



Times Allowed – 3 Hours

Maximum Marks – 70

SAMPLE PAPER

CHEMISTRY

General Instruction:-

- i. All questions are **compulsory**.
- ii. Q. no. 1 to 5 are very short answer questions and carry 1 mark each.
- iii. Q. no. 6 to 10 are short answer questions and carry 2 marks each.
- iv. Q. no. 11 to 22 are also short answer questions and carry 3 marks each.
- v. Q. no. 23 is a value based question and carries 4 marks.
- vi. Q. no. 24 to 26 are long answer questions and carry 5 marks each.
- vii. Use log tables if necessary, use of calculators is **not** allowed.

1. What is an adsorption isotherm?
2. Which of the 3rd series transition metals exhibits the largest number of oxidation states and why?
3. Write the structure of the compound :
4-*tert*-butyl-3-iodoheptane
4. Why is Frenkel defect not found in pure alkali metal halides?
5. Write the equation involved in the acetylation of salicylic acid.
6. $[\text{Fe}(\text{CN})_6]^{4-}$ and $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ are of different colours in dilute solutions. Why?

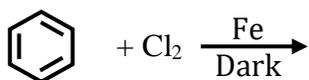
OR

Discuss the nature of bonding in metal carbonyls.

7. Write balanced chemical equations for the following reactions.
- Thermal decomposition of ammonium dichromate.
 - Reaction of Cl_2 with cold and dilute NaOH .
8. Calculate the mass of ascorbic acid (vitamin C, $\text{C}_6\text{H}_8\text{O}_6$) to be dissolved in 75 g acetic acid to lower its freezing point by 1.5°C . ($K_f = 3.9 \text{ K kg mol}^{-1}$)
9. A first order reaction has a specific reaction rate of 10^{-3} sec^{-1} . How much time will it take for 10g of the reactant to reduce to 2.5 g? (Given : $\log 2 = 0.301$, $\log 4 = 0.6021$, $\log 6 = 0.778$)
10. How will you distinguish between $(\text{CH}_3)_2\text{NH}$ and $(\text{CH}_3)_3\text{N}$?
11. Answer the following:
- In a cubic close-packed structure of a mixed oxide one-eighth of tetrahedral voids are occupied by divalent ions, X^{2+} while one half of the octahedral voids are occupied by trivalent ions, Y^{3+} . What is the formula of the compound?
 - Ferric oxide crystallizes in a hexagonal close packed array of oxide ions with two out of every three octahedral holes occupied by ferric ions. Derive the formula of the ferric oxide.
12. State the principle involved in refining of metals by each of the following methods :
- Zone refining
 - Vapour phase refining
 - Electrolytic refining
13. Answer the following:
- The following two reactions of HNO_3 with Zn are given as:

$$\text{Zn} + \text{conc. HNO}_3 \longrightarrow \text{A} + \text{B} + \text{H}_2\text{O}$$

$$\text{Zn} + \text{dil. HNO}_3 \longrightarrow \text{C} + \text{D} + \text{H}_2\text{O}$$
 Identify A, B, C & D respectively:
 - Write the structure of pyrophosphoric acid and peroxomonophosphoric acid.
14. i. Using valence bond theory predict the geometry and magnetic behaviour of $[\text{Cr}(\text{NH}_3)_6]^{3+}$ ion
 [Atomic number of Cr = 24]
 ii. Write all the geometrical isomers of $\text{Pt}(\text{NH}_3)(\text{Br})(\text{Cl})(\text{py})$?
 iii. Why is CO a stronger ligand than Cl^- ?
15. Answer the following:
- Explain why
 - the dipole moment of chlorobenzene is lower than that of cyclohexyl chloride?
 - alkyl halides, though polar, are immiscible with water?
 - Draw the structure of major monohalo product in the following reaction :



16. Explain the following :

Explain the following terms with suitable examples:

i. Alcosol

ii. Aerosol

iii. Hydrosol

17. The degree of dissociation of $\text{Ca}(\text{NO}_3)_2$ in a dilute aqueous solution containing 7.0 g of the salt per 100 g of water at 100°C is 70 percent. If the vapour pressure of water at 100°C is 760 mm, calculate the vapour pressure of the solution.

OR

At some temperature, the vapour pressure of pure benzene (C_6H_6) is 0.256 bar and that of pure toluene ($\text{C}_6\text{H}_5\text{CH}_3$) is 0.0925 bar. If the mole fraction of toluene in solution is 0.6. Then,

i. what will be the total pressure of the solution?

ii. what will be the mole fraction of each component in vapour phase?

18. Answer the following :

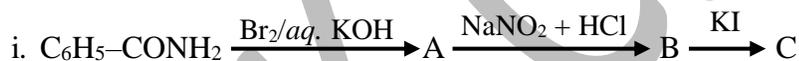
i. What is a developer used in photography and how does it work?

ii. How will you synthesise

a) 1-phenylethanol from a suitable alkene?

b) cyclohexylmethanol using an alkyl halide by an $\text{S}_{\text{N}}2$ reaction?

