

M.Sc. Sem.-I

Dec. 2016

MSC0C 101 - Inorganic Chemistry

Time : 3 Hours

[Max. Marks : 70]

- Instruction : (1) Figures to the right indicate full Marks.
(2) Indicate clearly the options you attempt.

1 Answer the following questions :

- (a) Explain the postulates of quantum mechanics 7
OR

Explain step up and step down operators of angular momentum.

Prove that $[\hat{L}_x, \hat{L}_y] = i\hbar \hat{L}_z$

- (b) For Simple harmonic oscillator prove that $E = \frac{1}{2}ka^2$ 7
OR

Discuss the variation method.

2 Answer the following questions :

- (a) Find out the direct product for 7
(i) $T_1 \times T_2$ in T_d (ii) $A_1 \times B_1$ in C_{2v}
OR

What is character table ? Explain its different compartments.

- (b) Discuss five important rules about irreducible representations and their characters. 7
OR

With the help of character table obtain irreducible components of following representation

C_4V	E	$2C_4$	C_2	$2\sigma_v$	$2\sigma_d$
	6	0	2	0	0

- 3 Answer the following questions:
- (a) Discuss the types of Antiferromagnetism. 7
- OR
- Explain about the different between Curie's and Neel's Temperature.
- (b) Explain the Pascal's constants and its utility. 7
- OR
- Discuss the super exchange mechanism.
- 4 Answer the following questions :
- (a) Write a note on Hemoglobin. 7
- OR
- Write a note on Cytochrome.
- (b) Explain the role of metal Complexes as radiodiagnostic agents. 7
- OR
- Write a note on Vitamin B₁₂.
- 5 Answer the following questions in short 14
- 1) Write the equation of $R(r)$, $\theta(\theta)$, $\phi(\phi)$
 - 2) Define: angular momentum operator.
 - 3) What is the application of Approximation method.
 - 4) Give an example of orthogonal matrix.
 - 5) Define: Vectors
 - 6) The quantum number l is known as
 - 7) What is curie-weiss law ?
 - 8) Define : