1. With respect to drug-enzyme interaction, identify the wrong statement:
   (1) Non-Competitive inhibitor binds to the allosteric site
   (2) Allosteric inhibitor changes the enzyme's active site
   (3) Allosteric inhibitor competes with the enzyme's active site
   (4) Competitive inhibitor binds to the enzyme's active site
   **Official Ans. by NTA (3)**

2. Which of the following is an aromatic compound?
   (1) ![Image of aromatic compound]
   (2) ![Image of aromatic compound]
   (3) ![Image of aromatic compound]
   (4) ![Image of aromatic compound]
   **Official Ans. by NTA (1)**

3. \[\text{OCC}_2\text{H}_4\text{OC}_2\text{H}_5 + \text{Ethylene Glycol} \rightarrow \text{A} \text{ (Major Product)}\]
   The product "A" in the above reaction is:
   (1) ![Image of product A]
   (2) ![Image of product A]
   (3) ![Image of product A]
   (4) ![Image of product A]
   **Official Ans. by NTA (2)**

4. A central atom in a molecule has two lone pairs of electrons and forms three single bonds. The shape of this molecule is:
   (1) see-saw
   (2) planar triangular
   (3) T-shaped
   (4) trigonal pyramidal
   **Official Ans. by NTA (3)**

5. Given below are two statements:
   Statement I : Potassium permanganate on heating at 573 K forms potassium manganate.
   Statement II : Both potassium permanganate and potassium manganate are tetrahedral and paramagnetic in nature.
   In the light of the above statements, choose the most appropriate answer from the options given below:
   (1) Statement I is true but statement II is false
   (2) Both statement I and statement II are true
   (3) Statement I is false but statement II is true
   (4) Both statement I and statement II are false
   **Official Ans. by NTA (1)**

6. Which of the following is correct structure of tyrosine?
   (1) ![Image of tyrosine structure 1]
   (2) ![Image of tyrosine structure 2]
   (3) ![Image of tyrosine structure 3]
   (4) ![Image of tyrosine structure 4]
   **Official Ans. by NTA (4)**
7. \[ \text{Cl} + \text{NaOH} \rightarrow \text{O}^−\text{Na}^+ \]

The above reaction requires which of the following reaction conditions?
1. 573 K, Cu, 300 atm
2. 623 K, Cu, 300 atm
3. 573 K, 300 atm
4. 623 K, 300 atm

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

8. The absolute value of the electron gain enthalpy of halogens satisfies:
1. I > Br > Cl > F
2. Cl > Br > F > I
3. Cl > F > Br > I
4. F > Cl > Br > I

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

9. Which of the following compound CANNOT act as a Lewis base?
1. NF₃
2. PCl₅
3. SF₄
4. ClF₃

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

10. Reducing smog is a mixture of:
1. Smoke, fog and O₃
2. Smoke, fog and SO₂
3. Smoke, fog and CH₂=CH–CHO
4. Smoke, fog and N₂O₃

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

11. Hoffmann bromide degradation of benzamide gives product A, which upon heating with CHCl₃ and NaOH gives product B. The structures of A and B are:

- A
  - NH₂
  - Br

- B
  - NH₂
  - CHO

- A
  - NH₂
  - Br

- B
  - NH₂
  - NC

- A
  - NH₂
  - Br

- B
  - NH₂
  - CHO

- A
  - O
  - NH₂

- B
  - O
  - NH₂

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

12. Mesityl oxide is a common name of:
1. 2,4-Dimethyl pentan-3-one
2. 3-Methyl cyclohexane carbaldehyde
3. 2-Methyl cyclohexanone
4. 4-Methyl pent-3-en-2-one

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

13. Which of the following reaction is an example of ammonolysis?
1. \[ \text{C}_6\text{H}_5\text{COCl} + \text{C}_6\text{H}_5\text{NH}_2 \rightarrow \text{C}_6\text{H}_5\text{CONHC}_6\text{H}_5 \]
2. \[ \text{C}_6\text{H}_5\text{CH}_2\text{CN} \rightarrow \text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{NH}_2 \]
3. \[ \text{C}_6\text{H}_5\text{NH}_2 \rightarrow \text{C}_6\text{H}_5\text{NH}_3\text{Cl}^- \]
4. \[ \text{C}_6\text{H}_5\text{CH}_2\text{Cl} + \text{NH}_3 \rightarrow \text{C}_6\text{H}_5\text{CH}_2\text{NH}_2 \]

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

14. \[ \text{CH}_3 \text{Br} \stackrel{\text{CCl}_4}{\rightarrow} \text{A} \] (Major product)

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

15. A colloidal system consisting of a gas dispersed in a solid is called a/an:
1. solid sol
2. gel
3. aerosol
4. foam

**Official Ans. by NTA (1)**
16. The INCORRECT statement(s) about heavy water is (are)
(A) used as a moderator in nuclear reactor
(B) obtained as a by-product in fertilizer industry.
(C) used for the study of reaction mechanism
(D) has a higher dielectric constant than water
Choose the correct answer from the options given below:
(1) (B) only (2) (C) only
(3) (D) only (4) (B) and (D) only
Official Ans. by NTA (3)

