

M.Sc. (Previous) Applied Chemistry Examination, August/September 2008
Directorate of Correspondence Course (Freshers)
Paper - 1.01 : ANALYTICAL AND SPECTROSCOPIC TECHNIQUES

Time : 3 Hours

Max. Marks : 85

Notes : 1) Answer any TEN questions from Part A, TWO questions from Part B and THREE questions from Part C.

2) Figures to the right indicate marks.

3) Repeaters answer any ONE question from Part B.

PART - A

(2×10=20)

1. What are indeterminate errors ?
2. What is a calibration graph ? Give its significance in spectrophotometric analysis.
3. Show the possible modes of bonding of NO_3^- in metal complexes.
4. What type of solvents used in ESR ?
5. Distinguish between accuracy and precision.
6. What is partition chromatography ?
7. What are the advantages of TCD ?
8. What is R_f value ? Give its significance.
9. Explain the principle involved in NMR spectroscopy.
10. State nitrogen rule.

P.T.O.

11. What is a shift reagent ? Give an example.
12. Give the characteristics of carrier gas employed in GC.
13. Distinguish between isocratic elution and gradient elution.
14. What are the characteristics of Flame in Flame photometer ?
15. What are the special features of reference material used in DTA ?

PART - B

16. a) What are the advantages of thin layer chromatography over other chromatographic methods ?
 b) Analysis of the iron content of a sample gave the following results (in ppm) :
 45.38, 44.56, 46.53, 43.92, 44.03 and 46.94
 Calculate the mean, median, standard deviation and variance. (5+5=10)
17. a) Explain the factors influencing position and intensity of spectral lines.
 b) Discuss the working principles of TGA. (5+5=10)
18. a) Explain the factors that influence fluorescence intensity of molecules.
 b) What are the basic principles of gas chromatography ? Outline the working principle of electron capture detector. (5+5=10)

PART - C

19. a) Describe the usefulness of infrared spectroscopy in the study of molecule with suitable examples.
 b) Give a brief note on interaction of electromagnetic radiation with matter.
 c) List out the factors that influence resolution in chromatography. (5+5+5=15)

20. a) What is ion-exchange capacity of a resin ? Describe the application of ion-exchange technique in the separation of lanthanides.
- b) Define the term "chemical shift". What is its significance ? Explain the factors influencing the chemical shift.
- c) What is McLafferty rearrangement ? Give a brief note on the applications of mass spectroscopy. (5+5+5=15)
21. a) Give the block diagram of Flame photometry. Name the components and explain their functions.
- b) Derive Beer - Lambert's law and discuss the deviation.
- c) Describe the sources of determinate errors. How it can be minimized ? (5+5+5=15)
22. a) With the help of a block diagram indicate the configuration modules used in HPLC. Highlight the applications of HPLC.
- b) Give a brief account of applications of EPR spectroscopy in the study of inorganic and organic compounds.
- c) Describe the factors that influence TG results. (5+5+5=15)
23. a) Discuss in detail the utility of NMR spectroscopy in structure elucidation of organic compounds.
- b) Give a brief note on differential scanning calorimetry.
- c) Describe the applications of differential thermal analysis. (5+5+5=15)

M.Sc. (Previous) Applied Chemistry Examination, August/September 2008
 Directorate of Correspondence Course (Freshers)
 App.Chem. 1.02 : INORGANIC CHEMISTRY – I

Time : 3 Hours

Max. Marks : 85

- Notes :* 1) Answer any **TEN** questions from Part – A, **TWO** questions from Part – B and **THREE** questions from Part – C.
 2) Figures to the right indicate marks.
 3) Repeaters answer any **ONE** question from Part – B.

