FINAL JEE–MAIN EXAMINATION – APRIL, 2023

(Held On Thursday 06th April, 2023) **TIME : 3 : 00 PM to 6 : 00 PM**

CHEMISTRY

TEST PAPER WITH SOLUTION

SECTION-A

61. Ion having highest hydration enthalpy among the given alkaline earth metal ions is:-

(1) Be^{2+}

(2) Ba^{2+}

(3) Sr^{2+}

(4) Ca^{2+}

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Hydration enthalpy $\propto \frac{1}{\text{size}}$

Down the group as size increases hydration enthalpy decreases

Order : $Be^{2+} > Mg^{+2} > Ca^{+2} > Sr^{+2} > Ba^{+2}$

62. The IUPAC name of $K_3[Co(C_2O_4)_3]$ is :-

(1) Potassium trioxalatocobaltate(III)

(2) Potassium tris(oxalato)cobalt(III)

(3) Potassium tris(oxalato)cobaltate(III)

(4) Potassium trioxalatocobalt(III)

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. IUPAC name of $K_3[Co(C_2O_4)_3]$ is

Potassium trioxalatocobaltate(III)

63. Match **List I** with **List II**

List I	**List II**
Natural Amino acid	**One Letter Code**
(A) Arginine	(I) D
(B) Aspartic acid	(II) N
(C) Asparagine	(III) A
(D) Alanine	(IV) R

Choose the correct answer from the options given below :-

(1) (A)–IV, (B)–I, (C)–III, (D)–II

(2) (A)–I, (B)–III, (C)–IV, (D)–II

(3) (A)–III, (B)–I, (C)–II, (D)–IV

(4) (A)–IV, (B)–I, (C)–II, (D)–III

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. Factual.

64. Element not present in Nessler's reagent is:-

(1) Hg

(2) I

(3) K

(4) N

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. Nessler reagent is – $K_2[HgI_4]$

65. Structure of $BeCl_2$ in solid state, vapour phase and at very high temperature respectively are :-

(1) Dimeric, Polymeric, Monomeric

(2) Polymeric, Dimeric, Monomeric

(3) Monomeric, Dimeric, Polymeric

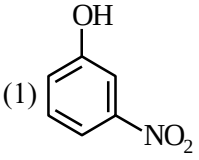
(4) Polymeric, Monomeric, Dimeric

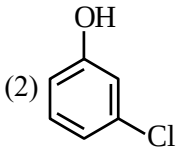
Official Ans. by NTA (2)

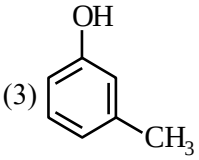
Allen Ans. (2)

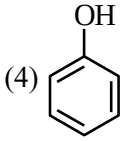
Sol. In solid state $BeCl_2$ as polymer, in vapour state it form chloro-bridged dimer while above 1200K it is monomer.

66. The strongest acid from the following is

(1) 

(2) 

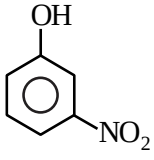
(3) 

(4) 

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Strongest acid from the following is



$-NO_2$ group has more EWG nature so more acidic,

67. Group-13 elements react with O_2 in amorphous form to form oxides of type M_2O_3 (M = element). Which among the following is the most basic oxide?

(1) Al_2O_3

(2) Ga_2O_3

(3) Tl_2O_3

(4) B_2O_3

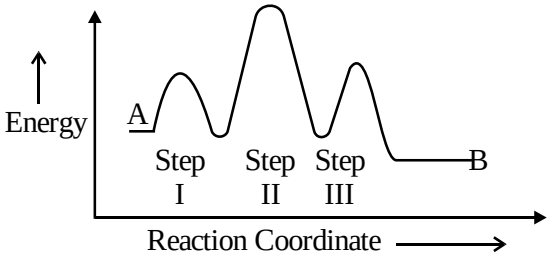
Official Ans. by NTA (3)

