

First Year M.Sc. Degree Examination
August 2009
(Freshers)

**DEC:APP:CHEM:1.01 - ANALYTICAL AND SPECTROSCOPIC
 TECHNIQUES**

Time : 3 Hours

Max. Marks : 85

- Note :**
1. Answer Part-A, any three from Part-B and Part-C.
 2. Figures to the right indicate marks.

PART-A

1. Answer any ELEVEN questions.

11x2=22

- a) Explain why N_2 is IR active where as NO is inactive.
- b) Define the terms ion exchange capacity and masking agents.
- c) What are the advantages and limitations of paper chromatography?
- d) How many H^1 NMR signals would expect for $CH_3CH_2CH_3$?
- e) What is fluorescence quenching?
- f) Differentiate relative error and absolute error.
- g) What is base peak in mass spectroscopy?
- h) Define red shift and blue shift.
- i) State Beer-Lambert's law and give the mathematical relation.
- j) What is the principle of HPLC?
- k) Write the selection rule of ESR?
- l) What is g_{\parallel} and g_{\perp} in ESR spectroscopy?
- m) Define precession and accuracy.
- n) What is eddy diffusion? What is its effect?
- o) Define Force constant.

PART-B

- Answer any THREE questions.

3x8=24

2. a) Discuss the different types of atomizers used in AAS and merits and demerits in each type.
- b) Explain Zero splitting and Karmmer's degeneracy in ESR spectroscopy. 4+4
3. a) Discuss the principle and instrumentation of fluorescence spectroscopy.
- b) What is chemical shift? Discuss the factors influencing the chemical shift. 4+4

4. a) Explain the different steps followed in rounding off a numerical value.
b) What are the methods for minimizing determinate errors in analytical estimations. 4+4
5. a) Explain the working principle of FID with a neat diagram.
b) Compare plate theory and Rate theory in chromatography. 4+4

PART-C

Answer any THREE questions.

3x13=39

6. a) Discuss the superiority of TLC over other chromatographic techniques.
b) Briefly explain the various factors affecting the position of UV -bands.
c) Discuss the basic principle of ion exchange chromatography. 5+5+3
7. a) Explain the theory of spin-spin splitting in NMR.
b) Discuss the different types of molecular vibrations.
c) Write a note on the factors affecting TG curve? 5+5+3
8. a) Draw a neat sketch of double beam IR spectroscope and explain the function of each component.
b) Give a brief note on interaction of electromagnetic radiation with matter.
c) Describe the usefulness of IR spectroscopy in the study of molecules with suitable example. 5+5+3
9. a) What is hyperfine splitting in ESR spectroscopy to predict the number of signals for $\text{CH}_3 \text{CD}_3$? Explain the relative intensity in each case.
b) Sketch the diagram of HPLC and explain the function of its components and operation. 7+6
10. a) Describe the experimental set up involved in paper chromatography in qualitative analysis.
b) Draw a neat diagram of gas chromatography and explain the functions of each component. 7+6

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M.Sc. (Previous) Degree Examination
August 2009
(Freshers)

APPLIED CHEMISTRY

APP.CHEM-1.02 : Inorganic Chemistry

Time : 3 Hours

Max. Marks : 85

- Note :**
1. Answer any ELEVEN subdivisions from Part-A, THREE full questions from Part-B and any THREE full questions from Part-C.
 2. Numbers to the right indicate marks.

PART-A

Answer any ELEVEN of the following.

11x2=22

1. a) Define Schottky and Frenkel defects.
- b) Give one method for synthesis of coordination compounds with example.
- c) Discuss the characteristics of the major regions of the atmosphere.
- d) What is lanthanide contraction?
- e) What are the similarities between lanthanides and actinides?
- f) Give any two methods for the preparation of S_4N_4 .
- g) Write the structure of B_5H_9 and B_5H_{11} .
- h) What is lattice energy of an ionic solid? How is it calculated?
- i) Give two examples each of acid-base reactions in liquid sulphur dioxide.
- j) Draw the crystal field splitting diagram for tetrahedral geometry.
- k) Define chelating ligand and chelates. Give examples.
- l) Draw the unit cell structure of CsCl and identify the coordination number of each of the ions.
- m) What are carboranes? How they are classified?
- n) Comment on the electric configuration of Cr and Cu.
- o) Define the solvent system concept of acids and bases.

