

FINAL JEE–MAIN EXAMINATION – JULY, 2022

(Held On Tuesday 26th July, 2022)

TIME : 3 : 00 PM to 6 : 00 PM

CHEMISTRY

TEST PAPER WITH SOLUTION

SECTION-A

1. Hemoglobin contains 0.34% of iron by mass. The number of Fe atoms in 3.3 g of hemoglobin is :
(Given : Atomic mass of Fe is 56 u, N_A in $6.022 \times 10^{23} \text{ mol}^{-1}$)

- (A) 1.21×10^5 (B) 12.0×10^{16}
(C) 1.21×10^{20} (D) 3.4×10^{22}

Official Ans. by NTA (C)

Ans. (C)

Sol. No. of Fe atoms = $\frac{0.34}{100} \times \frac{3.3}{56} \times 6.022 \times 10^{23}$
= 1.206×10^{20}

2. Arrange the following in increasing order of their covalent character.

- (A) CaF_2 (B) CaCl_2
(C) CaBr_2 (D) CaI_2

Choose the correct answer from the options given below.

- (A) $B < A < C < D$ (B) $A < B < C < D$
(C) $A < B < D < C$ (D) $A < C < B < D$

Official Ans. by NTA (B)

Ans. (B)

Sol. According to Fajan's rule,

Covalent character \propto size of Anion

3. Class XII students were asked to prepare one litre of buffer solution of pH 8.26 by their chemistry teacher. The amount of ammonium chloride to be dissolved by the student in 0.2 M ammonia solution to make one litre of the buffer is (Given $\text{p}K_b(\text{NH}_3) = 4.74$; Molar mass of $\text{NH}_3 = 17 \text{ g mol}^{-1}$; Molar mass of $\text{NH}_4\text{Cl} = 53.5 \text{ g mol}^{-1}$)

- (A) 53.5 g (B) 72.3 g
(C) 107.0 g (D) 126.0 g

Official Ans. by NTA (C)

Ans. (C)

Sol. $\text{pOH} = 14 - 8.26$

$$= \text{p}K_b + \log \frac{[\text{NH}_4^+]}{[\text{NH}_3]}$$

$$= 5.74 = 4.74 + \log \frac{[\text{NH}_4^+]}{0.2} \Rightarrow [\text{NH}_4^+] = 2$$

Hence

$$\text{NH}_4\text{Cl} = 2 \times 53.5 = 107 \text{ g}$$

4. At 30°C, the half life for the decomposition of AB_2 is 200 s and is independent of the initial concentration of AB_2 . The time required for 80% of the AB_2 to decompose is (Given: $\log 2 = 0.30$; $\log 3 = 0.48$)

- (A) 200 s (B) 323 s
(C) 467 s (D) 532 s

Official Ans. by NTA (C)

Ans. (C)

Sol. $T_{1/2} = 200 \text{ s}$ and 1st order reaction

$$K = \frac{2.303 \log 2}{200} = \frac{2.303}{t} \log \frac{A_0}{0.2A_0}$$

$$\frac{\log 2}{200} = \frac{1}{t} \log 5$$

$$t = \frac{7}{3} \times 200 = 466.67 \text{ s} = 467 \text{ s}$$

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

Assertion A : Finest gold is red in colour, as the size of the particles increases, it appears purple then blue and finally gold.

Assertion R : The colour of the colloidal solution depends on the wavelength of light scattered by the dispersed particles.

In the light of the above statements, choose the most appropriate answer from the options given below;

- (A) Both A and R are true and R is the correct explanation of A
(B) Both A and R are true but R is NOT the correct explanation of A
(C) A is true but R is false
(D) A is false but R is true

Official Ans. by NTA (A)

Ans. (A)

6. The metal that has very low melting point and its periodic position is closer to a metalloid is :

- (A) Al (B) Ga
(C) Se (D) In

Official Ans. by NTA (B)

Ans. (B)

Sol.