Allen Ans. (3)

Sol. As electropositive character increases basic character of oxide increases.

$$\underbrace{B_2O_3}_{\text{acidic}} < \underbrace{Al_2O_3 < Ga_2O_3}_{\text{amphoteric}} < \underbrace{In_2O_3 < Tl_2O_3}_{\text{basic}}$$

68. Consider the following reaction that goes from A to B in three steps as shown below:-



Choose the correct

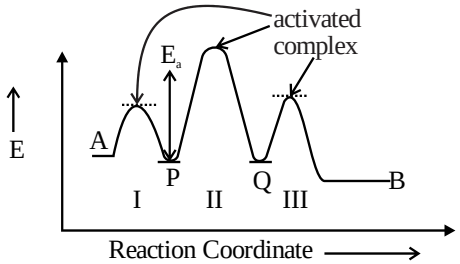
Number of intermediates	Number of Activated complexes	Rate determining step
(1) 3	2	II
(2) 2	3	II
(3) 2	3	I
(4) 2	3	III

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. Step with highest activation energy is RDS, so step II is RDS

No. of activated complex = 3



P and Q are intermediates

(Number of intermediates = 2)

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

Assertion A : In the complex $Ni(CO)_4$ and $Fe(CO)_5$, the metals have zero oxidation state.

Reason R : Low oxidation states are found when a complex has ligands capable of π-donor character in addition to the σ-bonding.

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

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

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

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

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

Official Ans. by NTA (1)

Allen Ans. (1)

Sol. Low oxidation state of metals can stabilized by synergic bonding so ligand has to be π-acceptor.

70. During the reaction of permanganate with thiosulphate, the change in oxidation of manganese occurs by value of 3. Identify which of the below medium will favour the reaction.

(1) aqueous acidic

(2) aqueous neutral

(3) both aqueous acidic and neutral

(4) both aqueous acidic and faintly alkaline.

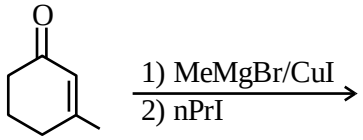
Official Ans. by NTA (2)

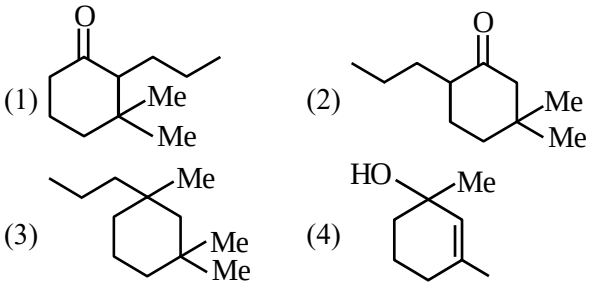
Allen Ans. (2)

Sol. In neutral or weakly alkaline solution oxidation state of Mn changes by 3 unit

$$\overset{+7}{Mn}O_4^{-1} \rightarrow \overset{+4}{Mn}O_2$$

71. Find out the major product from the following reaction

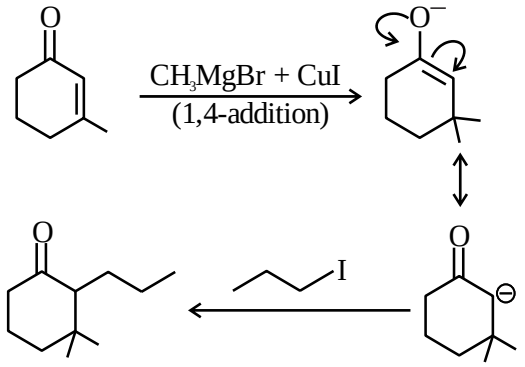




Official Ans. by NTA (1)

Allen Ans. (1)

Sol.



