

# FINAL JEE-MAIN EXAMINATION - APRIL, 2023

(Held On Thursday 06th April, 2023)

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TIME: 3:00 PM to 6:00 PM

## **CHEMISTRY**

#### **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)

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)

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 One Letter Code	
Natural Amino acid		
(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)

Ans. (4)

Sol. Factual.

## TEST PAPER WITH SOLUTION

- **64.** Element not present in Nessler's reagent is:-
  - (1) Hg
  - (2)I
  - (3) K
  - (4) N

#### Official Ans. by NTA (4)

Ans. (4)

- Sol. Nessler reagent is K<sub>2</sub>[HgI<sub>4</sub>]
- 65. Structure of BeCl<sub>2</sub> 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)

Ans. (2)

- **Sol.** In solid state BeCl<sub>2</sub> as polymer, in vapour state it form chloro-bridged dimer while above 1200K it is monomer.
- **66.** The strongest acid from the following is

$$(1) \qquad (2) \qquad (1) \qquad (3) \qquad (4) \qquad (4) \qquad (4) \qquad (5)$$

## Official Ans. by NTA (1)

Ans. (1)

Sol. Strongest acid from the following is

-NO<sub>2</sub> 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<sub>2</sub>O<sub>3</sub>
  - (2) Ga<sub>2</sub>O<sub>3</sub>
  - (3) Tl<sub>2</sub>O<sub>3</sub>
  - $(4) B_2O_3$

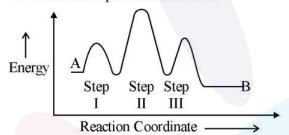
## Official Ans. by NTA (3)

Ans. (3)

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

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

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



#### Choose the correct

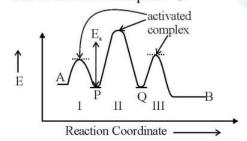
Number of intermediates	Number of Activated complexes	Rate determining step
(1) 3	2	II
(2) 2	3	П
(3) 2	3	I
(4) 2	3	III

### Official Ans. by NTA (2)

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)<sub>4</sub> and Fe(CO)<sub>5</sub>, the metals have zero oxidation state.

**Reason R**: Low oxidation states are found when a complex has ligands capable of  $\pi$ -donor character in addition to the  $\sigma$ -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)

Ans. (1)

- Sol. Low oxidation state of metals can stabilized by synergic bonding so ligand has to be  $\pi$ -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)

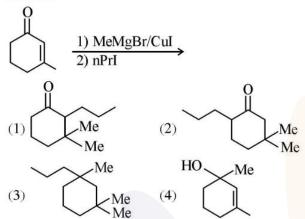
Ans. (2)

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

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



**71.** Find out the major product from the following reaction



Official Ans. by NTA (1)

Ans. (1)

$$\begin{array}{c}
CH_3MgBr + CuI \\
\hline
(1,4-addition)
\end{array}$$

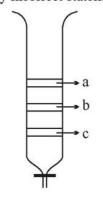
Sol.

- 72. Formation of which complex, among the following, is not a confirmatory test of Pb<sup>2+</sup> ions
  - (1) lead chromate
  - (2) lead iodide
  - (3) lead nitrate
  - (4) lead sulphate

## Official Ans. by NTA (3)

Ans. (3)

- Sol.  $\therefore$  Pb(NO<sub>3</sub>)<sub>2</sub> is a soluble colourless compound so it cannot be used in confirmatory test of Pb<sup>+2</sup> 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)

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)

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)<sub>2</sub> 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)

Ans. (3)

**Sol.**  $N_1v_1 = N_2v_2$ 

$$\Rightarrow 0.02 v_1 = 0.02 \times 10$$

 $\Rightarrow$   $\mathbf{v}_1 = 10 \text{ml}$ 



- The product, which is not obtained during the electrolysis of brine solution is
  - (1) NaOH
  - (2) Cl<sub>2</sub>
  - $(3) H_2$
  - (4) HC1

Official Ans. by NTA (4)

Ans. (4)

Brine is aq. Solution of NaCl Sol.