PART-B

Answer any THREE questions.

3x8=24

2. a) Discuss the structure and bonding in B_2H_6 .
- b) What is HSAB concept? Explain its applications. 4+4
3. a) Give an account on the separation of lanthanides by ion exchange method.
- b) Derive the Born-Landé equation and explain how lattice energy of an ionic solid can be calculated from it. 4+4

4. a) What is Stability constant? Discuss the factors influencing the stability of complexes.
 b) Give the preparation and structure of Closo- $C_2B_{10}H_{12}$. 4+4
5. a) What are Metal excess defects? Explain.
 b) Discuss the optical isomerism exhibited by complexes of coordination number 4 and 6. 4+4
6. a) Based on the VSEPR theory predict the structure of SF_4 and IF_7 .
 b) Write a note on sewage water treatment. 4+4

PART-C

Answer any THREE of the following.

3x13=39

7. a) Discuss the M.O.T. of bonding in coordination compounds with an example.
 b) Discuss the properties, variable oxidation state and colour of the d-block elements with suitable examples. 7+6
8. a) Explain with an example how the Born-Haber cycle is useful in the determination of lattice energy of an ionic compound.
 b) What are Fajan's rules? How are they useful in explaining the properties of ionic compounds. 7+6
9. a) How can you compare the d-block elements with f-block elements?
 b) Draw the schematic models of metal insulators, intrinsic semiconductors which are classified according to electronic properties. 5+8
10. a) Explain the physical properties that favour borazine to be called inorganic benzene but not the chemical properties. Discuss its structure and bonding.
 b) Explain the structure of $XeOF_4$. 8+5
11. a) Briefly explain the formation and toxic effects of photochemical smog.
 b) Write a note on green house effect.
 c) Explain in detail the pollution aspects of NO_x . 4+4+5

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M.Sc. (Previous) Degree Examination
August 2009
Directorate of Correspondence Course
(Freshers)

APPLIED CHEMISTRY
DEC.APP.CHEM.1.02 : Organic Chemistry

Time : 3 Hours

Max. Marks : 85

- Note :**
1. Answer any **ELEVEN** question from Part-A, **THREE** questions from Part-B and any **THREE** full questions from Part-C.
 2. Figures to the right indicate marks.

PART-A

1. Answer any **ELEVEN** of the following. **11x2=22**
- a) Explain stability of carbanions.
 - b) What are non-classical carbocations?
 - c) Give two differences between enantiomers and diastereomers.
 - d) Write the possible optical isomers for tartaric acid.
 - e) Discuss the mechanism of S_Ni reaction.
 - f) Explain the aromaticity of tropylium cation.
 - g) Write the mechanism of sulphonation of benzene.
 - h) Explain Markownikoff's rule with an example.
 - i) What is Chugaev reaction?
 - j) Give one method of synthesis of isoquinoline.
 - k) Between thiophene and furan which one is more aromatic and why?
 - l) Arrange the following acids in the increasing order of their acid strength:
 $ClCH_2COOH$, CH_3COOH , Cl_3CCOOH and $Cl_2C(R)COOH$
 - m) Outline the azlactone synthesis of amino acids.
 - n) What is anomeric affect?
 - o) Name any two carboxylic group blocking agents and used in the peptide synthesis.

