

General Instructions

- (i) This question paper contains 26 questions. All questions are compulsory.
- (ii) It comprises 6 single-correct multiple-choice questions.
- (iii) Attempt every question; detailed solutions are provided in the companion solutions booklet.

1. Lanthanide contraction is observed in —

- (A) s-block element
- (B) p-block element
- (C) d-block element
- (D) f-block element

2. IUPAC name of $\text{CH}_3 - \text{CH}_2 - \text{CH}(\text{OH}) - \text{CH}_3$ is —

- (A) Butan-2-ol
- (B) Butan-1-ol
- (C) Propan-2-ol
- (D) Propan-1-ol

3. Which of the following is a colourless ion?

- (A) Cu^+ ion
 - (B) Cu^{2+} ion
 - (C) Ni^{2+} ion
 - (D) Co^{2+} ion
-

4. Unit of rate constant of a first order reaction is —

- (A) $\text{mol L}^{-1} \text{s}^{-1}$
 - (B) s^{-1}
 - (C) $\text{mol}^{-1} \text{L s}^{-1}$
 - (D) None of these
-

5. $\text{CH}_3 - \text{CH}_2 - \text{CH} = \text{CH}_2 + \text{HBr} \xrightarrow{\text{Peroxide}}$ product. In this reaction, the main product is —

- (A) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH}_2 - \text{Br}$
 - (B) $\text{CH}_3 - \text{CH}_2 - \text{CHBr} - \text{CH}_3$
 - (C) Both are main products
 - (D) None of these
-

6. The unit of rate constant of a zero order reaction is —

- (A) min^{-1}
 - (B) $\text{L mol}^{-1} \text{min}^{-1}$
 - (C) $\text{mol L}^{-1} \text{min}^{-1}$
 - (D) Dimensionless
-

7. Explain first order reaction with example.



8. Differentiate between order and molecularity of a reaction.



9. Write the Nernst equation and also explain the relation between electrode potential (E_{cell}) and the equilibrium constant (K_c).



10. How will you prepare phenol from the following reagents (write only chemical equation)?

i) Benzene

ii) Aniline



11. Write two characteristics of transition elements.



12. Write the reason of the following: Ethylamine is soluble in water, while aniline is not soluble in water.



13. $[\text{NiCl}_4]^{2-}$ is paramagnetic, while $\text{Ni}(\text{CO})_4$ is diamagnetic, although both are tetrahedral. Why?



14. The two strands of DNA are not identical, but complementary to each other. Explain.



15. A 200 cm^3 aqueous solution of a protein contains 1.26 g of protein. The osmotic pressure at 300 K was found to be 2.57×10^{-3} bar. Calculate the molar mass of the protein. ($R = 0.083\text{ L bar K}^{-1}\text{ mol}^{-1}$)

16. Define conductivity and molar conductivity of an electrolyte solution. Discuss the change in their value with the change in concentration of electrolyte.

17. For the first-order reaction $\text{N}_2\text{O}_5(\text{g}) \rightarrow 2\text{NO}_2(\text{g}) + \text{O}_2(\text{g})$, the initial concentration of N_2O_5 at 318 K was $1.24 \times 10^{-2}\text{ mol L}^{-1}$, which decreased to $0.20 \times 10^{-2}\text{ mol L}^{-1}$ after 60 minutes. Calculate the rate constant at 318 K.

18. Explain, giving reasons:

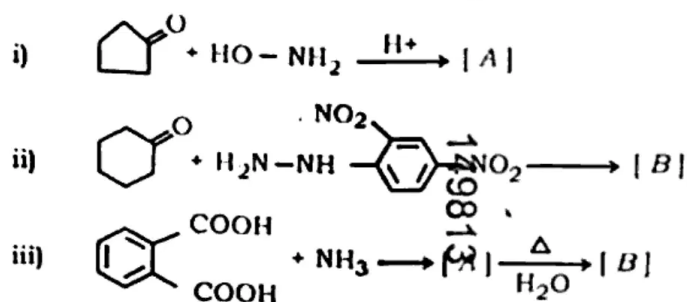
- i) Transition metals and most of their compounds are paramagnetic.
 - ii) Transition metals generally form coloured compounds.
-

