

FINAL JEE–MAIN EXAMINATION – JULY, 2022

(Held On Monday 25th July, 2022)

TIME : 3 : 00 PM to 06 : 00 PM

CHEMISTRY

SECTION-A

1. Match List I with List II :

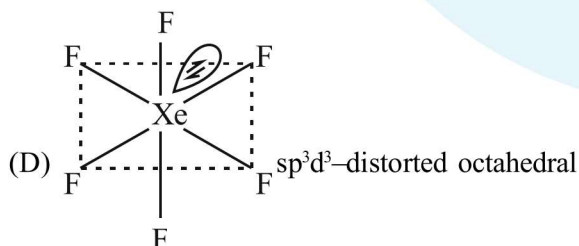
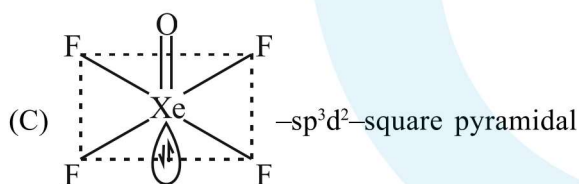
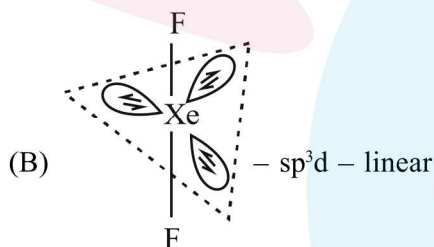
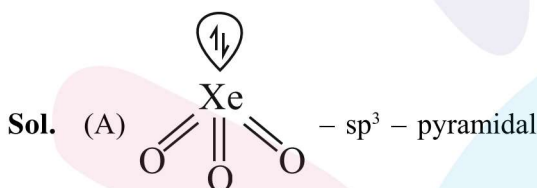
List-I (molecule)	List-II (hybridization; shape)
A. XeO ₃	I. sp ³ d ; linear
B. XeF ₂	II. sp ³ ; pyramidal
C. XeOF ₄	III. sp ³ d ³ ; distorted octahedral
D. XeF ₆	IV. sp ³ d ² ; square pyramidal

Choose the correct answer from the options given below:

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

Official Ans. by NTA (A)

Ans. (A)



TEST PAPER WITH SOLUTION

2. Two solutions A and B are prepared by dissolving 1 g of non-volatile solutes X and Y, respectively in 1 kg of water. The ratio of depression in freezing points for A and B is found to be 1 : 4. The ratio of molar masses of X and Y is :

- (A) 1 : 4
 (B) 1 : 0.25
 (C) 1 : 0.20
 (D) 1 : 5

Official Ans. by NTA (B)

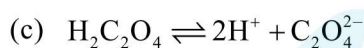
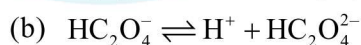
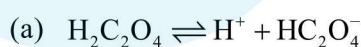
Ans. (B)

Sol.
$$\frac{\Delta T_{fx}}{\Delta T_{fy}} = \frac{k_f \cdot m_x}{k_f \cdot m_y} = \frac{\frac{1}{M_x}}{\frac{1}{M_y}}$$

$$\Rightarrow \frac{1}{4} = \frac{M_y}{M_x}$$

$$\Rightarrow M_x : M_y = 1 : 0.25$$

3. K_{a1}, K_{a2} and K_{a3} are the respective ionization constants for the following reactions (a), (b), and (c).

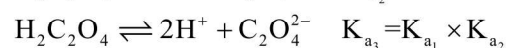
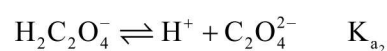
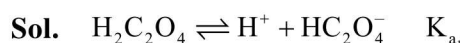


The relationship between K_{a1}, K_{a2} and K_{a3} is given as



Official Ans. by NTA (D)

Ans. (D)



4. The molar conductivity of a conductivity cell filled with 10 moles of 20 mL NaCl solution is Λ_{m1} and that of 20 moles another identical cell heaving 80 mL NaCl solution is Λ_{m2} , The conductivities exhibited by these two cells are same.

