



H-141001 Seat No. _____
M. Sc. (Sem. I) Examination
November - 2019
MSC0C101 : Inorganic Chemistry
(Old Course)

Time : 3 Hours]

[Total Marks : 70

- 1 (a) Calculate the eigen value for H-atom on the bases of variation method. 7

OR

- (a) Find out the values for correction to the energy and wave function for first order perturbation. 7
(b) Find out the commutator value of the operators L_x and L_z . 7

OR

- (b) Write a note on spherical harmonics. 7

- 2 (a) Explain the difference between Identity matrix and Diagonal matrix with example. 7

OR

- (a) Find out the direct product for 7
(i) $T_2 \times T_1$
(ii) $E \times T_1$ in T_d .
(b) State and explain five important rules about irreducible representations and their characters. 7

OR

- (b) Explain the similarity transformations. 7

- 3 (a) Explain the difference between "Curie temperature" and 'Neel temperature'. 7

OR

- (a) Discuss "Pascal's Constants" with suitable example. 7
(b) Explain the following terms : 7
(1) Torque
(2) Magnetic Induction

OR

- (b) Write a note on Diamagnetism and Diamagnetic Substance. 7

4 (a) Write a note on : 7
Zincmetalloenzymes.

OR

(a) Write a note on Cytochromes. 7

(b) Write a note on Vitamin B₁₂. 7

OR

(b) Explain the following terms : 7

(1) Antimicrobial Agents

(2) Radiodiagnostic Agents

5 Answer the following in short : 14

(1) Define : Angular operator.

(2) When will you use perturbation method ?

(3) What is the application of commutator relationship ?

(4) Write : $R_{(r)}$ equation.

(5) What is transpose of a matrix ?

(6) Write the reducible representation $T_1 + E$ in T_d molecule.

(7) How do we designate all three dimensional representation in character table ?

(8) Define : Ferromagnetism.

(9) Define : Magnetic Induction.

(10) What is Magnetic Susceptibility ?

(11) Explain the term : Doming.

(12) Define : Toxic metals and give its example.

(13) What is Enzymes ?

(14) What is the biological function of Manganese ?



H-141002

Seat No. _____

M. Sc. (Sem. I) Examination

November - 2019

MSC0C102 : Organic Chemistry
(Old Course)

Time : 3 Hours]

[Total Marks : 70

Instructions: (1) All questions are compulsory

(2) Figures to Right indicate full marks.

1. Answer the following

(A) (i) Explain how (erythro) 1,2-dibromo 1,2-diphenyl ethane yields cis product while its dl (threo) form gives trans product through E_2 reaction. 04

(ii) Discuss E_1CB reaction with supporting evidences. 03

OR

(i) Explain Hofmanns and Saytzeffs rule of elimination with suitable illustrations. 04

(ii) Compare Chugave and Cope reaction with example. 03

(B) (i) Base catalysed hydrolysis of β -dichloro diethyl sulphide in dioxane proceeds thousand time faster as compound to β -chloro diethyl ether. Explain. 04

(ii) Conversion of 5-methyl-2-cyclohexenol to trans 3-chloro-5-methyl cyclohexene with retention of configuration. Name the reaction and explain giving mechanism. 03

OR

(i) Ethanolysis of conjugate base of 2-(p-hydroxy phenyl) ethyl bromide occurs much faster than 2-(p-methoxy phenyl) ethylbromide. Explain giving suitable mechanism. 04

(ii) Discuss mixed SN^1 and SN^2 mechanism with suitable examples. 03

2. Answer the following :

(A) (i) What is diatropic current ? Discuss its role in determining aromaticity. 04
(ii) Prepare HMO diagram for cyclopropenyl anion and cycloheptatrienyl cation using froth circle method . Discuss their aromatic character. 03

OR

(i) State the huckel's rule of aromaticity and explain the terms antiaromaticity and non- aromaticity. 04