17. The correct order of conductivity of ions in water is:
(1) Na⁺ > K⁺ > Rb⁺ > Cs⁺
(2) Cs⁺ > Rb⁺ > K⁺ > Na⁺
(3) K⁺ > Na⁺ > Cs⁺ > Rb⁺
(4) Rb⁺ > Na⁺ > K⁺ > Li⁺
Official Ans. by NTA (2)

18. What is the spin-only magnetic moment value (BM) of a divalent metal ion with atomic number 25, in its aqueous solution?
(1) 5.92
(2) 5.0
(3) zero
(4) 5.26
Official Ans. by NTA (1)

19. Given below are two statements:
Statement-I : Retardation factor (Rₚ) can be measured in meter/centimeter.
Statement-II : Rₚ value of a compound remains constant in all solvents.
Choose the most appropriate answer from the options given below:
(1) Statement-I is true but statement-II is false
(2) Both statement-I and statement-II are true
(3) Both statement-I and statement-II are false
(4) Statement-I is false but statement-II is true
Official Ans. by NTA (3)

20. The point of intersection and sudden increase in the slope, in the diagram given below, respectively, indicates:

![Diagram](attached)

(1) ΔG = 0 and melting or boiling point of the metal oxide
(2) ΔG > 0 and decomposition of the metal oxide
(3) ΔG < 0 and decomposition of the metal oxide
(4) ΔG = 0 and reduction of the metal oxide
Official Ans. by NTA (1)

Official Ans. by ALLEN (Bonus)

SECTION-B

1. The reaction of white phosphorus on boiling with alkali in inert atmosphere resulted in the formation of product 'A'. The reaction 1 mol of 'A' with excess of AgNO₃ in aqueous medium gives ______ mol(s) of Ag. (Round off to the Nearest Integer).

2. 0.01 moles of a weak acid HA(Kₐ = 2.0 × 10⁻⁶) is dissolved in 1.0 L of 0.1 M HCl solution. The degree of dissociation of HA is ______ × 10⁻⁵ (Round off to the Nearest Integer).

[Neglect volume change on adding HA.
Assume degree of dissociation <<1]

Official Ans. by NTA (2)
3. A certain orbital has \( n = 4 \) and \( m_L = -3 \). The number of radial nodes in this orbital is _______. (Round off to the Nearest Integer).

**Official Ans. by NTA (0)**

4. ![Chemical Reaction](image)

In the above reaction, 3.9 g of benzene on nitration gives 4.92 g of nitrobenzene. The percentage yield of nitrobenzene in the above reaction is ______ %. (Round off to the Nearest Integer).

(Given atomic mass: C: 12.0 u, H: 1.0 u, O: 16.0 u, N: 14.0 u)

**Official Ans. by NTA (80)**

5. The mole fraction of a solute in a 100 molal aqueous solution ______ × 10\(^{-2}\). (Round off to the Nearest Integer).

([Given: Atomic masses: H: 1.0 u, O: 16.0 u])

**Official Ans. by NTA (64)**

6. For a certain first order reaction 32% of the reactant is left after 570 s. The rate constant of this reaction is ______ × 10\(^{-3}\) s\(^{-1}\). (Round off to the Nearest Integer).

([Given: \( \log_{10}2 = 0.301 \), \( \ln 10 = 2.303 \)])

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

7. The standard enthalpies of formation of \( \text{Al}_2\text{O}_3 \) and \( \text{CaO} \) are \(-1675\) kJ mol\(^{-1}\) and \(-635\) kJ mol\(^{-1}\) respectively.

For the reaction

\[
3\text{CaO} + 2\text{Al} \rightarrow 3\text{Ca} + \text{Al}_2\text{O}_3
\]

the standard reaction enthalpy \( \Delta H^0 \) is ______ kJ. (Round off to the Nearest Integer).

**Official Ans. by NTA (230)**

8. 15 mL of aqueous solution of \( \text{Fe}^{2+} \) in acidic medium completely reacted with 20 mL of 0.03 M aqueous \( \text{Cr}_2\text{O}_7^{2-} \). The molarity of the \( \text{Fe}^{2+} \) solution is ______ × 10\(^{-2}\) M (Round off to the Nearest Integer).

**Official Ans. by NTA (24)**

9. The oxygen dissolved in water exerts a partial pressure of 20 kPa in the vapour above water. The molar solubility of oxygen in water is ______ × 10\(^{-5}\) mol dm\(^{-3}\).

(Round off to the Nearest Integer).

([Given: Henry’s law constant

\( K_H = 8.0 \times 10^4 \) kPa for \( \text{O}_2 \).

Density of water with dissolved oxygen = 1.0 kg dm\(^{-3}\)]

**Official Ans. by NTA (25)**

**Official Ans. by ALLEN (1389)**

10. The pressure exerted by a non-reactive gaseous mixture of 6.4 g of methane and 8.8 g of carbon dioxide in a 10 L vessel at 27°C is ______ kPa.

(Round off to the Nearest Integer).

([Assume gases are ideal, R = 8.314 J mol\(^{-1}\) K\(^{-1}\). Atomic masses: C: 12.0 u, H: 1.0 u, O: 16.0 u]]

**Official Ans. by NTA (150)**