The relationship between Λ_{m2} and Λ_{m1} is

- (A) $\Lambda_{m2} = 2\Lambda_{m1}$ (B) $\Lambda_{m2} = \Lambda_{m1} / 2$
 (C) $\Lambda_{m2} = \Lambda_{m1}$ (D) $\Lambda_{m2} = 4\Lambda_{m1}$

Official Ans. by NTA (A)

Ans. (A)

Sol. $\Lambda_m = \kappa \times \frac{1000}{M}$

$\Rightarrow \Lambda_m \propto \frac{1}{M}$

$$\frac{\Lambda_{m1}}{\Lambda_{m2}} = \frac{M_2}{M_1} = \frac{80}{10} = \frac{1}{4} \times \frac{2}{1} = \frac{1}{2}$$

$\Rightarrow \Lambda_{m2} = 2\Lambda_{m1}$

5. For micelle formation, which of the following statements are correct?

- (A) Micelle formation is an exothermic process.
 (B) Micelle formation is an endothermic process.
 (C) The entropy change is positive.
 (D) The entropy change is negative.
 (A) A and D only (B) A and C only
 (C) B and C only (D) B and D only

Official Ans. by NTA (A)

Ans. (C)

- Sol.** For micelle formation, $\Delta S > 0$ (hydrophobic effect) This is possible because, the decrease in entropy due to clustering is offset by increase in entropy due to desolvation of the surfactant, Also $\Delta H > 0$

6. The first ionization enthalpies of Be, B, N and O follow the order

- (A) $O < N < B < Be$ (B) $Be < B < N < O$
 (C) $B < Be < N < O$ (D) $B < Be < O < N$

Official Ans. by NTA (D)

Ans. (D)

Sol. 1st I.E. $\frac{N}{(2p^3)} > \frac{O}{(2p^4)} > \frac{Be}{(2s^2)} > \frac{B}{(2p^1)}$

7. Given below are two statements.

Statement I : Pig iron is obtained by heating cast iron with scrap iron.

Statement II: Pig iron has a relatively lower carbon content than that of cast iron. In the light of the above statements, choose the correct answer from the options given below.

- (A) Both Statement I and Statement II are correct.
 (B) Both Statement I and Statement II are not correct.
 (C) Statement I is correct but Statement II is not correct
 (D) Statement I is not correct but Statement II is correct.

Official Ans. by NTA (B)

Ans. (B)

- Sol.** Statement –I is incorrect because cast iron is obtained by heating pig iron with scrap iron Statement–II is also incorrect because pig iron has more carbon content (~4%) than cast iron (~3%)

8. High purity (>99.95%) dihydrogen is obtained by
 (A) reaction of zinc with aqueous alkali.
 (B) electrolysis of acidified water using platinum electrodes.
 (C) electrolysis of warm aqueous barium hydroxide solution between nickel electrodes.
 (D) reaction of zinc with dilute acid.

Official Ans. by NTA (C)

Ans. (C)

- Sol.** High purity (>99.95%) dihydrogen is obtained by electrolysis of warm aqueous $Ba(OH)_2$ solution between Ni-electrodes

9. The correct order of density is

- (A) $Be > Mg > Ca > Sr$
 (B) $Sr > Ca > Mg > Be$
 (C) $Sr > Be > Mg > Ca$
 (D) $Be > Sr > Mg > Ca$

Official Ans. by NTA (C)

Ans. (C)

- Sol.** In II'A' group density decreases down the group till Ca and after that it increases.

Correct order of density is
 $Sr > Be > Mg > Ca$

10. The total number of acidic oxides from the following list is: NO, N₂O, B₂O₃, N₂O₅, CO, SO₃, P₄O₁₀

- (A) 3 (B) 4
(C) 5 (D) 6

Official Ans. by NTA (B)

Ans. (B)

Sol. Neutral Oxides — N₂O, NO, CO

Acidic Oxides — B₂O₃, N₂O₅, SO₃, P₄O₁₀

11. The correct order of energy of absorption for the following metal complexes is

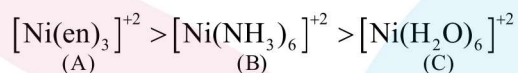
A: [Ni(en)₃]²⁺, B: [Ni(NH₃)₆]²⁺, C: [Ni(H₂O)₆]²⁺

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

Official Ans. by NTA (A)

Ans. (A)

Sol. Stronger the ligand, larger the splitting & higher the energy of absorption.



