3.

JEE-MAIN EXAM JANUARY, 2025

Date: - 24-01-2025 (SHIFT-1)

CHEMISTRY

SECTION-A

1. Aman has been asked to synthesise the molecule $\int_{c}^{ll} -c$

- $_{\mathrm{CH}_3}$ (x). He thought of preparing the

molecule using an aldol condensation reaction. He found a few cyclic alkenes in his laboratory. He thought of performing ozonolysis reaction on alkene to produce a dicarbonyl compound followed by aldol reaction to prepare "x". Predict the suitable alkene that can lead to the formation of "x".



2. For a reaction, $N_2O_{5(g)} \rightarrow 2NO_{2(g)} + \frac{1}{2}O_{2(g)}$ in a constant volume container, no products were present

initially. The final pressure of the system when 50% of reaction gets completed is

- (1) 5/2 times of initial pressure (2) 5 times of initial pressure
 - (4) 7/4 tim<mark>es</mark> of initia<mark>l pressure</mark>
- Which of the following statements are NOT true about the periodic table?
 - A. The properties of elements are function of atomic weights.

(3) 7/2 times of initial pressure

- B. The properties of elements are function of atomic numbers.
- C. Elements having similar outer electronic configurations are arranged in same period.
- D. An element's location reflects the quantum numbers of the last filled orbital.
- E. The number of elements in a period is same as the number of atomic orbitals available in energy level that is being filled.

Choose the correct answer from the options given below:

(1) A, C and E Only (2) A and E Only (3) B, C and E Only (4) D and E Only

- 4. Which of the following statement is true with respect to H_2O, NH_3 and CH_4 ?
 - A. The central atoms of all the molecules are sp^3 hybridized.
 - B. The H-O-H,H-N-H and H-C-H angles in the above molecules are 104.5°,107.5° and 109.5°, respectively.
 - C. The increasing order of dipole moment is $CH_4 < NH_3 < H_2O$.
 - D. Both H_2O and NH_3 are Lewis acids and CH_4 is a Lewis base.
 - E. A solution of NH_3 in H_2O is basic. In this solution NH_3 and H_2O act as Lowry-Bronsted acid and base respectively.

Choose the correct answer from the options given below:

(1) C, D and E Only (2) A, B, C and E Only (3) A, B and C Only (4) A, D and E Only



CHEMISTRY

- 5. Which of the following linear combination of atomic orbitals will lead to formation of molecular orbitals in homonuclear diatomic molecules [internuclear axis in z-direction]?
 - C. $3d_{xy}$ and $3d_{x^2-y^2}$ D. 2 s and $2p_z$ A. $2p_z$ and $2p_x$ B. 2 s and $2p_x$ E. $2p_z$ and $3d_x^2 - y^2$

Choose the correct answer from the options given below:

- (1) E Only (2) C and D Only (3) D Only (4) A and B Only
- Consider the given plots of vapour pressure (VP) vs temperature (T/K). Which amongst the following 6. options is correct graphical representation showing $\Delta T_{\rm f}$, depression in the freezing point of a solvent in a solution?



Which one of the carbocations from the following is most stable? 7.

- (1)- 0 - CH₃ (3)CH₂
- 8. Let us consider an endothermic reaction which is non-spontaneous at the freezing point of water. However, the reaction is spontaneous at boiling point of water. Choose the correct option.
 - (1) Both ΔH and ΔS are (-ve)
- (2) ΔH is (-ve) but ΔS is (+ve)

CH3

(3) Both ΔH and ΔS are (+ve)

