3) A and D

(4) B and C

Official Ans. by NTA (2)

Allen Ans. (2)

Solution : $[NiBr_2Cl_2]^{2-} \rightarrow$ This complex species is tetrahedral as $Br^{\ominus}$ & $Cl^{\ominus}$ are weak field ligands.

$[PtBr_2Cl_2]^{2-} \rightarrow$ As Pt belongs to 5d series. This complex species is square planar.

Both the complex species are optically inactive.

$[NiBr_2Cl_2]^{2-}$, being tetrahedral does not show Geometrical Isomerism.

$[PtBr_2Cl_2]^{2-}$ shows two Geometrical Isomers.

SECTION-B

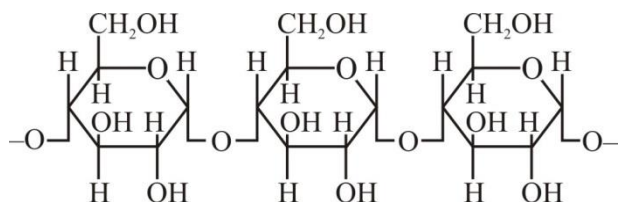**81.** Number of compounds from the following which will not produce orange red precipitate with Benedict solution is ……….

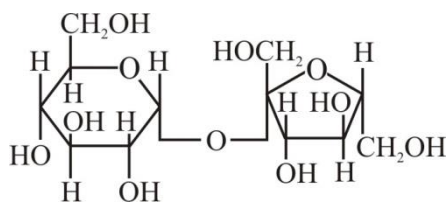Glucose, maltose, sucrose, ribose, 2-deoxyribose, amylose, lactose.

Official Ans. by NTA (3)

Allen Ans. (2)

Solution :

Amylose

Sucrose :

Both Amylose and Sucrose does not give Benedict's test.

82. 4.5 moles each of hydrogen and iodine is heated in a sealed ten litre vessel. At equilibrium, 3 moles of HI were found. The equilibrium constant for $H_2(g) + I_2(g) \rightleftharpoons 2HI(g)$ is …….

Official Ans. by NTA (1)

Allen Ans. (1)

Solution :

$$H_{2(g)} + I_{2(g)} \rightleftharpoons 2HI_{(g)}$$

t = 0	4.5	4.5	–
t_{eq}	3	3	3

$$K_c = \frac{[HI]^2}{[H_2][I_2]} = \frac{(3)^2}{3 \times 3} = \frac{9}{9} = 1$$

83. The number of correct statements about modern adsorption theory of heterogeneous catalysis from the following is ……….

A. The catalyst is diffused over the surface of reactants.

B. Reactants are adsorbed on the surface of the catalyst.

C. Occurrence of chemical reaction on the catalyst's surface through formation of an intermediate.

D. It is a combination of intermediate compound formation theory and the old adsorption theory.

E. It explains the action of the catalyst as well as those of catalytic promoters and poisons.

Official Ans. by NTA (3)

Allen Ans. (3)

Solution : B, C and D are correct.

(NCERT – Surface Chemistry)

84. The number of correct statements from the following _____

A. For 1s orbital, the probability density is maximum at the nucleus.

B. For 2s orbital, the probability density first increases to maximum and then decreases sharply to zero.

C. Boundary surface diagrams of the orbitals encloses a region of 100% probability of finding the electron.

D. p and d-orbitals have 1 and 2 angular nodes respectively.

E. Probability density of p-orbital is zero at the nucleus.

Official Ans. by NTA (3)

Allen Ans. (3)

Solution : A, D and E statements are correct.
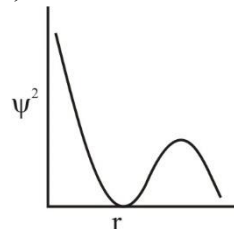
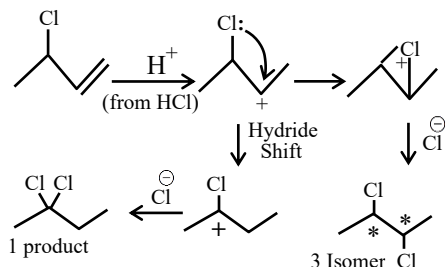For 2s orbital, the probability density first decreases and then increases.

At any distance from nucleus the probability density of finding electron is never zero and it always have some finite value.

85. The number of possible isomeric products formed when 3-chloro-1-butene reacts with HCl through carbocation formation is _____

Official Ans. by NTA (4)

Allen Ans. (4)

Solution :

Total Possible Isomeric product = 1+3 = 4

86. $Mg(NO_3)_2 \cdot XH_2O$ and $Ba(NO_3)_2 \cdot YH_2O$, represent formula of the crystalline forms of nitrate salts. Sum of X and Y is _____

Official Ans. by NTA (6)

Allen Ans. (6)

Solution : $Mg(NO_3)_2 \cdot 6H_2O$ is a hydrated salt whereas $Ba(NO_3)_2$ is a anhydrous salt.

∴ x + y = 6

87. The total number of intensive properties from the following is _____

Volume, Molar heat capacity, Molarity, E^θ cell, Gibbs free energy change, Molar mass, Mole

Official Ans. by NTA (4)

Allen Ans. (4)

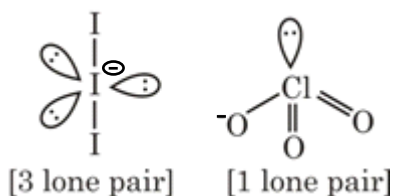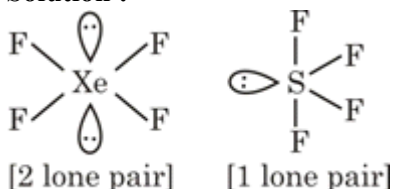**Solution :** Extensive ⟹ Mole, Volume, Gibbs free energy.

Intensive ⟹ Molar mass, Molar heat capacity, Molarity, E^θ cell.

88. The maximum number of lone pairs of electrons on the central atom from the following species is ____

ClO_3^-, XeF_4, SF_4 and I_3^-

Official Ans. by NTA (3)

Allen Ans. (3)

Solution :

89. The volume of hydrogen liberated at STP by treating 2.4 g of magnesium with excess of hydrochloric acid is _____ $\times 10^{-2}$ L.
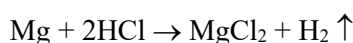
Given: Molar volume of gas is 22.4 L at STP.

Molar mass of magnesium is 24 g mol^{-1}.

Official Ans. by NTA (224)

Allen Ans. (224)

Solution :

$Mg + 2HCl \rightarrow MgCl_2 + H_2 \uparrow$

w = 2.4 g

$N = \dfrac{2.4}{24} = 0.1$ mole

1 mole of gas at STP ⟹ 22.4 lit.

∴ 0.1 mole of gas = 0.1 × 22.4

= 2.24 lit. = 224 × 10^{-2} litre

90. The number of correct statements from the following is :

A. E_{cell} is an intensive parameter.

B. A negative E^Θ means that the redox couple is a stronger reducing agent than the H^+/H_2 couple.

C. The amount of electricity required for oxidation or reduction depends on the stoichiometry of the electrode reaction.

D. The amount of chemical reaction which occurs at any electrode during electrolysis by a current is proportional to the quantity of electricity passed through the electrolyte.

Official Ans. by NTA (4)

Allen Ans. (4)

Solution : Given statements A, B, C and D are correct.