PART – A

(2×10=20)

1. a) Use the MO theory to predict the bond order and number of unpaired electrons in NO molecule.
- b) Write the applications of radius ratio rules?
- c) What are the rules for linear combination of atomic orbitals?
- d) Why the Schottky defects in the metallic crystals and ionic crystals are different?
- e) The order of valence shell electron pair repulsions is $lp-lp > lp-bp > dp-bp$. Give reason.
- f) Draw the crystal structure of CsCl and indicate the coordination number of each ion.
- g) Give the preparation of polyacetylene.
- h) What are the geometric arrangement of sp^3d^2 and dsp^2 hybrid orbitals?
- i) What are the sources of contaminants in ground and surface water?
- j) HgO is soluble in HCl but HgS is not. Why?
- k) What is the shape and bond order in the following isoelectronic molecules, CO_3^{2-} , NO_3^- .
- l) What is lattice energy of a crystal? Write the Born-Landé equation.
- m) What is meant by capacity of ion-exchange resins?
- n) Why the intensity of d-d transitions is weak?
- o) Explain the role of ozone in atmosphere.

P.T.O.

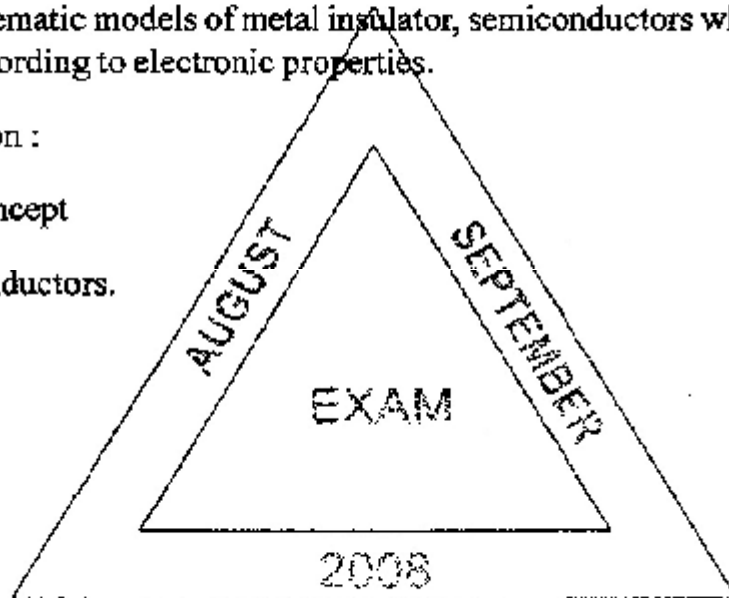


PART - B

2. a) What are silicones ? How cross-linked silicone polymers are obtained ? Give their properties and applications.
- b) How is diborane prepared ? Discuss its structure and bonding. (5+5=10)
3. a) Draw the MOE diagram for CO. Comments on its bond order and magnetic properties.
- b) Discuss the techniques involved in the separation of lanthanides by ion exchange chromatography. (5+5=10)
4. a) How is $B_3N_3H_6$ obtained ? Discuss the chemical reactions and structure of this molecule.
- b) Discuss the semiconducting properties of doped π -bonding organic solids. (5+5=10)
5. a) What are the effects of air pollutants on living and nonliving things ? Explain the consequences of green house effect. Suggest the steps involved to control it.
- b) How are geometrical isomers distinguished ? How many geometrical isomers are possible for the octahedral complex $[Cr(NH_3)_3(NO_2)_2]$? Can it exhibit optical isomerism ? Explain. (7+8=15)
6. a) With suitable example, discuss the general properties of d-block elements.
- b) What is stability constant ? Discuss the factors affecting stability of complexes. (7+8=15)



7. a) What are phosphazenes ? How are they prepared ? Discuss its structure and bonding.
- b) Draw the two types of structure of ZnS. Show the co-ordination around each type of ion in these structures. Explain the differences in these structures. (7+8=15)
8. a) Discuss the importance of radius ratio rule with examples.
- b) Describe the determination of stability constant of complexes by Job's method of continuous variations. (7+8=15)
9. a) Draw the schematic models of metal insulator, semiconductors which are classified according to electronic properties.
- b) Write a note on :
- i) HSAB concept
 - ii) Super conductors. (7+4+4=15)