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

Cathode reaction

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

Anode reaction

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

So HCl will not form during electrolysis.

- The group of chemicals used as pesticide is 77.
  - (1) Sodium chlorate, DDT, PAN
  - (2) Aldrin, Sodium chlorate, Sodium arsinite
  - (3) DDT, Aldrin
  - (4) Dieldrin, Sodium arsinite, Tetrachloroethene

Official Ans. by NTA (3)

Ans. (3)

- Pesticides → D.D.T and Aldrin Sol.
- In the following reaction, 'B' is 78.

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Official Ans. by NTA (2)

Ans. (2)

Sol.

$$\begin{array}{c} & \xrightarrow{H^+} \\ & \xrightarrow{OH} \\ & \longleftarrow \\ & \xrightarrow{H_2O^+} \\ & \xrightarrow{1, 2-CH_3} \\ & \xrightarrow{Shift} \\ \end{array}$$

- 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)

Ans. (2)

Sol. Li, Cs reacts vigorously with water.

Br<sub>2</sub> changes in vapour state in boiling water  $(BP = 58^{\circ}C)$ 

Ga reacts with water above 100°C (MP = 29°C, BP  $= 2400^{\circ}C$ 

- 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)  $\frac{\pi a_0}{6}$

  - $(3) 6\pi a_0$
  - $(4) 3\pi a_0$

Official Ans. by NTA (3)

Ans. (3)

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

$$2\pi \mathbf{r} = \mathbf{n}\lambda$$

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

$$\Rightarrow \lambda = 6\pi a_0$$

## SECTION-B

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

## Official Ans. by NTA (4)

## 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.

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

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

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

Given: Kc for the reaction at 298 K is 20

## Official Ans. by NTA (48)

#### Ans. (49)

Sol.  $PCl_3 + Cl_2 \rightleftharpoons PCl_5$   $0.2M \quad (0.1+0.2)M \quad 0.4M$  $Eq^m. 0.2-x \quad 0.3-x \quad 0.4+x$ 

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

$$\Rightarrow x \approx 0.086$$

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

- **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<sub>2</sub> and 1.5 M aq. KCl
  - C. 1.5 M aq. AlCl<sub>3</sub> and 2 M aq. Na<sub>2</sub>SO<sub>4</sub>
  - **D.** 2.5 M aq. KCl and 1 M aq.  $Al_2(SO_4)_3$

## Official Ans. by NTA (4)

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<sub>3</sub> in aqueous solution is \_\_\_\_\_.

## Official Ans. by NTA (3)

## Ans. (3)

- Sol. Metal having lower SRP than 0.97V will be oxidised by NO<sub>3</sub>.
- 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)

## 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)

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  $H_2(g) = -241.8 \text{ kJ mol}^{-1}$ 

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

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

The heat of formation of  $C_2H_5OH(1)$  is (-)

\_\_\_\_ kJ mol<sup>-1</sup> (Nearest integer)

Official Ans. by NTA (278)

Ans. (278)

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

 $(\Delta H_f)_{C_2H_5OH_{(1)}} = \sum (\Delta H_{comb})_{reactant} - \sum (\Delta H_{comb})_{product}$ =  $2 \times (-393.5) + 3(-241.8) - (-1234.7)$ 

=-277.7kJ/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)

Ans. (4)

Sol. (a) Ph

OH

(c)  $CH_3$  (Positive for iodoform)

(d) Ph-CH-CH<sub>3</sub> (Positive for iodoform)

ÒН

(e) (Positive for iodoform)

(f) Ph (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)

Ans. (6)

Sol.

CH<sub>2</sub>-CH<sub>2</sub>-NH<sub>2</sub>
CH<sub>2</sub>-NH<sub>2</sub>
CH<sub>3</sub>
CH<sub>2</sub>-NH<sub>2</sub>
CH<sub>2</sub>-NH<sub>2</sub>

 $CH_2$ -IVII $_2$   $CH_3$   $CH_3$ 

CH<sub>3</sub>-CH-NH<sub>2</sub>
(d+1)

**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)

Ans. (3)

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