(ii) Discuss the aromaticity in different annulenes. 03

- (B) (i) Explain with suitable example hybridization and field effect on the strength of acid. 04
(ii) Give Hammett equation. Explain the terms involved in it. 03
- OR**
- (i) Guanidine is the stronger base than amine. Explain. 04
(ii) Discuss the application and limitations of Hammett equation. 03
- 3. Answer the following:**
- (A) (i) Discuss non-classical carbocations. 04
(ii) Discuss the structure and stability of carbenes. 03
- OR**
- (i) What are free radicals? Discuss their stability. 04
(ii) Discuss the structure and stability of carbocation. 03
- (B) Answer the following:**
- (i) Discuss the mechanism and application of pinacol-pinacolone rearrangement. 04
(ii) Discuss migration aptitude in Baeyer-Villiger's rearrangement. 03
- OR**
- (i) Discuss the mechanism and application of Curtius rearrangement. 04
(ii) Discuss the mechanism and application of hydroperoxide rearrangement. 03
- 4. Answer the following :**
- (A) (i) Discuss the stereoselective and stereospecific reactions. Describe any three methods of resolution of racemates. 07
- OR**
- (i) Discuss the stereochemistry of quaternary ammonium salts. 07
- (B) (i) Discuss the stereochemistry of spiranes and sulphoxides. 07**
- OR**
- (i) Discuss the stereochemistry of allenes. 07
- 5. Answer the following: 14**
- (i) Explain the effect of hydrogen bonding in determining the strength of acid.
(ii) What principle of Favorsky rearrangement.
(iii) What are nitrenes ?
(iv) Define homotopic and enantiotropic atom.
(v) Mention various types of configurational isomers.
(vi) Explain helicity.
(vii) How acid azides are converted to corresponding urethanes?
(viii) Give cope elimination reaction.
(ix) What is neighbouring group effects.
(x) Give one reaction of carboxylate anion as neighbouring groups.
(xi) Giving the reactions show the end product when alcohol is dehydrated.
(xii) What is homoaromatic system?
(xiii) Protonation of Pyrrole is occurring on carbon and not on nitrogen- Explain.
(xiv) Why compared to [14] annulene, [18] annulene is stable?



H-141003

Seat No. _____

M. Sc. (Sem. I) Examination

November – 2019

MSC0C103 – Physical Chemistry

(Old Course)

Time : 3 Hours]

[Total Marks : 70

Instruction : All questions carry equal marks.

Necessary constants :

$$N = 6.022 \times 10^{23} \text{ mole}^{-1}$$

$$K = 1.38 \times 10^{-16} \text{ erg. K}^{-1} = 1.38 \times 10^{-23} \text{ J.K}^{-1}$$

$$h = 6.626 \times 10^{-27} \text{ erg. sec} = 6.626 \times 10^{-34} \text{ J.sec.}$$

$$C = 2.998 \times 10^{10} \text{ C.M. Sec.}^{-1} = 2.998 \times 10^8 \text{ m.sec}^{-1}.$$

$$R = 8.3145 \times 10^7 \text{ erg. k}^{-1} \text{ mole}^{-1} = 8.3145 \text{ J.K}^{-1} \text{ mole}^{-1} = 1.987 \text{ cal deg}^{-1} \text{ mole}^{-1}.$$

$$F = 96500 \text{ coulomb.}$$

- 1 (a) Discuss the Nernst's heat theorem and derive an equation giving the relation between free energy, enthalpy and heat capacity. 7

OR

Discuss Gibbs–Duhem equation.

- (b) What are partial molar properties ? Show how partial molar volume can be determined by density measurements? 7

OR

Calculate the fugacity of N_2 gas at 0°C and pressure of 50 atmosphere and 100 atmosphere, it being given

that the value of integral of $\frac{\alpha}{RT}$ between $P = 0$ and

$P = P$ is 0.0206 at 50 atm and -0.6060 at 100 atmosphere.

- 2 (a) Discuss activated complex theory of bimolecular reaction. 7

OR

Discuss the kinetics of branched chain reaction.