PART-B

- Answer any **THREE** of the following questions. **3x8=24**
2. a) Discuss the formation and stability of carbocations. **4+4**
 b) Explain optical isomerism exhibited by biphenyl compounds. **4+4**
 3. a) Describe S_N1 reaction with mechanism. **4+4**
 b) What are annulenes? Discuss its aromaticity. **4+4**

4. a) Discuss the mechanism of Friedel-Crafts acylation.
b) Explain with an example Saytzeff rule of elimination. 4+4
5. a) Outline Skraup synthesis of quinoline.
b) Discuss the effect of substituents on the strength of organic bases with appropriate examples. 4+4
6. a) Outline the synthesis of any one dipeptide.
b) How the configuration of glucose is established? 4+4

PART-C

Answer any THREE of the following questions. 3x13=39

7. a) Discuss the primary and secondary structure of proteins.
b) Elucidate the structure of sucrose. 7+6
8. a) Write any two methods each for the synthesis of thiophene and pyrrole.
b) What is Chichibabin reaction? Write the product obtained in the case of pyridine. 8+5
9. a) Explain the mechanism of E1 reaction and predict the stereochemistry involved in it.
b) Discuss the mechanism of nitration of i) Toluene ii) Nitrobenzene. 7+6
10. a) Write a note on conformational analysis of cyclohexane.
b) How can be *cis* and *trans* isomers distinguished by physical and chemical methods? 7+6
11. a) What are carbenes? How are they generated? Discuss any one reaction involving carbenes.
b) Write a note on effect of solvent and nature of substrate on S_N1 and S_N2 reactions. 7+6

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M.Sc. (Previous) Degree Examination
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CHEMISTRY
Physical Chemistry

Time : 3 Hours

Max. Marks : 85

- Note :** 1. Answer any ELEVEN question from Part-A, THREE questions from Part-B and any THREE full questions from Part-C.
 2. Figures to the right indicate marks.

PART-A

1. Answer any ELEVEN of the following. 11x2=22
- a) Write the rate expression on the basis of Collision theory and explain the terms involved.
 - b) State and explain steady state approximation with examples.
 - c) Distinguish between chemisorption and physisorption.
 - d) Explain elastic and inelastic scattering with examples.
 - e) What are isotopes and isobars? Give one example for each.
 - f) Mention the uses of radioactive isotopes.
 - g) State and explain coulombs law of electrochemistry.
 - h) Define the terms activity and activity coefficients.
 - i) What are electrolytes? Explain their different kinds with examples.
 - j) Give the difference between galvanic cell and electrolytic cells.
 - k) Represent nickel - cadmium battery and mention its applications.
 - l) Define and mention the significance of decomposition potential.
 - m) State and explain first law of thermodynamics.
 - n) Mention the limitations of Van't Hoff equation.
 - o) What is meant by residual entropy? Explain.

PART-B

- Answer any THREE of the following questions. 3x8=24
2. a) Discuss the factors affecting the critical micellar concentration (CMC)s of Surfactants. 4+4=8
 - b) Discuss about collision theory. 4+4=8
 3. a) Show that half-life period of given radioactive substance is independent of the amount of the substance present initially but it depends upon decay constant. 4+4=8
 - b) Give an account of Power reactors. 4+4=8

4. a) Deduce Debye-Hackel-Onsagar conduction equation.
b) Write a note on ion-selective electrodes. 4+4=8
5. a) Define and explain polarization. Mention the factors affecting polarization.
b) Write a note on over-voltage. 4+4=8
6. a) Deduce Gibbs-Dubem equation.
b) Describe variation of free energy with temperature. 4+4=8

PART-C

Answer any THREE of the following questions. 3x13=39

7. a) Obtain an expression for the rate constant on the basis of activated complex theory.
b) Briefly discuss about Gibbs adsorption isotherm. 7+6=13
8. a) Show that radioactive disintegration follows first order kinetics.
b) Explain nuclear fission and fusion reactions with examples. 7+6=13
9. a) Discuss the Debye-Huckel theory of strong electrolytes.
b) Discuss in detail about biosensors. 7+6=13
10. a) What are fuel cells? How do you classify into different types? Explain the working of hydrogen-oxygen fuel cell.
b) Describe construction, working and applications of dry cell. 7+6=13
11. a) Derive Duhem-Margules equation and mention its applications.
b) Obtain Clausius Clapeyron equation. 7+6=13

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