19. Write the IUPAC names of the following coordination compounds:

- i) $[\text{Pt}(\text{NH}_3)_2\text{ClNO}_2]$
 - ii) $[\text{Co}(\text{NH}_3)_5(\text{CO}_3)]\text{Cl}$
 - iii) $[\text{Ni}(\text{CO})_4]$
 - iv) $[\text{Co}(\text{NH}_3)_5\text{ONO}]^{2+}$ (1 + 1 + 1 + 1)
-

20. Differentiate between primary, secondary and tertiary alcohols, showing their structure. In the presence of which enzyme does glucose convert to ethyl alcohol? (3+1)

21.



Identify the product of the following reactions:

i) cyclopentanone + $\text{HO}-\text{NH}_2 \xrightarrow{\text{H}^+} [\text{A}]$ (1)

ii) cyclohexanone + 2,4-dinitrophenylhydrazine ($\text{H}_2\text{N}-\text{NH}-\text{C}_6\text{H}_3(\text{NO}_2)_2$) $\rightarrow [\text{B}]$ (1)

iii) benzene-1,2-dicarboxylic acid (phthalic acid) + $\text{NH}_3 \rightarrow [\text{A}] \xrightarrow[\text{-H}_2\text{O}]{\Delta} [\text{B}]$ (2)

22. i) Explain the Hell-Volhard-Zelinsky reaction with example. (2)

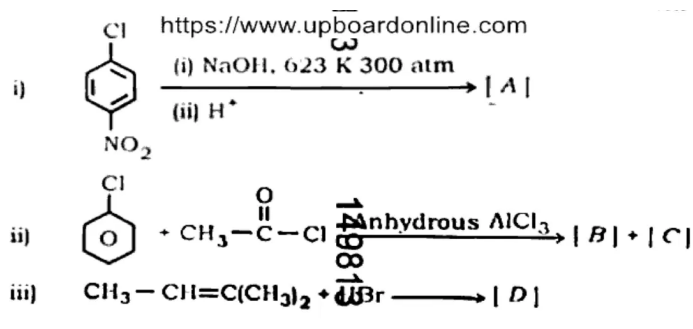
ii) Explain the Hofmann bromamide degradation reaction with example. (2)

23. What are nucleic acids? Explain the difference between DNA and RNA and state their two important biological functions.

OR

How can vitamins be classified? Write the name of a fat soluble vitamin. Which vitamin is responsible for blood clotting?

24.



Write the product of the following reactions along with their mechanism:

i) p-nitrochlorobenzene + NaOH (623 K, 300 atm), then H^+ $\rightarrow$ [A]

ii) Chlorobenzene + CH_3COCl (anhydrous AlCl_3) $\rightarrow$ [B] + [C]

iii) $\text{CH}_3\text{CH}=\text{C}(\text{CH}_3)_2 + \text{HBr} \rightarrow$ [D]

OR

Write short notes on the following: i) D.D.T. ii) Freon iii) Carbon tetrachloride

25. If 2 g of benzoic acid is dissolved in 25 g of benzene, its depression in freezing point was found to be 1.62 K. Molal depression constant of benzene is $4.9 \text{ K kg mol}^{-1}$. If benzoic acid forms a dimer in this solution, what will be the percentage association of benzoic acid? (5)

OR

A 200 cm^3 aqueous solution of a protein contains 1.26 g of protein. The osmotic pressure of this solution at 300 K is 2.57×10^{-3} bar. Calculate the molar mass of this protein. (5)

26. How would you convert:

- i) Ethanoic acid to methanamine? (1)
- ii) Aniline to 2,4,6-tribromoaniline? (1)
- iii) Aniline to benzene diazonium chloride? (1)
- iv) Aniline to phenyl isocyanide? (1)
- v) Chlorobenzene to chlorobenzene sulphonic acid? (1)

OR

- i) Write four chemical equations for the methods of preparation of aniline. (1+1+1+1)
- ii) Write the chemical equation of any one method for the preparation of chlorobenzene. (1)