- (b) Discuss the Lindemann theory of unimolecular reaction. 7
- OR**
- (b) (i) Write a note on explosion limit.
(ii) Write a note on energy catalyzed reaction.
- 3** (a) Discuss defects in solid. 7
- OR**
- Derive an equation to calculate number of Schottky defects in solids.
- (b) Write note on Superconductivity. 7
- OR**
- Explain Band theory of metals.
- 4** (a) Derive BET equation. 7
- OR**
- Discuss any two methods for the determination of surface area of adsorbents.
- (b) Derive Gibbs absorption isotherm and explain positive and negative surface activity from it.
- OR**
- (b) (1) Write a note on Critical Micellar Concentration. 7
- (2) For 3×10^{-4} m solution of an organic acid $\frac{dr}{dc}$ is 7
 $- 0.08 \text{ Nm}^2 \text{ mole}^{-1}$ at 25° C . Calculate Surface excess of the acid.
- 5** Answer the following questions in one or two lines : 14
- (1) Define chemical potential.
 - (2) Define Raoult's law.
 - (3) Define fugacity.
 - (4) Give relation between Joule and erg.
 - (5) Define order of the reaction.
 - (6) Define energy of activation.
 - (7) Define chain reaction.
 - (8) Define unit cell.
 - (9) Define Franckel defects.
 - (10) What is conductance ?
 - (11) What is surface tension ?
 - (12) Define micellar.
 - (13) Write full form of BET equation.
 - (14) Give two characteristics of physical adsorption.



H-141004

Seat No. _____

M. Sc. (Sem. I) Examination

November - 2019

MSC0C104 : Analytical Chemistry

Time : 3 Hours]

[Total Marks : 70

1 Answer the following :

- (a) Write a short note on the scope of analytical science and its Literature. 7

OR

Write a short note on control charts, confidence interval and confidence limits.

- (b) Explain the important of quality assurance and quality control in GLP. 7

OR

Write a brief note on Q-test from the following data predict the acceptance or rejection of the questionable value. If any 0.189, 0.167, 0.187, 0.183, 0.186, 0.182, 0.181, 0.184, 0.181, 0.177. (The tabulated value for rejection at 95% confidence is 0.466)

2 Answer the following :

- (a) Explain the brief the procedure to find the best straight line using least square regression. 7

OR

What is sampling and sample preparation? Discuss the general steps involved in chemical analysis.

- (b) Write a brief note on the use of Internal standard and standard addition technique with an illustration. 7

OR

Discuss in detail correlation co-efficient and calibration curves.

- 3** Answer the following :
- (a) Explain in brief circular Dichroism and Optical rotator Dispersion. **7**
- OR**
- Write a short note on Derivative spectrophotometry.
- (b) Write a brief note on ' Ringbom plot.' **7**
- OR**
- Derive Lambert-Beer's law in technical analysis and state its limitations.
- 4** Answer the following :
- (a) Describe the role of continuous variation method in finding stoichiometry of a complex. **7**
- OR**
- How will you measure an equilibrium constant using Setchard plot ?
- (b) Illustrate various photometric titration curves and its advantages in locating the equivalence point. **7**
- OR**
- Explain the analysis of mixture when (1) the individual spectra overlap and (2) the individual spectra are well resolved.
- 5** Answer in brief : (one marks each). **14**
- (1) What are quality control charts?
 - (2) Define limit of detection and limit of quantitation.
 - (3) Define significant figures: - 0.0070106.
 - (4) Define: - molality and normality.
 - (5) What do you understand by confidence limits?
 - (6) Define:- Auxochrome and chromophore.
 - (7) Give names of any two validation parameters.
 - (8) Explain the Vibration spectra.
 - (9) Give the wavelength region of UV-Visible radiation.
 - (10) Give Unit's of absorbance and molar absorptive.
 - (11) Define wavelength and wave number.
 - (12) Significance of Ringbom plot.
 - (13) What is derivative spectrophotometry ?
 - (14) Give the relation between absorbance and transmittance.



H-301001 Seat No. _____
M. Sc. (Sem. I) Examination
November - 2019
MSC1C101 : Inorganic Chemistry
(New Course)

Time : 3 Hours]

[Total Marks : 70

- 1 (A) For simple harmonic oscillator prove that $E = \frac{1}{2}ka^2$. 7

OR

Find out the commutator value of the operators
 L_x and L_z .

- (B) State perturbation principle. Give its application 7
to Helium atom.

OR

Show that $[L_x, L_y] = iL_z$.

- 2 (A) Explain the great orthogonality theorem. 7

OR

Discuss the difference between Identity matrix and
Diagonal matrix with suitable example.

- (B) Explain the Similarity transformations. 7

OR

For a point with a coordinate x,y,z obtain the matrix
for symmetry operation E and C_n .