	Melting point
Al →	933 K
Ga →	303 K
In →	430 K
Se →	490 K

7. The metal that is not extracted from its sulphide ore is :

- (A) Aluminium (B) Iron
(C) Lead (D) Zinc

Official Ans. by NTA (A)

Ans. (A)

Sol. Al is extracted from $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$ i.e., Bauxite ore

8. The products obtained from a reaction of hydrogen peroxide and acidified potassium permanganate are

- (A) Mn^{4+} , H_2O only (B) Mn^{2+} , H_2O only
(C) Mn^{4+} , H_2O , O_2 only (D) Mn^{2+} , H_2O , O_2 only

Official Ans. by NTA (D)

Allen Ans. (D)

Sol. $6\text{H}^+ + 2\text{MnO}_4^- + 5\text{H}_2\text{O}_2 \longrightarrow 2\text{Mn}^{2+} + 8\text{H}_2\text{O} + 5\text{O}_2$

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

Assertion A : LiF is sparingly soluble in water.

Reason R : The ionic radius of Li^+ ion is smallest among its group members, hence has least hydration enthalpy.

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

- (A) Both A and R are true and R is the correct explanation of A
(B) Both A and R are true but R is NOT the correct explanation of A
(C) A is true but R is false
(D) A is false but R is true

Official Ans. by NTA (C)

Ans. (C)

Sol. Due to high lattice energy LiF is sparingly soluble in water. Li^+ has high hydration energy among its group members due to smallest size.

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

Assertion A : Boric acid is a weak acid

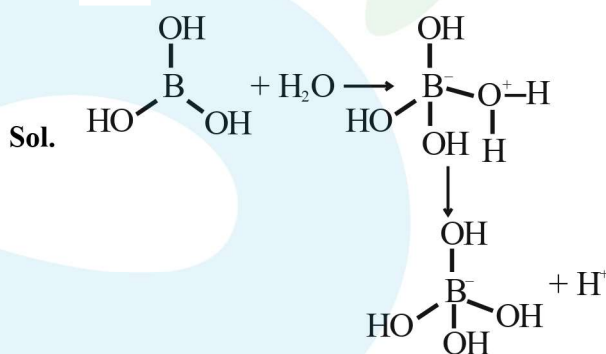
Reason R : Boric acid is not able to release H^+ ion on its own. It receives OH^- ion from water and releases H^+ ion.

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

- (A) Both A and R are correct and R is the correct explanation of A
(B) Both A and R are correct but R is NOT the correct explanation of A
(C) A is correct but R is not correct
(D) A is not correct but R is correct

Official Ans. by NTA (A)

Ans. (A)



11. The metal complex that is diamagnetic is (Atomic number : Fe, 26; Cu, 29)

- (A) $\text{K}_3[\text{Cu}(\text{CN})_4]$
(B) $\text{K}_2[\text{Cu}(\text{CN})_4]$
(C) $\text{K}_3[\text{Fe}(\text{CN})_4]$
(D) $\text{K}_4[\text{FeCl}_6]$

Official Ans. by NTA (A)

Allen Ans. (A)

Sol. $\text{K}_3[\text{Cu}(\text{CN})_4]$

O.N. of copper is Cu^{+1}

$\text{Cu}^{+1} = [\text{Ar}]3\text{d}^{10} \Rightarrow \text{Diamagnetic}$

12. Match List I with List II

List I Pollutant	List II Source
A. Microorganisms	I. Strip mining
B. Plant nutrients	II. Domestic sewage
C. Toxic heavy metals	III. Chemical fertilizer
D. Sediment	IV. Chemical factory

Choose the correct answer from the options given below :

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

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

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

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

Official Ans. by NTA (A)

Ans. (A)

Sol.

List I Pollutant	List II Source
A. Microorganisms	Domestic sewage
B. Plant nutrients	Chemical fertilizer
C. Toxic heavy metals	Chemical factory
D. Sediment	Strip mining

13. The correct decreasing order of priority of functional groups in naming an organic compound as per IUPAC system of nomenclature is :

(A) $-\text{COOH} > -\text{CONH}_2 > -\text{COCl} > -\text{CHO}$

(B) $-\text{SO}_3\text{H} > -\text{COCl} > -\text{CONH}_2 > -\text{CN}$

(C) $-\text{COOR} > -\text{COCl} > -\text{NH}_2 > >\text{C}=\text{o}$

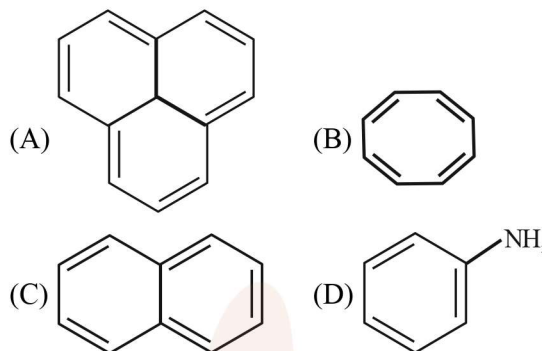
(D) $-\text{COOH} > -\text{COOR} > -\text{CONH}_2 > -\text{COCl}$