12. Match List I with List II.

List-I		List-II	
A.	Sulphate	I.	Pesticide
B.	Fluoride	II.	Bending of bones
C.	Nicotine	III.	Laxative effect
D.	Sodium arsinite	IV.	Herbicide

Choose the correct answer from the options given below:

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

Official Ans. by NTA (C)

Ans. (C)

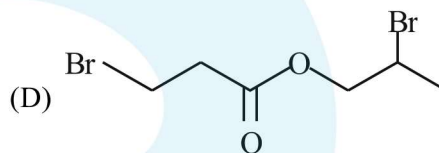
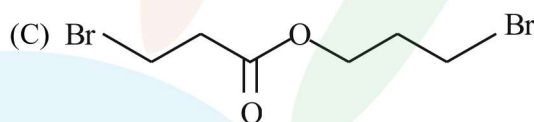
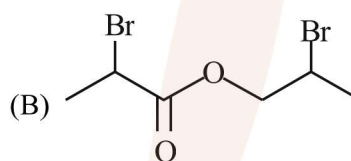
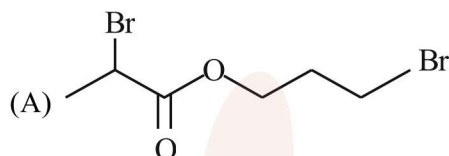
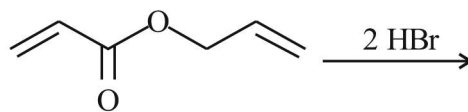
Sol. A-Sulphate – III (Laxative effect)

B-Fluoride – II (Bending of bones)

C-Nicotine – I (pesticides)

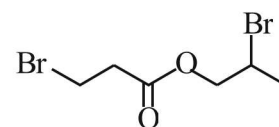
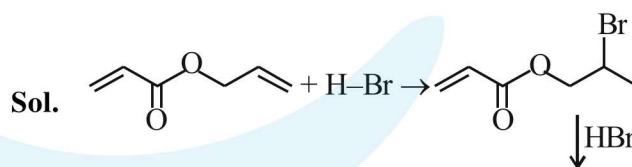
D-Sodium Arsinite – IV (herbicide)

13. Major product of the following reaction is

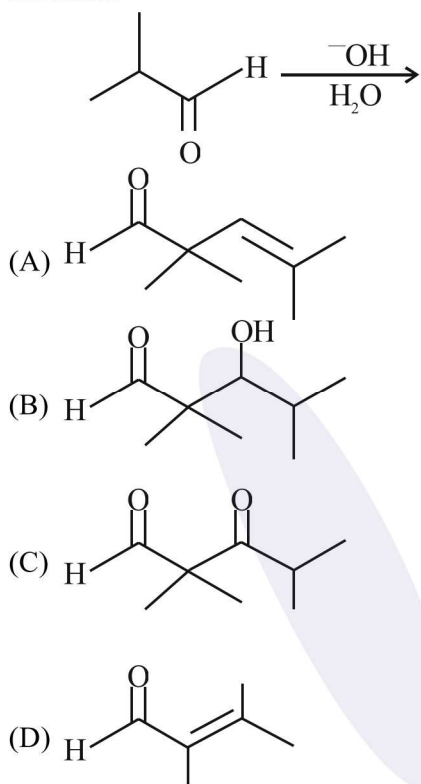


Official Ans. by NTA (D)

Ans. (D)