- 3 (A) Explain the following terms : 7
(1) Magnetic susceptibility
(2) Torque

OR

Explain Curie-Weiss Law.

(B) Explain the types of antiferromagnetism. 7

OR

Discuss the "Pascal's constants" with suitable example.

4 (A) Discuss in detail cytochrome. 7

OR

Explain the discovery, synthesis and mode of action of Cis-platin.

(B) Write a note on biological nitrogen fixation. 7

OR

Explain the following terms :

(1) Chelation therapy.

(2) Magnetic resonance imaging.

5 Answer the following in short : 14

(1) What is Hermitian operator ?

(2) Define : Linear Operator.

(3) Write any two applications of variation principle.

(4) What is the value of L_+L_- ?

(5) Define : Matrix

(6) Define : Vector

(7) What is non-zero matrix element ?

(8) Give the meaning of "permeability".

(9) Define : Diamagnetic susceptibility.

(10) Define : Ferromagnetism.

(11) Which are the essential and trace elements in biological system ?

(12) What is Metalloporphyrins ?

(13) Deficiency of which metal ion is seen in diabetes and leukemia ?

(14) Write the drawback of MRI.



H-301002

Seat No. _____

M. Sc. (Sem. I) Examination

November - 2019

**MSC1C102 : Organic Chemistry
(New Course)**

Time : 3 Hours]

[Total Marks : 70

**Instructions: (1) All questions are compulsory
(2) Figures to Right indicate full marks.**

1. Answer the following :

- (A) (1) Give orientation draw structures for all possible E₂ products when 2-bromo butane react with concentrated potassium ethoxide. **04**
(2) Explain the effects of solvent and leaving group on Elimination reactions. **03**

OR

- (1) Discuss the E₁CB reaction with Supporting evidence. **04**
(2) Explain Hoffmans and Satzeffs rule of elimination with evidence. **03**
(B) (1) Give mixed SN¹, SN² reaction with supporting evidence. **04**
(2) What is allylic rearrangement? Explain allylic rearrangement suitable example. **03**

OR

- (1) Explain SET mechanism with supporting evidence. **04**
(2) Base catalysed hydrolysis of β-dichloro diethylsulphide in dioxane proceeds Thousand time faster as compared to β-chloro diethyl ether Explain. **03**

2. Answer the following :

- (A) (1) Using first circle method show, Cyclopentadiene anion is aromatic while Cyclooctatetraene is non aromatic. **04**
(2) What is diatropic current? Discuss its role in determining aromaticity. **03**

OR

- (1) State Huckels rule of aromaticity. Explain the terms of non-aromaticity and anti-aromaticity given illustrations. **04**
(2) Discuss aromaticity in different Annulenes. **03**
(B) (1) Explain why Maleic acid is stronger acid than Fumaric acid? **04**
(2) Discuss the applications and limitations of Hammett equation. **03**

OR

- (1) Explain with suitable example of hybridization an effect on the strength of acid. **04**
(2) Guanidine acid is strong base than amine. Explain **03**

3. Answer the following :

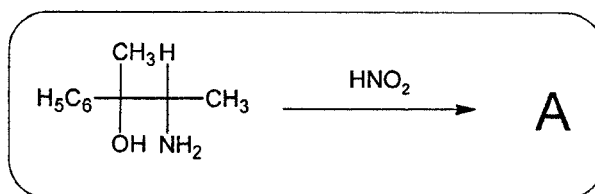
- (A) (1) Discuss three different reaction in which carbanion is a reactive intermediate. **04**
(2) Discuss non-classical carbocations. **03**

OR

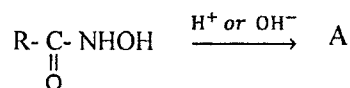
- (1) What are free radicals? How they are generated ? Discuss their stability 04
 (2) Discuss method to distinguish singlet & triplet carbenes. 03
 (B) (1) $RCHO + HN_3 \longrightarrow A$ 04
 Identify product A, Name the rearrangement and offer suitable mechanism for this conversion.
 (2) $PhCH_2COCH_2Br \longrightarrow A$ 03
 Identify product A, Name the rearrangement and offer suitable mechanism for this conversion.