Official Ans. by NTA (B)

Ans. (B)

Sol. $-\text{SO}_3\text{H} > -\text{COCl} > -\text{CONH}_2 > -\text{CN}$

14. Which of the following is not an example of benzenoid compound ?



Official Ans. by NTA (B)

Allen Ans. (A & B)

15. Hydrolysis of which compound will give carbolic acid ?

(A) Cumene

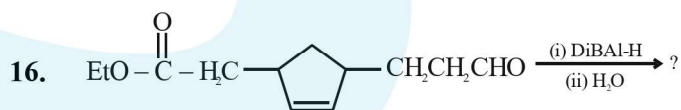
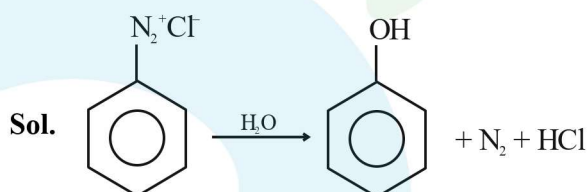
(B) Benzenediazonium chloride

(C) Benzal chloride

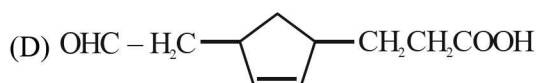
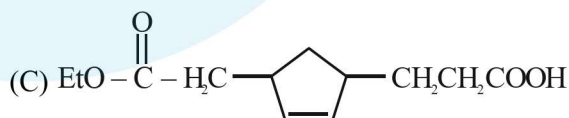
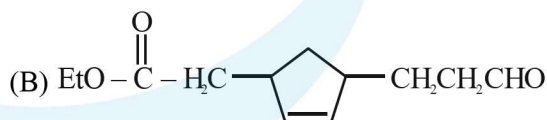
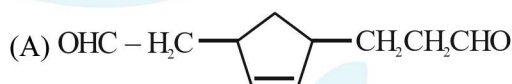
(D) Ethylene glycol ketal

Official Ans. by NTA (B)

Ans. (B)

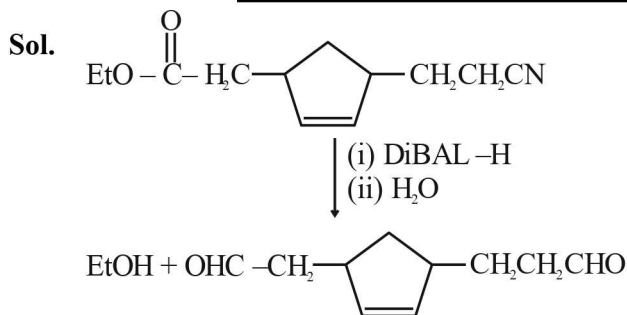


Consider the above reaction and predict the major product.

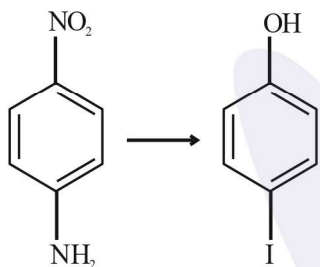


Official Ans. by NTA (A)

Ans. (A)



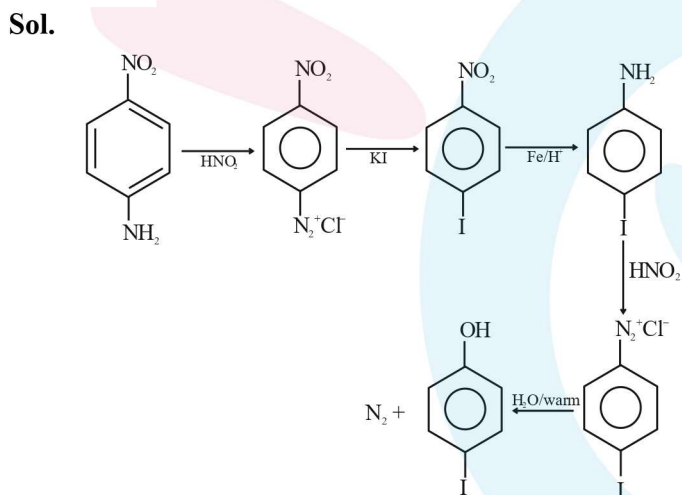
17. The correct sequential order of the reagents for the given reaction is :