72. Formation of which complex, among the following, is not a confirmatory test of Pb^{2+} ions

(1) lead chromate

(2) lead iodide

(3) lead nitrate

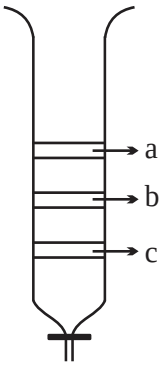
(4) lead sulphate

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. $\because$ $Pb(NO_3)_2$ is a soluble colourless compound so it cannot be used in confirmatory test of Pb^{+2} ion.

73. From the figure of column chromatography given below, identify incorrect statements.



A. Compound 'c' is more polar than 'a' and 'b'

B. Compound 'a' is least polar

C. Compound 'b' comes out of the column before 'c' and after 'a'

D. Compound 'a' spends more time in the column

Choose the correct answer from the options given below :-

(1) A, B and C only

(2) B, C and D only

(3) A, B and D only

(4) B and D only

Official Ans. by NTA (1)

Allen Ans. (1)

74. Given below are two statements :-

Statement-I : Morphine is a narcotic analgesis. It helps in relieving pain without producing sleep.

Statement-II : Morphine and its derivatives are obtained from opium poppy.

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

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

(2) Both Statement I and Statement II are false

(3) Both Statement I and Statement II are true

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

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. **Statement-I-** Morphine relieves in pain and produce sleep (incorrect)

Statement-II - Correct

75. The volume of 0.02 M aqueous HBr required to neutralize 10.0 mL of 0.01 M aqueous $Ba(OH)_2$ is (Assume complete neutralization)

(1) 2.5 mL

(2) 5.0 mL

(3) 10.0 mL

(4) 7.5 mL

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. $N_1v_1 = N_2v_2$

$\Rightarrow 0.02v_1 = 0.02\times10$

$\Rightarrow v_1 = 10ml$

76. The product, which is not obtained during the electrolysis of brine solution is

(1) NaOH

(2) Cl_2

(3) H_2

(4) HCl

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. Brine is aq. Solution of NaCl

$NaCl_{(aq)} \rightarrow Na^+ + Cl^-$

Cathode reaction

$2H_2O + 2e^- \xrightarrow{\text{reduction}} H_{2(g)} + 2OH^-$

Anode reaction

$2Cl^- \xrightarrow{\text{oxidation}} Cl_{2(g)} + 2e^-$

So HCl will not form during electrolysis.

77. The group of chemicals used as pesticide is

(1) Sodium chlorate, DDT, PAN

(2) Aldrin, Sodium chlorate, Sodium arsinite

(3) DDT, Aldrin

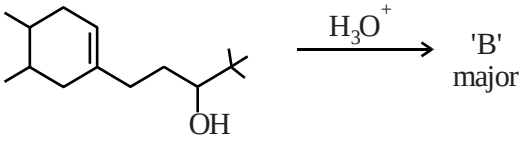
(4) Dieldrin, Sodium arsinite, Tetrachloroethene

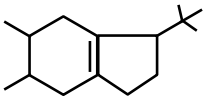
Official Ans. by NTA (3)

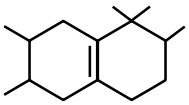
Allen Ans. (3)

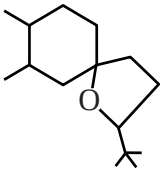
Sol. Pesticides $\rightarrow$ D.D.T and Aldrin

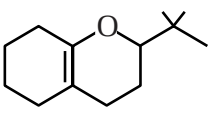
78. In the following reaction, 'B' is



(1) 

(2) 

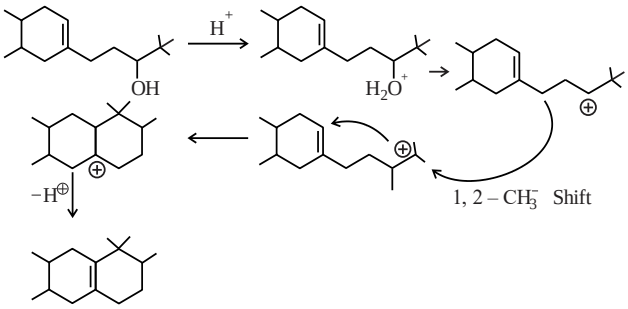
(3) 

(4) 

Official Ans. by NTA (2)

Allen Ans. (2)

Sol.