OR

- (1) Identify product A, Name the rearrangement and offer suitable mechanism for this conversion. 04



- (2) Identify product A, Name the rearrangement and offer suitable mechanism for this conversion. 03



4. Answer the following.

- (A) Explain (a) Geometrical isomerism (b) Chiral center & Chirality 07

OR

- (a) Optical isomerism (b) Origin of chirality and prochiral centre. 07

- (B) Explain (a) Enantiotopic and Diastereotopic atoms (b) Diastereotopic Groups and Faces 07

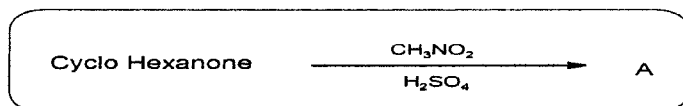
OR

- (a) stereochemistry in addition reaction for alkenes with suitable example. 07

5. Answer the following :

14

1. Give the limitations of Huckel's rule.
2. Giving example discuss geometrical isomerism.
3. Give mechanism for carbyl amine reaction.
4. What are bridged carbocations?
5. What are nitrenes?
6. Mention various types of configurational isomers.
7. Write structure of A and name the reaction.



8. What are neighboring group effects?
9. What is homoaromatic system?

10. Why compared to [14] annulene, [18] annulene is stable?
 11. Write principle of Schmidt rearrangement.
 12. What is Inductive effect?
 13. Give name of singlet and triplet carbenes distinguish method
 14. Give example of quasi-Favorski rearrangement.
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H-301003

Seat No. _____

M. Sc. (Sem. I) Examination

November - 2019

MSC1C103 : Physical Chemistry

(New Course)

Time : 3 Hours]

[Total Marks : 70

Instruction : All questions carry equal marks.

Necessary constants :

$$N = 6.022 \times 10^{23} \text{ mole}^{-1}$$

$$K = 1.38 \times 10^{-16} \text{ erg. K}^{-1} = 1.38 \times 10^{-23} \text{ J.K}^{-1}$$

$$h = 6.626 \times 10^{-27} \text{ erg. sec} = 6.626 \times 10^{-34} \text{ J.sec.}$$

$$c = 2.998 \times 10^{10} \text{ cm. sec.}^{-1} = 2.998 \times 10^8 \text{ m.sec}^{-1}.$$

$$R = 8.3145 \times 10^7 \text{ erg. K}^{-1} \text{ mole}^{-1} = 8.3145 \text{ J.K}^{-1}$$

$$\text{mole}^{-1} = 1.987 \text{ cal deg}^{-1} \text{ mole}^{-1}.$$

$$F = 96500 \text{ coulomb.}$$

- 1 (a) Discuss the Nernst's heat theorem and derive an equation giving the relation between free energy, enthalpy and heat capacity. 7

OR

- (a) Explain the term partial molal free energy. Derive the Gibbs-Duhem equation. 7
- (b) Calculate the entropy of SO_2 from the following data. The value of C_{pat} at 15 K is $0.83 \text{ cal deg}^{-1} \text{ mole}^{-1}$. On integration of CP/T from 15K to 197.6 K it gives entropy of $20.1 \text{ cal deg}^{-1} \text{ mole}^{-1}$. At this temperature the heat of fusion is $1769 \text{ cal mole}^{-1}$. On integration of CP/T from 197.6 K to 263.1 K, it gives entropy of $6.0 \text{ cal deg}^{-1} \text{ mole}^{-1}$. The heat of vaporization of liquid SO_2 is $5960 \text{ cal mole}^{-1}$. On integration of gaseous CP/T from 263.1 K to 298 K, it gives entropy of $1.2 \text{ cal deg}^{-1} \text{ mole}^{-1}$. The correction of entropy for gas imperfection is $0.1 \text{ cal deg}^{-1} \text{ mole}^{-1}$. 7

OR

- (b) Calculate the fugacity of N_2 gas at 0°C and pressure of 50 atmosphere and 100 atmosphere, it being given that the value of integral of $\frac{\alpha}{RT}$ between $P = 0$ and $P = P$ is 0.0206 at 50 atm and -0.6060 at 100 atmosphere. 7

- 2 (a) Discuss activated complex theory of bimolecular reaction. 7

OR

- (a) Discuss the kinetics of branched chain reaction. 7

- (b) Discuss the Lindemann theory of unimolecular reaction. 7

OR

- (b) Calculate the entropy of activation ΔS^* for a reaction $H_2 + I_2 \rightleftharpoons 2HI$ at 575 K. The value of frequency factor A is $7.94 \times 10^{10} \text{ sec}^{-1}$. 7