M.Sc. Previous (Applied Chemistry) Examination, August/September 2008
 Directorate of Correspondence Course
 DCC App – Chem 1.03 : ORGANIC CHEMISTRY (Freshers)

Time : 3 Hours

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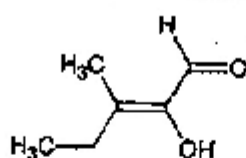
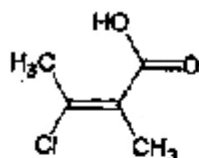
- Note : 1) Answer any TEN questions from Part – A, TWO questions from Part – B and any THREE questions from Part – C.
 2) Figures to the right indicate marks.
 3) Repeaters answer any ONE questions from Part – B.*

PART – A

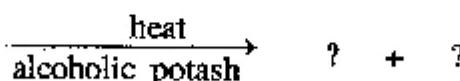
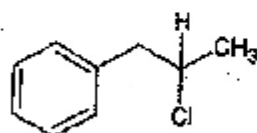
Answer any TEN of the following :

(2×10=20)

- Account for the stability of triphenyl methyl free radical.
- What are nitrenes ? How are they generated ?
- What is anomeric effect ? Write the Haworth structures of α and β – D-Glucose.
- Write the IUPAC name with E and Z notation.

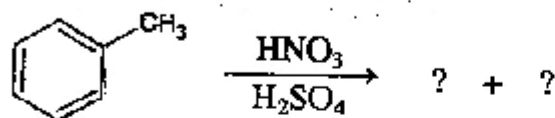


5. Write the major and minor products in the following reaction.

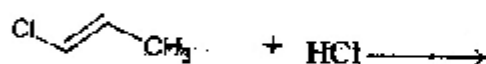


P.T.O.

6. [18] Annulene is aromatic. Explain.
7. Give the appropriate products and give reason in the following reaction.



8. Write the product (s) in the following reaction.



Complete the reaction with mechanism.

9. Give one reaction involving carbene as intermediate.
10. Explain Hofmann degradation reaction.
11. Give synthesis of thiazole from α -haloketones.
12. 2° -amines are less basic than 3° -amines, give reason.
13. Write the Fisher projection and conformational structure of D-Mannose.
14. Give any two N-terminal and C-terminal blocking agent.
15. What are the products obtained when cellulose is fully methylated followed by hydrolysis ?

PART - B

Answer any **TWO** of the following :

(10×2=20)

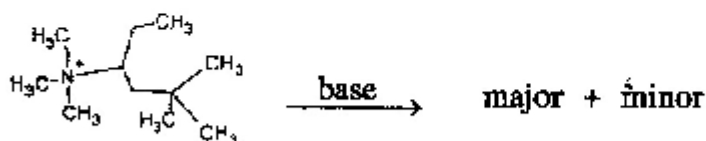
16. a) Discuss the conformational analysis of 1, 2 dichloroethane in vapour and liquid phase. 5
- b) Describe the optical isomerism in tartaric acid. 5

17. a) Explain the mechanism of electrophilic aromatic nitration with suitable examples. 5
 b) Write the stereochemistry and mechanism of S_N^2 reactions. 5
18. a) Elucidate the structure of maltose. 7
 b) Give two biological importance of protein. 3

PART - C

Answer any **THREE** of the following : (15×3=45)

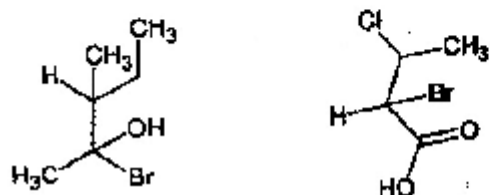
19. a) Describe the chemical method for establishing the configuration of geometrical isomers. 6
 b) Give any four reactions involving carbocations. 5
 c) Discuss the stability of carbocations. 4
20. a) Discuss the stereochemistry of elimination reactions. 5
 b) Compare the basicity and aromaticity of pyrrole with pyridine. 5
 c) What are amylose and amylopectin ? How are they obtained from starch ? Give the structure of amylose. 5
21. a) Discuss any three method of synthesis of amino acids. 6
 b) Discuss the mechanism of the following reaction : 5



- c) What is Hudson's rule ? Explain with an example. 4

22. a) Assign R and S notation for the following molecule.