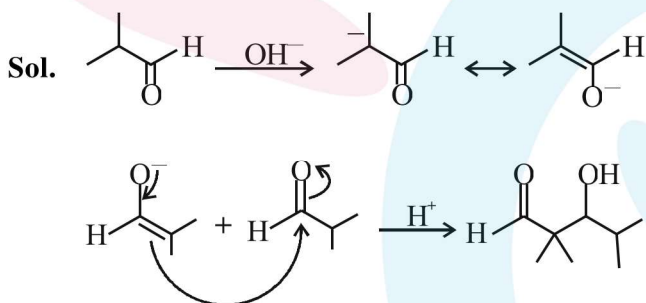


14. What is the major product of the following reaction?



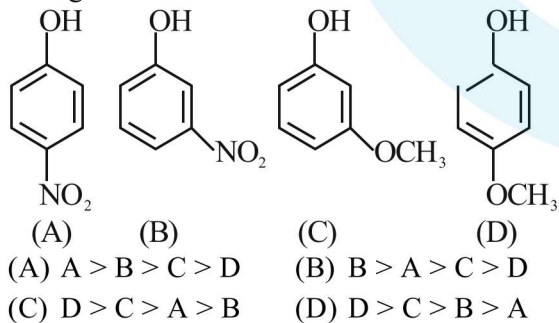
Official Ans. by NTA (B)

Ans. (B)



Aldol formation takes place.

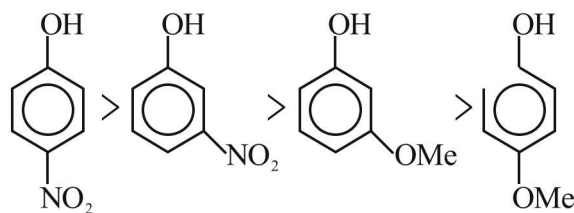
15. Arrange the following in decreasing acidic strength.



Official Ans. by NTA (A)

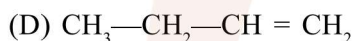
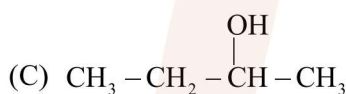
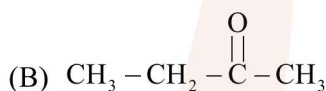
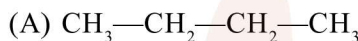
Ans. (A)

Sol. The correct order of acid strength is



16. $\text{CH}_3-\text{CH}_2-\text{CN} \xrightarrow[\text{Ether}]{\text{CH}_3\text{MgBr}} \text{A} \xrightarrow{\text{H}_3\text{O}^+} \text{B} \xrightarrow[\text{HCl}]{\text{Zn-Hg}} \text{C}$

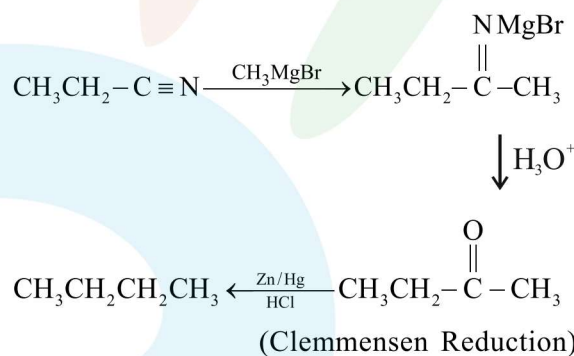
The correct structure of C is



Official Ans. by NTA (A)

Ans. (A)

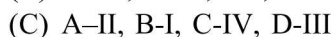
Sol.



17. Match List I with List II :

List-I Polymer	List-II used for items
A. Nylon 6,6	I. Buckets
B. Low density polythene	II. Non-stick utensils
C. High density polythene	III. Bristles of brushes
D. Teflon	IV. Toys

Choose the correct answer from the options given below:



Official Ans. by NTA (B)

Ans. (B)

Sol. LDPE → Toys

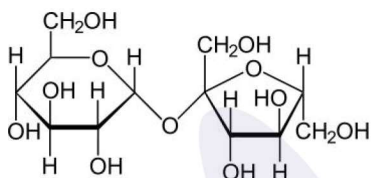
HDPE → Buckets (As per NCERT)

18. Glycosidic linkage between C_1 of α -glucose and C_2 of β -fructose is found in
 (A) maltose (B) sucrose
 (C) lactose (D) amylose

Official Ans. by NTA (B)

Ans. (B)

Sol. Theoretical



19. Some drugs bind to a site other than, the active site of an enzyme. This site is known as
 (A) non-active site (B) allosteric site
 (C) competitive site (D) therapeutic site