- 3 (a) Discuss defects in solid. 7

OR

- (a) Derive an equation to calculate number of Frenkel defects in solids. 7

- (b) Write note on electrical conductivity in solids. 7

OR

- (b) Explain Band theory of metals. 7

- 4 (a) Derive BET equation. 7

OR

- (a) Discuss any two methods for the determination of surface area of adsorbents. 7

- (b) (1) Write a note on detergents. 3

OR

- (b) (1) Write a note on critical micellar concentration. 3

- (2) According to BET isotherm the value of V_m for absorption of nitrogen gas on silica gel at -183°C is $116.2 \text{ ml gram}^{-1}$. The surface area of silica gel is $506.3 \text{ m}^{-2} \text{ gram}^{-1}$. Calculate the area covered by one molecule of nitrogen. 4

OR

- (2) In the study of absorption of nitrogen gas on $\text{Fe-Al}_2\text{O}_3$ at 77°K the area occupied by a molecule of nitrogen is 16.2 \AA^2 . If the specific area of Al_2O_3 is $12.46 \text{ m}^{-2} \text{ gram}^{-1}$. Calculate the value of V_m in BET isotherm.

5 Answer the following questions in one or two lines : 14

- (1) Define chemical potential.
 - (2) What is fugacity ?
 - (3) Define Raoult's law.
 - (4) Give the value of gas constant in different four units.
 - (5) Define molecularity of the reaction.
 - (6) Define energy of activation.
 - (7) Define chain reaction.
 - (8) Define unit cell.
 - (9) Define Schottky defects.
 - (10) What is conductance ?
 - (11) What is surface tension ?
 - (12) Define micellar.
 - (13) Write full form of BET equation.
 - (14) Give two characteristics of physical adsorption.
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H-301004

Seat No. _____

M. Sc. (Sem. I) Examination

November - 2019

MSCOC104 : Analytical chemistry

(New Course)

Time : 3 Hours]

[Total Marks : 70

1 Answer the following :

(A) Describe qualitative and quantities analysis in analytical Science with a suitable example. 7

OR

(A) Write a short note on control charts, confidence interval and confidence limits. 7

(B) Explain the important of quality assurance and quality control in GLP. 7

OR

(B) Describe in brief the scope of analytical Science and its literature. 7

2 Answer the following :

(A) Explain the brief the procedure to find the best straight line using least square regression. 7

OR

(A) What is sampling and sample preparation? Discuss the general steps involved in chemical analysis. 7

(B) Write a brief note on the use of Internal standard and standard addition technique with an illustration. 7

OR

(B) Discuss in detail correlation co-efficient and calibration curves. 7

3 Answer the following :

(A) Explain different components of UV-Visible Spectrophotometer. 7

OR

- (A) Write a short note on Derivative spectrophotometry. 7
- (B) Write a brief note on 'Ringbom plot.' 7
- OR**
- (B) Derive Lambert-Beer's law in technical analysis and state its limitations. 7
- 4 Answer the following : 7
- (A) Explain the analysis of a mixture with resolved and unresolved spectra. 7
- OR**
- (A) How will you measure an equilibrium constant using Sctchard plot? 7
- (B) Illustrate various photometric titration curves and its advantages in locating the equivalence point. 7
- OR**
- (B) Explain the analysis of a mixture when : 7
- (1) The individual spectra overlap and
- (2) The individual spectra are well resolved.
- 4 Answer in brief : (One marks each) 14
- (1) Define : Significant figures.
- (2) What are quality control charts?
- (3) Define significant figures: - 0.0070106.
- (4) Define : mole fraction.
- (5) What do you understand by confidence limits?
- (6) Define : Auxochrome and chromophore.
- (7) Give names of any two validation parameters.
- (8) Explain the Vibration spectra.
- (9) Give the wavelength region of UV-Visible radiation.
- (10) Give Unit's of absorbance and molar absorptivity.
- (11) Define wavelength and wave number.
- (12) State any two application of spectrophotometry.
- (13) Significance of Ringbom plot.
- (14) What is derivative spectrophotometry?