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- (4) ΔH is (+ve) but ΔS is (-ve)
- 9. The product (1) formed in the following reaction sequence is

$$CH_{3}-C \equiv CH \xrightarrow{i) Hg^{2^{+}}, H_{2}SO_{4}}_{iii) HCN} (A)$$
Product
$$OH \qquad VH_{2}$$

$$(1) CH_{3}-CH_{2}-CH-CH_{2}-NH_{2}$$

$$(2) CH_{3}-C-CH_{2}-OH \qquad CH_{3}$$

$$(3) CH_{3}-CH_{2}-CH-CH_{2}-OH \qquad (4) CH_{3}-C-CH_{2}-NH_{2}$$

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10. For the given cell $\operatorname{Fe}^{2+}_{(aq)} + \operatorname{Ag}^{+}_{(aq)} \rightarrow \operatorname{Fe}^{3+}_{(aq)} + \operatorname{Ag}_{(s)}$ The standard cell potential of the above reaction is Given: $Ag^+ + e^- \rightarrow Ag$ $E^\theta = xV$ $Fe^{2+} + 2e^- \rightarrow Fe \qquad E^{\theta} = yV$ $Fe^{3+} + 3e^- \rightarrow Fe \qquad E^{\theta} = zV$ (1) x + 2y(2) x + 2y - 3z(3) x + y - z (4) y - 2x 11. Which of the following ions is the strongest oxidizing agent? (Atomic Number of Ce = 58, Eu = 63, Tb = 65, Lu = 71) (1) Eu^{2+} (3) Tb⁴⁺ (2) Ce^{3+} (4) Lu^{3+} 12. The carbohydrate "Ribose" present in DNA, is A. A pentose sugar B. present in pyranose from C. in "D" configuration D. a reducing sugar, when free E. in ∞ -anomeric form Choose the correct answer from the options given below: (1) B, D and E Only (2) A, D and E Only (3) A, B and E Only (4) A, C and D Only One mole of the octahedral complex compound $Co(NH_3)$, Cl_3 gives 3 moles of ions on dissolution in 13. water. One mole of the same complex reacts with excess of AgNO₃ solution to yield two moles of $AgCl_{(s)}$. The structure of the complex is: (1) $\left[\operatorname{Co}(\operatorname{NH}_3)_5 \operatorname{Cl} \right] \operatorname{Cl}_2$ (2) $\left[\operatorname{Co}(\operatorname{NH}_3)_4\operatorname{Cl}\right]\cdot\operatorname{Cl}_2\cdot\operatorname{NH}_3$ (3) $\left[\operatorname{Co}(\operatorname{NH}_3)_4\operatorname{Cl}_2\right]\cdot\operatorname{Cl}\cdot\operatorname{NH}_3$ (4) $\left[\operatorname{Co}(\mathrm{NH}_3), \mathrm{Cl}_3 \right] \cdot 2\mathrm{NH}_3$ 14. Given below are two statements: Statement-I: The conversion proceeds well in the less polar medium. $CH_3 - CH_2 - CH_2 - CH_2 - CI \xrightarrow{HO^-} CH_3 - CH_2 - CH_2 - CH_2 - OH + Cl^{(-)}$ Statement-II: The conversion proceeds well in the more polar medium.

$$CH_{3} - CH_{2} - CH_{2} - CH_{2} - CH_{2} - CI \xrightarrow{R_{3} \ddot{N}} CH_{3} - CH_{2} - CH_{2} - CH_{2} - CH_{2} - N_{1} \prod_{R}^{\ddot{I}} (+) R Cl^{(-)}$$

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 true
- (3) Both Statement I and Statement II are false (4) Statement I is false but Statement II is true



15. Which of the following arrangements with respect to their reactivity in nucleophilic addition reaction is correct?

- (1) acetophenone < p-tolualdehyde < benzaldehyde < p-nitrobenzaldehyde
- (2) benzaldehyde < acetophenone < p-nitrobenzaldehyde < p-tolualdehyde
- (3) acetophenone < benzaldehyde < p-tolualdehyde < p-nitrobenzaldehyde
- (4) p-nitrobenzaldehyde < benzaldehyde < p-tolualdehyde < acetophenone
- **16.** Given below are two statements I and II.

Statement-I: Dumas method is used for estimation of "Nitrogen" in an organic compound.