Official Ans. by NTA (B)

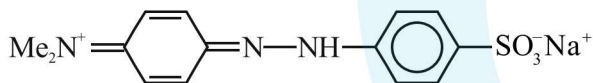
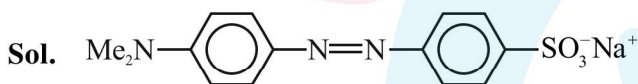
Ans. (B)

Sol. Theoretical

20. In base vs. Acid titration, at the end point methyl orange is present as
 (A) quinonoid form (B) heterocyclic form
 (C) phenolic form (D) benzenoid form

Official Ans. by NTA (A)

Ans. (A)



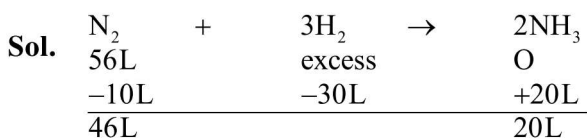
(QUINONOID FORM)

SECTION-B

1. 56.0 L of nitrogen gas is mixed with excess of hydrogen gas and it is found that 20 L of ammonia gas is produced. The volume of unused nitrogen gas is found to be ____ L.

Official Ans. by NTA (46)

Ans. (46)



2. A sealed flask with a capacity of 2 dm^3 contains 11 g of propane gas. The flask is so weak that it will burst if the pressure becomes 2 MPa. The minimum temperature at which the flask will burst is ____ $^\circ\text{C}$. [Nearest integer]
 (Given: $R = 8.3 \text{ J K}^{-1} \text{ mol}^{-1}$. Atomic masses of C and H are 12u and 1u respectively.) (Assume that propane behaves as an ideal gas.)

Official Ans. by NTA (1655)

Ans. (1655)

- Sol. Moles of $C_3H_8 = \frac{11}{44} = 0.25$ moles

$$PV = nRT$$

$$\Rightarrow 2 \times 10^6 \times 2 \times 10^{-3} = 0.25 \times 8.3 \times T$$

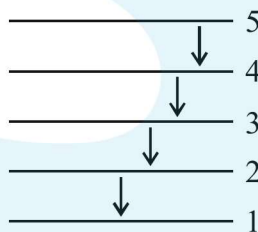
$$\Rightarrow T = 1927.710 \text{ K} = 1654.56^\circ\text{C}$$

3. When the excited electron of a H atom from $n = 5$ drops to the ground state, the maximum number of emission lines observed are ____

Official Ans. by NTA (10)

Ans. (4)

- Sol. Since only a single H atom is present, maximum number of spectral lines = 4



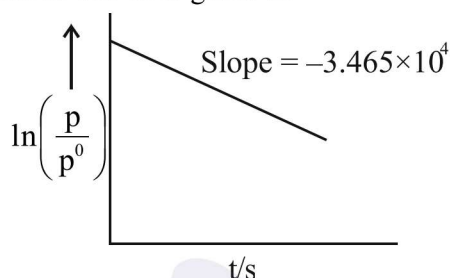
4. While performing a thermodynamics experiment, a student made the following observations,
 $HCl + NaOH \rightarrow NaCl + H_2O \Delta H = -57.3 \text{ kJ mol}^{-1}$
 $CH_3COOH + NaOH \rightarrow CH_3COONa + H_2O \Delta H = -55.3 \text{ kJ mol}^{-1}$
 The enthalpy of ionization of CH_3COOH as calculated by the student is ____ kJ mol^{-1} . (nearest integer)

Official Ans. by NTA (2)

Ans. (2)

- Sol. $\Delta H_{\text{ionisation}}$ of $CH_3COOH = |-57.3 - (-55.3)|$
 $= 2 \text{ KJ/mol}$

5. For the decomposition of azomethane.
 $\text{CH}_3\text{N}_2\text{CH}_3(\text{g}) \rightarrow \text{CH}_3\text{CH}_3(\text{g}) + \text{N}_2(\text{g})$ a first order reaction, the variation in partial pressure with time at 600 K is given as



The half life of the reaction is _____ $\times 10^{-5}$ s.
 [Nearest integer]