5



b) Discuss the secondary structure of protein.

5

c) Write a note on electrophilic reactions of pyrimidine.

5

23. a) Describe the Huckel rule for aromaticity with suitable example.

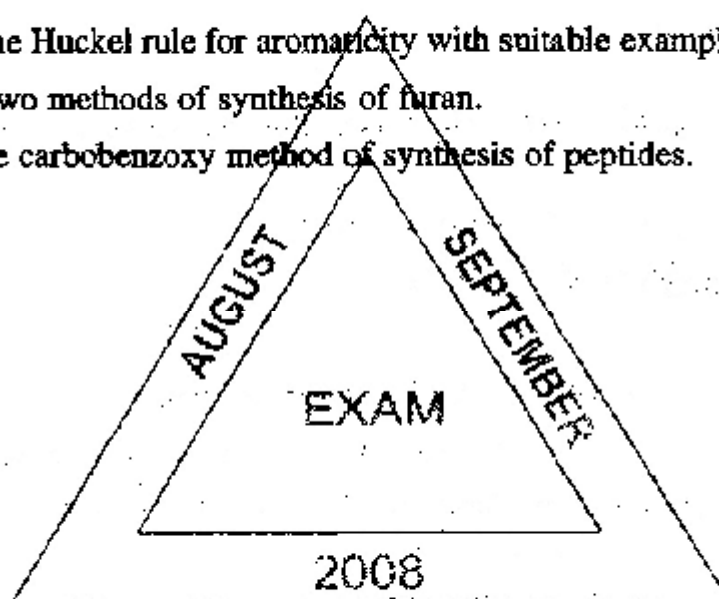
6

b) Give any two methods of synthesis of furan.

5

c) Discuss the carbobenzoxy method of synthesis of peptides.

4





PART - B

(10×2=20)

16. a) Explain the Lindemann's theory of unimolecular reactions.
 b) Write a note on fuel cells. (5+5=10)
17. a) Give a brief account on artificial radio activity.
 b) Discuss the factors affecting the CMC of surfactants. (5+5=10)
18. a) Explain the criteria for spontaneity and equilibrium in a chemical process.
 b) Out line the principle of evaluation of fugacity of a gas. (5+5=10)

PART - C

(15×3=45)

19. a) Describe briefly the theories involved in the mechanism of hydrogen over voltage.
 b) Write a note on electrolytes.
 c) Explain the charging theory and practices of storage batteries. (5+5+5=15)
20. a) Explain nuclear fission reaction with suitable examples.
 b) Derive Van't Hoff's reaction isotherm and deduce the relation giving the temperature dependence of free energy.
 c) Explain the term ionic atmosphere. Deduce Clausius-Glaapeyron equation. (5+5+5=15)
21. a) Discuss the working principle of semiconductor radiation detectors.
 b) The energy of activation of a reaction is 15 k cal/mole. If the rate constant of this reaction is $6 \times 10^{-4} \text{ sec}^{-1}$ at 27°C , what would be the rate constant at 37°C ?
 c) State and explain the Nernst heat theorem. (5+5+5=15)
22. a) Discuss the determination of partial molar volume by the method of density measurements.
 b) With a neat diagram explain dry cell and mention its uses.
 c) Write an explanatory note on breeder reactor. (5+5+5=15)
23. a) Deduce Debye heat capacity equation.
 b) Explain the thermodynamics of real gases.
 c) Write the Debye-Huckel limiting law and explain the significance of each term in it. Discuss the modifications in the equation to account for the activity coefficients in a concentrated electrolyte. (5+5+5=15)