Statement-II : Dumas method involves the formation of ammonium sulphate by heating the organic compound with conc H_2SO_4 .

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

- (1) Both Statement I and Statement II are true
- (2) Statement I is false but Statement II is true
- (3) Both Statement I and Statement II are false
- (4) Statement I is true but Statement II is false
- **17.** The large difference between the melting and boiling points of oxygen and sulphur may be explained on the basis of

(1) Atomicity (2) Electronegativity (3) Electron gain enthalpy (4) Atomic size

18. Following are the four molecules "P", "Q", "R" and "S".

Which one among the four molecules will react with $H - Br_{(aq)}$ at the fastest rate?



19. K_{sp} for $Cr(OH)_3$ is 1.6×10^{-30} . What is the molar solubility of this salt in water?

(1)
$$\sqrt[5]{1.8 \times 10^{-30}}$$

(2) $\sqrt[2]{1.6 \times 10^{-30}}$
(3) $\sqrt[4]{\frac{1.6 \times 10^{-30}}{27}}$
(4) $\frac{1.8 \times 10^{-30}}{27}$

20. Preparation of potassium permanganate from MnO_2 involves two step process in which the 1st step is a reaction with KOH and KNO, to produce

a reaction with KOH and $\ensuremath{\,K\!NO_3}$ to produce

(1) K_2MnO_4 (2) K_3MnO_4 (3) $K_4[Mn(OH)_6]$ (4) $KMnO_4$



SECTION-B

21. Standard entropies of X_2, Y_2 and XY_5 are 70, 50 and 110 J K⁻¹ mol⁻¹ respectively. The temperature in Kelvin at which the reaction $\frac{1}{2}X_2 + \frac{5}{2}Y_2 \rightleftharpoons XY_5 \Delta H^{\Theta} = -35 \text{ kJ mol}^{-1}$ will be at equilibrium is ______(Nearest integer).

(Nearest integer)

22. Consider the following reaction occurring in the blast furnace:

 $Fe_3O_{4(s)} + 4CO_{(g)} \rightarrow 3Fe_{(1)} + 4CO_{2(g)}$

'x' kg of iron is produced when $2.32 \times 10^3 \text{ kgFe}_3 O_4$ and $2.8 \times 10^2 \text{ kgCO}$ are brought together in the furnace. The value of 'x' is______. (nearest integer)

{Given:

molar mass of $Fe_3O_4 = 232 \text{ g mol}^{-1}$

molar mass of $CO = 28 g mol^{-1}$

molar mass of $Fe = 56 g \text{ mol}^{-1}$ }

23. Among the following cations, the number of cations which will give characteristic precipitate in their identification tests with K_4 [Fe(CN)₆] is _____.

Cu²⁺, Fe³⁺, Ba²⁺, Ca²⁺, NH₄⁺, Mg²⁺, Zn²⁺

- 24. Xg of benzoic acid on reaction with aq NaHCO₃ released CO₂ that occupied 11.2 L volume at STP.
 X is ______ g.
- 25. $37.8 g N_2 O_5$ was taken in a 1 L reaction vessel and allowed to undergo the following reaction at 500 K

 $2 N_2 O_{5(g)} \rightleftharpoons 2 N_2 O_{4(g)} + O_{2(g)}$

The total pressure at equilibrium was found to be 18.65 bar.

Then, $Kp = _$ ×10⁻² [nearest integer]

Assume N_2O_5 to behave ideally under these conditions.

Given: $R=0.082 \mbox{ bar } Lmol^{-1}\,K^{-1}$

NTA ANSWERS													
1.	(4)	2.	(4)	3.	(1)	4.	(3)	5.	(3)	6.	(2)	7.	(2)
8.	(3)	9.	(4)	10.	(2)	11.	(3)	12.	(4)	13.	(1)	14.	(2)
15.	(1)	16.	(4)	17.	(1)	18.	(3)	19.	(3)	20.	(1)	21.	(700)
22.	(420)	23.	(3)	24.	(61)	25.	(962)						