79. Which one of the following elements will remain as liquid inside pure boiling water ?

(1) Cs

(2) Ga

(3) Li

(4) Br

Official Ans. by NTA (2)

Allen Ans. (2)

Sol. Li, Cs reacts vigorously with water.

Br_2 changes in vapour state in boiling water (BP = 58°C)

Ga reacts with water above 100°C (MP = 29°C, BP = 2400°C)

80. If the radius of the first orbit of hydrogen atom a_0, then de Broglie's wavelength of electron in 3rd orbit is

(1) $\frac{\pi a_0}{6}$

(2) $\frac{\pi a_0}{3}$

(3) $6\pi a_0$

(4) $3\pi a_0$

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. $(r_3)_H = \frac{a_0 n^2}{Z} = a_0 \times 3^2 = 9a_0$

$2\pi r = n\lambda$

$\Rightarrow 2\pi \times 9a_0 = 3\lambda$

$\Rightarrow \lambda = 6\pi a_0$

SECTION-B

81. In an ice crystal, each water molecule is hydrogen bonded to ……..neighbouring molecules.

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. In ice each water molecule is hydrogen bonded with four other water molecules.

82. The equilibrium composition for the reaction $PCl_3 + Cl_2 \rightleftharpoons PCl_5$ at 298 K is given below.

$[PCl_3]_{eq} = 0.2$ mol L^{-1} $[Cl_2]_{eq} = 0.1$ mol L^{-1},

$[PCl_5]_{eq} = 0.40$ mol L^{-1}

If 0.2 mol of Cl_2 is added at the same temperature, the equilibrium concentrations of PCl_5 is_____ $\times 10^{-2}$ mol L^{-1}.

Given : K_c for the reaction at 298 K is 20

Official Ans. by NTA (48)

Allen Ans. (49)

Sol.

	PCl_3	+	Cl_2	$\rightleftharpoons$	PCl_5
	0.2M		(0.1+0.2)M		0.4M
Eqm.	0.2–x		0.3–x		0.4+x

$$\frac{(0.4+x)}{(0.2-x)(0.3-x)} = 20$$

$\Rightarrow x \simeq 0.086$

$[PCl_5]_{eq} = 0.486M = 48.6 \times 10^{-2} M$

83. Consider the following pairs of solution which will be isotonic at the same temperature. The number of pairs of solutions is/are……..

A. 1 M aq. NaCl and 2 M aq. Urea

B. 1 M aq. $CaCl_2$ and 1.5 M aq. KCl

C. 1.5 M aq. $AlCl_3$ and 2 M aq. Na_2SO_4

D. 2.5 M aq. KCl and 1 M aq. $Al_2(SO_4)_3$

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. $\pi = icRT$

A, B, C and D are isotonic pairs.

84. The standard reduction potential at 298 K for the following half cells are given below :-

$NO_3^- + 4H^+ + 3e^- \rightarrow NO(g) + 2H_2O$ $E^0 = 0.97V$

$V^{2+}(aq) + 2e^- \rightarrow V$ $E^0 = -1.19V$

$Fe^{3+}(aq) + 3e^- \rightarrow Fe$ $E^0 = -0.04V$

$Ag^+(aq) + e^- \rightarrow Ag(s)$ $E^0 = 0.80V$

$Au^{3+}(aq) + 3e^- \rightarrow Au(s)$ $E^0 = 1.40V$

The number of metal(s) which will be oxidized by NO_3^- in aqueous solution is _____.

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. Metal having lower SRP than 0.97V will be oxidised by NO_3^-.

