

MODEL TEST PAPER (III)

Chemistry (Theory)

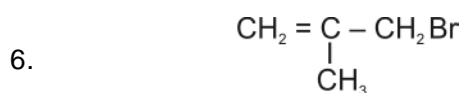
Time : 3 hours

Total Marks : 70

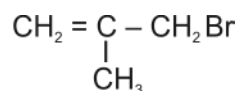
General Instruction

- (i) All questions are compulsory.
- (ii) Question number 1 to 8 are very short answer questions, carrying 1 mark each. Answer these in one word or about one sentence each.
- (iii) Question number 9 to 18 are short answer questions, carrying 2 marks each. Answer these in about 30 words each.
- (iv) Question number 19 to 27 are short answer questions, carrying 3 marks each. Answer these in about 40 words each.
- (v) Question number 28 to 30 are long answer questions, carrying 5 marks each. Answer these in about 70 words each.
- (vi) Use log table, if necessary.
- (vii) Use of calculator is not permitted.

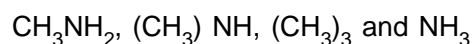
1. Write a point of distinction between a metallic solid and an ionic solid other than metallic lustre. 1
2. Which one of PCl_4^+ and PCl_4^- is not likely to exist and why? 1
3. What is the role of graphite in the electrometallurgy of aluminium? 1
4. Arrange the following compounds in an increasing order of their reactivity in nucleophilic addition reactions : ethanal, propanal, propanone, butanone.
5. Draw the structural formula of 2-methylpropan -2-ol molecule. 1



Give the IUPAC name of the following compound.



7. Define the term, 'homopolymerisation' giving an example.
8. Arrange the following in the decreasing order of their basic strength in aqueous solutions.



9. A 1.00 molal aqueous solution of trichloroacetic acid (CCl_3COOH) is heated to its boiling point. The solution has the boiling point of 100.18°C . Determine the van't Hoff factor for trichloroacetic acid. (K_b for water = $0.512\text{ K kg mol}^{-1}$)

OR

Define the following terms :

- (i) Mole fraction
 - (ii) Isotonic solutions
 - (iii) Van't Hoff factor
 - (iv) Ideal solution
11. Describe a conspicuous change observed when
- (i) a solution of NaCl is added to a sol of hydrated ferric oxide.
 - (ii) a beam of light is passed through a solution of NaCl and then through a sol.
12. What is meant by coagulation of a colloidal solution? Describe briefly any three methods by which coagulation of lyophobic sols can be carried out.
13. Describe the following :
- (i) The role of cryolite in electro metallurgy of aluminium.
 - (ii) The role of carbon monoxide in the refining of crude nickel.
14. What is meant by (i) peptide linkage (ii) biocatalysts?
15. Explain the following giving an appropriate reason in each case.
- (i) O_2 and F_2 both stabilize higher oxidation states of metals but O_2 exceeds F_2 in doing so.
 - (ii) Structures of Xenon fluorides cannot be explained by Valence Bond approach.
16. Complete the following chemical equations :
- (i) $\text{Cr}_2\text{O}_7^{2-} + \text{H}^+ + \text{I}^- \rightarrow$
 - (ii) $\text{MnO}_4^- + \text{NO}_2^- + \text{H}^+ \rightarrow$
17. Draw the structure of the monomer for each of the following polymers :
- (i) Nylon 6
 - (ii) Polypropene

18. Write the main structural difference between DNA and RNA. Of the two bases, thymine and uracil, which one is present in DNA?
19. Tungsten crystallizes in body centred cubic unit cell. If the edge of the unit cell is 316.5 pm, what is the radius of tungsten atom?

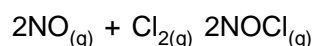
OR

Iron has a body centred cubic unit cell with a cell dimension of 286.65 pm. The density of iron is 7.874 g cm^{-3} . Use this information to calculate Avogadro's number. (At mass of Fe=55.845u).

20. A solution of glycerol ($\text{C}_3\text{H}_8\text{O}_3$) in water was prepared by dissolving some glycerol in 500 g of water. This solution has a boiling point of 100.42°C while pure water boils at 100°C . What mass of glycerol was dissolved to make the solution?