19. Write the structures of A, B and C in the following :



20. i. Mention the type of linkage responsible for the formation of the following :

a) Primary structure of protein

b) Cross linkage of polypeptide chains

c) α -helix formation

d) β -sheet structure

ii. What is meant by reducing sugars?

21. Answer the following :

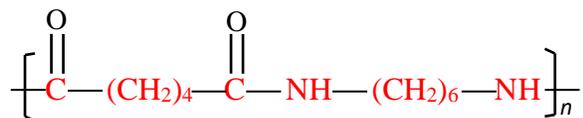
i. The half-life for radioactive decay of ^{14}C is 5730 years. An archaeological artifact containing wood had only 80% of the ^{14}C found in a living tree. Calculate the age of the sample.

ii. Why does the rate of a reaction not remain constant throughout the reaction process?

22. Answer the following :

i. Why rubbers are elastomers?

ii. Identify the monomers in the following polymer.



iii. Arrange the following polymer in the increasing order of their intermolecular forces.

Nylon-6,6, buna-S, Polythene

23. Sonam is a student of Class XII. Once her mother fell down from stairs and her leg bruised with lot of pain. Sonam gave her mother a non-narcotic analgesic which was safe to use. Her mother questioned if there is some other type of analgesic as well. Sonam replied affirmatively and told her mother that narcotic analgesics should be taken only when one is in acute pain.

After reading the above passage, answer the following question:

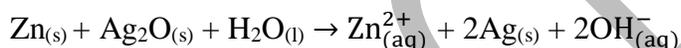
i. What values are expressed by Sonam by her choice about using narcotic and non-narcotic analgesics?

ii. Give some examples of narcotic and non-narcotic analgesics.

iii. Give one example of an antipyretic which also acts as an analgesic. How does it work as an analgesic?

24. Answer the following :

i. In the button cells, widely used in watches and other devices, the following reaction take place :



Determine E° and ΔG° for the reaction.

(Given : $E^\circ_{\text{Ag}^+/\text{Ag}} = +0.80 \text{ V}$, $E^\circ_{\text{Zn}^{2+}/\text{Zn}} = -0.76 \text{ V}$)

ii. What type of a battery is the lead storage battery? Write the anode and the cathode reactions and the overall reaction occurring in a lead storage battery when current is drawn from it.

OR

Answer the following :

i. The cell in which the following reaction occurs,

$2\text{Fe}_{(aq)}^{3+} + 2\text{I}_{(aq)}^- \rightarrow 2\text{Fe}_{(aq)}^{2+} + \text{I}_{2(s)}$ has $E^\circ_{\text{cell}} = \text{V}$ at 298 K, calculate the standard Gibbs energy and the equilibrium constant of the cell reaction.

ii. The chemistry of corrosion of iron is essentially an electrochemical phenomenon. Explain the reactions occurring during the corrosion of iron in the atmosphere.

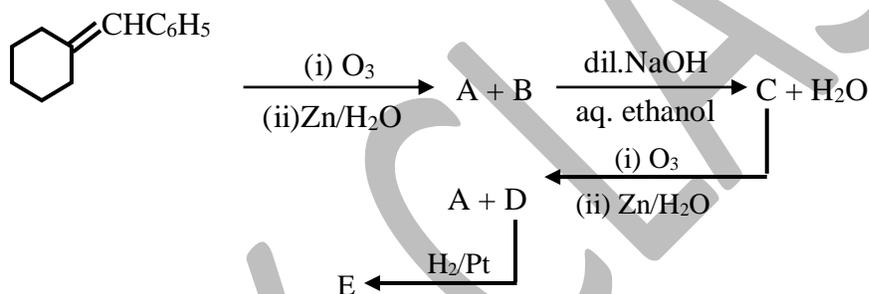
25. Answer the following :

- i. A blackish brown coloured solid 'A' when fused with alkali metal hydroxide in presence of air, produces a dark green coloured compound 'B', which on electrolytic oxidation in alkaline medium gives a dark purple coloured compound 'C'. Identify A, B and C and write the reaction involved.
- ii. What happens when an acidic solution of the green compound (B) is allowed to stand for some time? Give the equation involved. What is this type of reaction called?

OR

Answer the following :

- i. Explain why mercury(I) ion exists as Hg_2^{2+} ion, while copper(I) exists as Cu^+ ion.
- ii. Assign suitable reasons for the following :
- Mn^{2+} compounds are more stable than Fe^{2+} compounds towards oxidation to their +3 oxidation state.
 - In the 3d series from Sc (Z = 21) to Zn (Z = 30), the enthalpy of atomization of Zn is the lowest.
 - Sc^{3+} is colourless in aqueous solution whereas Ti^{3+} is coloured.
26. Identify compounds (A to D) in the following reactions sequence :



OR

Answer the following :

- i. A compound with molecular formula, $\text{C}_4\text{H}_{10}\text{O}_3$ on acetylation with acetic anhydride gives a compound with molecular weight 190. Find out the number of hydroxyl groups present in the compound.
- ii. Identify A, B and C and give their structures.