85. The number of colloidal systems from the following, which will have 'liquid' as the dispersion medium, is_____

Gem stones, paints, smoke, cheese, milk, hair cream, insecticide sprays, froth, soap lather.

Official Ans. by NTA (5)

Allen Ans. (5)

Sol. Paints, milk, hair cream, froth, soap lather.

86. The number of species having a square planar shape from the following is _____

XeF_4, SF_4, SiF_4, BF_4^-, BrF_4^-, $[Cu(NH_3)_4]^{2+}$, $[FeCl_4]^{2-}$, $[PtCl_4]^{2-}$

Official Ans. by NTA (4)

Allen Ans. (4)

Sol. XeF_4, BrF_4^{-1}, $[Cu(NH_3)_4]^{+2}$, $[PtCl_4]^{-2}$ has square planar shape.

87. Consider the following date

Heat of combustion of $H_2(g) = -241.8$ kJ mol^{-1}

Heat of combustion of $C(s) = -393.5$ kJ mol^{-1}

Heat of combustion of $C_2H_5OH(l) = -1234.7$ kJ mol^{-1}.

The heat of formation of $C_2H_5OH(l)$ is (–) _____ kJ mol^{-1} (Nearest integer)

Official Ans. by NTA (278)

Allen Ans. (278)

Sol. $2C_{(s)} + 3H_{2(g)} + \frac{1}{2}O_{2(g)} \rightarrow C_2H_5OH_{(l)}$

$(\Delta H_f)_{C_2H_5OH_{(l)}} = \Sigma(\Delta H_{comb})_{reactant} - \Sigma(\Delta H_{comb})_{product}$

$= 2\times(-393.5) + 3(-241.8) - (-1234.7)$

$= -277.7\,kJ/mol$

88. Among the following, the number of compounds which will give positive iodoform reaction is_____

(a) 1-Phenylbutan-2-one

(b) 2-Methylbutan-2-ol

(c) 3-Methylbutan-2-ol

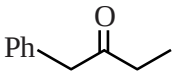
(d) 1-Phenylethanol

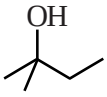
(e) 3,3-dimethylbutan-2-one

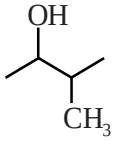
(f) 1-Phenylpropan-2-ol

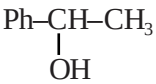
Official Ans. by NTA (4)

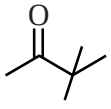
Allen Ans. (4)

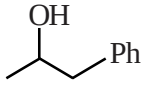
Sol. (a) 

(b) 

(c)  (Positive for iodoform)

(d)  (Positive for iodoform)

(e)  (Positive for iodoform)

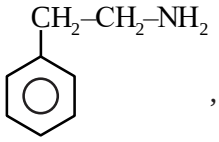
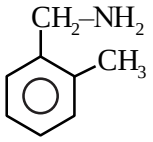
(f)  (Positive for iodoform)

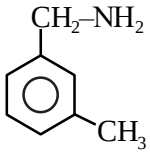
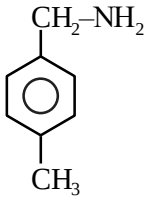
89. Number of isomeric aromatic amines with molecular formula $C_8H_{11}N$, which can be synthesized by Gabriel Phthalimide synthesis is_____

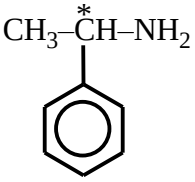
Official Ans. by NTA (5)

Allen Ans. (6)

Sol.

 , 

 , 



(d + l)

90. Number of crystal systems from the following where body centred unit cell can be found, is…..

Cubic, tetragonal, orthorhombic, hexagonal, rhombohedral, monoclinic, triclinic.

Official Ans. by NTA (3)

Allen Ans. (3)

Sol. Cubic, tetragonal and orthorhombic have body centered unit cell.