- (A) HNO₂, Fe/H⁺, HNO₂, KI, H₂O/H⁺
 (B) HNO₂, KI, Fe/H⁺, HNO₂, H₂O/warm
 (C) HNO₂, KI, HNO₂, Fe/H⁺, H₂O/H⁺
 (D) HNO₂, Fe/H⁺, KI, HNO₂, H₂O/warm

Official Ans. by NTA (B)

Ans. (B)



18. Vulcanization of rubber is carried out by heating a mixture of :

- (A) isoprene and styrene
 (B) neoprene and sulphur
 (C) isoprene and sulphur
 (D) neoprene and styrene

Official Ans. by NTA (C)

Ans. (C)

Sol. Vulcanization of rubber is carried out by heating a mixture of isoprene & sulphur

19. Animal starch is the other name of :

- (A) amylose (B) maltose
 (C) glycogen (D) amylopectin

Official Ans. by NTA (C)

Ans. (C)

Sol. Glycogen

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

Assertion A : Phenolphthalein is a pH dependent indicator, remains colourless in acidic solution and gives pink colour in basic medium

Reason R : Phenolphthalein is a weak acid. It doesn't dissociate in basic medium.

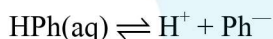
In the light of the above statements, choose the most appropriate answer from the options given below :

- (A) Both A and R are true and R is the correct explanation of A
 (B) Both A and R are true but R is NOT the correct explanation of A.
 (C) A is true but R is false
 (D) A is false but R is true

Official Ans. by NTA (C)

Ans. (D)

Sol. Phenolphthalein dissociate in basic medium



(colourless) (Pink)

SECTION-B

1. A 10 g mixture of hydrogen and helium is contained in a vessel of capacity 0.0125 m³ at 6 bar and 27°C. The mass of helium in the mixture is _____ g. (nearest integer)

Given : R = 8.3 JK⁻¹mol⁻¹ (Atomic masses of H and He are 1u and 4u, respectively)

Official Ans. by NTA (8)

Ans. (8)

Sol. PV = n_{mix}RT

$$n_{\text{mix}} = \frac{6 \times 12.5}{0.083 \times 300} \approx 3$$

Let mole of He = x

Mole of H₂ = 3 - x

$$4x + 2(3 - x) = 10$$

$$\boxed{x = 2\text{mol}}$$

Mass of He = 8g

2. Consider an imaginary ion ${}_{22}^{48}\text{X}^{3-}$. The nucleus contains 'a'% more neutrons than the number of electrons in the ion. The value of 'a' is _____. [nearest integer]

Official Ans. by NTA (4)

Ans. (4)

Sol. ${}_{22}^{48}\text{X}^{3-}$

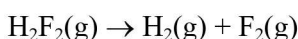
No. of neutrons = 26

No. of electrons = 25

% of extra neutrons

$$\text{than electrons} = \frac{26-25}{25} \times 100 = 4$$

3. For the reaction



$$\Delta U = -59.6 \text{ kJ mol}^{-1} \text{ at } 27^\circ\text{C}.$$

The enthalpy change for the above reaction is (-) ____ kJ mol⁻¹ [nearest integer] Given : R = 8.314 JK⁻¹ mol⁻¹.

