

Five Year Integrated M. Sc. Examination 2022

Semester-VII

Course: CH-4-7-1

(Chemistry)

Time: Four Hours

Full Marks: 80

Questions are of value as indicated in the margin

Group-A

(Answer **any ten** questions)

1. (a) Which law governs the relationship between molar magnetic susceptibility and temperature in case of paramagnetic substances? Explain the various terms appearing in the relationship and their significance. 2 x 10
- (b) $[\text{CuF}_6]^{3-}$ is paramagnetic but $[\text{AuF}_4]^-$ is diamagnetic. Explain
- (c) Comment on the magnetic behaviour of MnO_4^- .
- (d) Identify which of the following will have orbital contribution in their magnetic moment values.
 d^2 (octahedral), d^4 (tetrahedral), d^7 (tetrahedral), d^8 (octahedral).
- (e) What do you mean by stereospecific reaction? Give an example.
- (f) When is the *syn*-addition possible? Give an example of *syn*-addition reaction.
- (g) What do you mean by enantiomeric excess? Explain with example.
- (h) What will be the product if *meso*-1,2-dibromobutene undergoes dehalogenation and how?
- (i) Define sedimentation potential.
- (j) Draw the different models of ionic solvation
- (k) What are the forces predominate in the primary minimum of the potential energy curve of a colloidal suspension?
- (l) What are colloids? Classify in terms of solute-solvent interaction.

Group-B

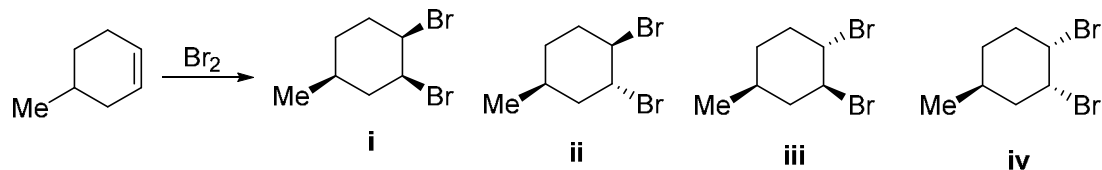
(Answer **any four** questions)

2. (a) Derive the equation for μ_{dia} for a multi-electron atom. 3+2
- (b) Explain spin state isomerism in terms of Tanabe-Sugano diagrams.
3. (a) Discuss the dependence of paramagnetism on the relative value of the multiplet width ($\Delta E_{J, J+1}$) and thermal energy ($K_B T$). 3+2
- (b) Explain the magnetic behavior observed in CoFe_2O_4 .
4. Find out the μ_J and μ_S value of Sm^{3+} (f^5 system). Briefly discuss on the μ_{exp} value of the system. 5
5. (a) Draw the different types of spin transition curves as a function of temperature. What type of transition is shown by $[\text{Fe}(\text{NCS})_2(\text{phen})_2]$? 3+2
- (b) Comment on the magnetic property of $[\text{Cu}_2(\text{CH}_3\text{COO})_4 \cdot 2\text{H}_2\text{O}]$.
6. (a) State the Goodenough-Kanamori-Anderson (GKA) Rules and explain the interactions involved with suitable illustration. 3+2
- (b) From the plot of magnetization *versus* field strength for a ferromagnetic material explain coercivity, remanence and saturation magnetisation

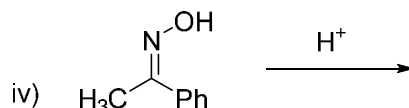
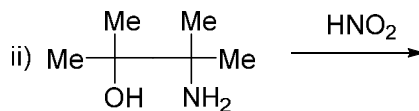
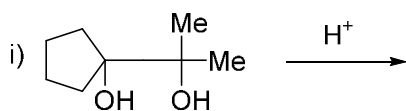
Group-C

(Answer **any four** questions)

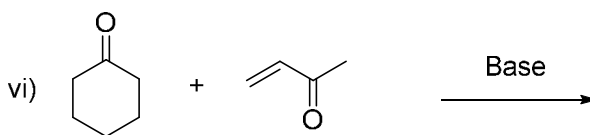
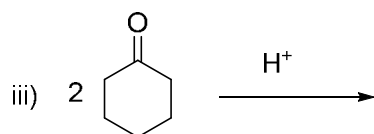
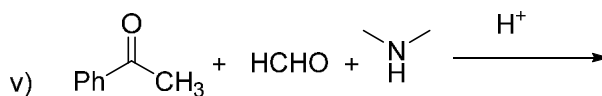
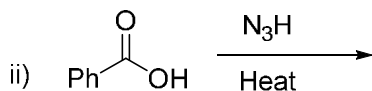
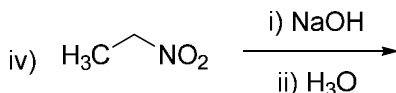
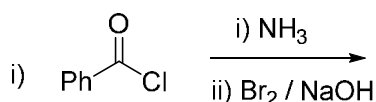
7. (a) Explain the mechanistic path of the *anti*-addition reaction of *cis*-butene with bromine. 3+2
- (b) Which one will be the product of the following reaction and why?



8. (a) Write (R)-Benzoin and predict the product by reduction of LiAlH_4 according to Cram's rule. 2.5+2.5
 (b) Write the favoured conformation using Felkin-Anh model of (S)-Benzoin and show that by reduction with LiAlH_4 it gives different stereoisomer.
 9. Suggest the possible product with probable mechanism (any two). 2.5+2.5



10. Predict the product(s) of the following reactions (any five). 1 x 5



11. Write Short notes on (any two).

- I) Wittig Reaction
- II) Heck reaction
- III) Prevost reaction

2.5+2.5

Group-D

(Answer *any four* questions)

12. (a) Describe the factors that govern the interfacial surface tension between a metal and electrolytic solution. 2+3
 (b) When a planar metal electrode is dipped in an electrolytic solution, a potential is developed at the interface. Explain
 13. Using parallel-plate condenser model, show that the surface tension (γ) vs. potential curve is a parabola symmetrical about the electro-capillary maximum (γ_{max}). 5
 14. (a) Ion association takes place in an electrolytic solution. Explain. 1+4
 (b) Calculate the fraction of ions that form ion-pair according to Bjerrum.
 15. (a) Define the solvation number. 1+4
 (b) The activity co-efficient or the ratio of activity to concentration of an electrolyte keep on getting smaller in the low concentration region, then it hesitate in the intermediate range and then finally it increases at the higher range. Explain why does it do this?
 16. What is streaming potential and how does it develop? Discuss with a suitable diagram. 1+4