(K_b for water = $0.512 \text{ K kg mol}^{-1}$)

21. For reaction



the following data were collected. All the measurements were taken at 263 K:

Experiment No.	Initial [NO]/(M)	Initial [Cl_2]/(M)	Initial rate of disappearance of Cl_2 (M/min)
1	0.15	0.15	0.60
2	0.15	0.30	1.20
3	0.30	0.15	2.40
4	0.25	0.25	?

- (a) Write the expression for rate law.
- (b) Calculate the value of rate constant and specify its units.
- (c) What is the initial rate of disappearance of Cl_2 in exp. 4?
22. State a reason for each of the following situations :
- (i) Co^{2+} is easily oxidized to Co^{3+} in presence of a strong ligand.
- (ii) CO is a stronger complexing reagent than NH_3 .
- (iii) The molecular shape of $\text{Ni}(\text{CO})_4$ is not the same as that of $[\text{Ni}(\text{CN})_4]^{2-}$

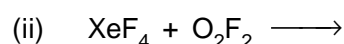
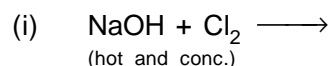
23. How would you account for the following?
- With the same d-orbital configuration (d^4) Cr^{2+} is a reducing agent while Mn^{3+} is an oxidizing agent.
 - The actinoids exhibit a larger number of oxidation states than the corresponding members in the lanthanoid series.
 - Most of the transition metal ions exhibit characteristic colours in aqueous solutions.
24. Write chemical equations for the following conversions :
- nitrobenzene to benzoic acid.
 - benzyl chloride to 2-phenylethanamine.
 - aniline to benzyl alcohol.
25. What are the following substances? Give one example of each one of them.
- Tranquilizers
 - Food preservatives
 - Synthetic detergents
26. Draw the structure and name the product formed if the following alcohols are oxidized. Assume that an excess of oxidizing agent is used.
- $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
 - 2-butenol
 - 2-methyl-1-propanol
27. Although chlorine is an electron withdrawing group, yet it is ortho-, para-directing in electrophilic aromatic substitution reaction. Explain why it is so? 3
28. (a) complete the following chemical reaction equations :
- $\text{P}_4 + \text{SO}_2\text{Cl}_2 \longrightarrow$
 - $\text{XeF}_6 + \text{H}_2\text{O} \longrightarrow$
- (b) Predict the shape and the asked angle (90° or more or less) in each of the following cases :
- SO_3^{2-} and the angle $\text{O} - \text{S} - \text{O}$

(ii) ClF_3 and the angle F – Cl – F

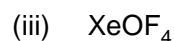
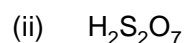
(iii) XeF_2 and the angle F – Xe – F

OR

(a) Complete the following chemical equations :

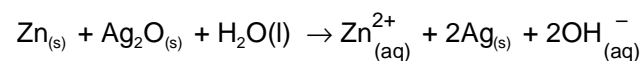


(b) Draw the structure of the following molecules :

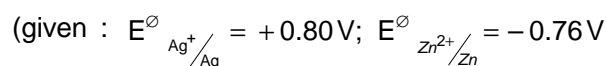


29. (a) What type of a battery is lead storage battery? Write the anode and the cathode reactions and the overall reaction occurring in a lead storage battery when current is drawn from it.

(b) In the button cell, widely used in watches, the following reaction takes place



Determine E^\ominus and ΔG^\ominus for the reaction.



OR

(a) Define molar conductivity of a solution and explain how molar conductivity changes with change in concentration of solution for a weak and a strong electrolyte.

(b) The resistance of a conductivity cell containing 0.001 M KCl solution at 298 K is 1500 Ω . What is the cell constant if the conductivity of 0.001 M KCl solution at 298 K is $0.146 \times 10^{-3} \text{ S cm}^{-1}$?

30. Give a plausible explanation for each one of the following :

(i) There are two – NH_2 groups in semicarbazide. However, only one such group is involved in the formation of semicarbazones.

(ii) Cyclohexanone forms cyanohydrin in good yield but 2, 4, 6-trimethylcyclohexanone does not.

- (b) An organic compound with molecular formula $C_9H_{10}O$ forms 2, 4, -DNP derivative, reduces Tollens' reagent and undergoes Cannizzaro's reaction. On vigorous oxidation it gives 1, 2-benzenedicarboxylic acid. Identify the compound.

OR

- (a) Give chemical tests to distinguish between
- phenol and benzoic acid
 - benzophenone and acetophenone
- (b) Write the structures of the main products of following reactions :