Official Ans. by NTA (57)

Ans. (57)

Sol. $\Delta H = \Delta U + \Delta n_g RT$

$$\Delta H = -59.6 + 1 \times 8.314 \times 300 \times 10^{-3} = -57.10$$

4. The elevation in boiling point for 1 molal solution of non-volatile solute A is 3K. The depression in freezing point for 2 molal solution of A in the same solvent is 6 K. The ratio of K_b and K_f i.e., K_b/K_f is 1 : X. The value of X is [nearest integer]

Official Ans. by NTA (1)

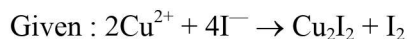
Ans. (1)

Sol. $\Delta T_b = iK_b m_1$ $\Delta T_f = iK_f m_2$

$$\frac{\Delta T_b}{\Delta T_f} = \frac{K_b \times 1}{K_f \times 2} \Rightarrow \frac{3}{6} = \frac{1}{2} = \frac{K_b}{K_f} \times \frac{1}{2}$$

$$\frac{K_b}{K_f} = \frac{1}{1} \Rightarrow x = 1$$

5. 20 mL of 0.02 M hypo solution is used for the titration of 10 mL of copper sulphate solution, in the presence of excess of KI using starch as an indicator. The molarity of Cu^{2+} is found to be ____ $\times 10^{-2}$ M [nearest integer]



Official Ans. by NTA (4)

Ans. (4)

Sol. n_{eq} of $\text{I}_2 = n_{\text{eq}}$ of $\text{Na}_2\text{S}_2\text{O}_3 = 20 \times 0.002 \times 1$

$$2 \times n_{\text{mol}} \text{ of } \text{I}_2 = 0.4$$

$$n_{\text{mol}} \text{ of } \text{I}_2 = 0.2 \text{ m mol}$$

$$n_{\text{mol}} \text{ of } \text{Cu}^{+2} = 0.2 \times 2 \times 10^{-3}$$

$$[\text{Cu}^{+2}] = \frac{0.4 \times 10^{-3}}{10 \times 10^{-3}} = 0.04 = 4 \times 10^{-2}$$

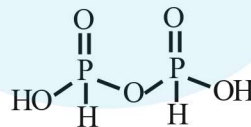
6. The number of non-ionisable protons present in the product B obtained from the following reaction is _____. $\text{C}_2\text{H}_5\text{OH} + \text{PCl}_3 \rightarrow \text{C}_2\text{H}_5\text{Cl} + \text{A}$



Official Ans. by NTA (2)

Ans. (2)

Sol. $\text{C}_2\text{H}_5\text{OH} + \text{PCl}_3 \rightarrow \text{C}_2\text{H}_5\text{Cl} + \text{H}_3\text{PO}_3$



7. The spin-only magnetic moment value of the compound with strongest oxidizing ability among MnF_4 , MnF_3 and MnF_2 is ____ B.M. [nearest integer]

Official Ans. by NTA (5)

Ans. (5)

Sol. $\begin{array}{ccc} \text{MnF}_4 & \text{MnF}_3 & \text{MnF}_2 \\ \swarrow +4 & \swarrow +3 & \swarrow +2 \\ \text{E.C} = [\text{Ar}]3d^3 & [\text{Ar}]3d^4 & [\text{Ar}]3d^5 \end{array}$

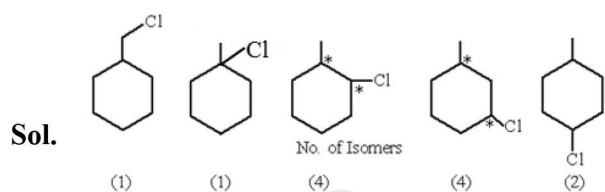
Hence $\text{MnF}_3 \Rightarrow$ strongest O.A

$$\mu = \sqrt{4(4+2)} = \sqrt{24} = 4.89 = 5$$

8. Total number of isomers (including stereoisomers) obtain on monochlorination of methylcyclohexane is _____.

Official Ans. by NTA (12)

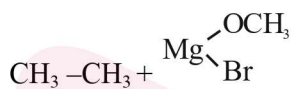
Ans. (12)



9. A 100 mL solution of $\text{CH}_3\text{CH}_2\text{MgBr}$ on treatment with methanol produces 2.24 mL of a gas at STP. The weight of gas produced is _____ mg. [nearest integer]

Official Ans. by NTA (3)

Ans. (3)



$$n = \frac{2.24 \times 10^{-3}}{22.4} = 10^{-4}$$

$$W = n \times M$$

$$= 10^{-4} \times 30 = 3 \text{ mg}$$

10. How many of the following drugs is/are example(s) of broad spectrum antibiotic ?
Ofloxacin, Penicillin G, Terpineol, Salvarsan

Official Ans. by NTA (1)

Ans. (1)