Official Ans. by NTA (2)

Ans. (2)

Sol. For first order reaction

$$k = \frac{1}{t} \ln \left(\frac{P_0}{P} \right)$$

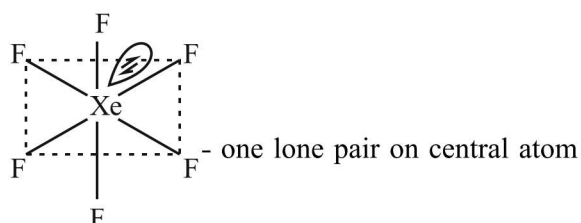
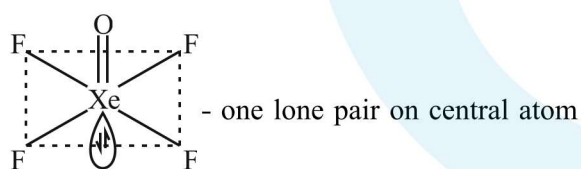
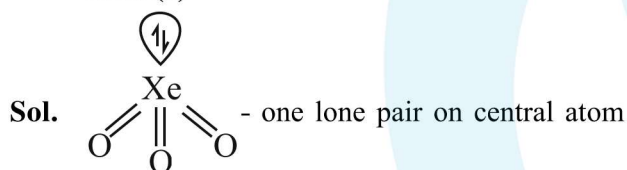
$$\ln \left(\frac{P_0}{P} \right) = kt$$

$$t_{1/2} = \frac{\ln 2}{k} = \frac{0.693}{3.465 \times 10^4} = 2 \times 10^{-5}$$

6. The sum of number of lone pairs of electrons present on the central atoms of XeO_3 , XeOF_4 and XeF_6 is _____

Official Ans. by NTA (3)

Ans. (3)



7. The spin-only magnetic moment value of M^{3+} ion (in gaseous state) from the pairs $\text{Cr}^{3+}/\text{Cr}^{2+}$, $\text{Mn}^{3+}/\text{Mn}^{2+}$, $\text{Fe}^{3+}/\text{Fe}^{2+}$ and $\text{Co}^{3+}/\text{Co}^{2+}$ that has negative standard electrode potential, is B.M.

[Nearest integer]

Official Ans. by NTA (4)

Ans. (4)

Sol. $E_{\text{Cr}^{3+}}^0 |_{\text{Cr}^{2+}} = -0.41\text{V}$

$$[\text{Cr}^{+3}] = 4s^0 3d^3$$

$$\mu = \sqrt{n(n+2)} \text{ B.M}$$

$$= \sqrt{15} \text{ B.M} \sim 4 \text{ B.M}$$

8. A sample of 4.5 mg of an unknown monohydric alcohol, R-OH was added to methylmagnesium iodide. A gas is evolved and is collected and its volume measured to be 3.1 mL. The molecular weight of the unknown alcohol is _____ g/mol.
 [Nearest integer]

Official Ans. by NTA (33)

Ans. (33)



moles of CH_4 = moles of ROH

$$\Rightarrow \frac{V}{22400} = \frac{m}{\text{M.M}} \quad (\text{Assuming NTP Condition})$$

$$\Rightarrow \frac{3.1}{22400} = \frac{4.5 \times 10^{-3}}{\text{M.M}}$$

$$\Rightarrow \text{M.M} = 32.51$$

Nearest Integer = 33

9. The separation of two coloured substances was done by paper chromatography. The distances travelled by solvent front, substance A and substance B from the base line are 3.25 cm, 2.08 cm and 1.05 cm, respectively. The ratio of R_f values of A to B is _____

Official Ans. by NTA (2)

Ans. (2)

Sol.
$$\frac{R_{f_A}}{R_{f_B}} = \frac{\frac{2.08}{3.25}}{\frac{1.05}{3.25}} = \frac{2.08}{1.05} \approx 2$$

10. The total number of monobromo derivatives formed by the alkanes with molecular formula C_5H_{12} is (excluding stereo isomers) _____

Official Ans. by NTA (8)

Ans. (8)

Sol. The Alkanes and their monobromoderivative are

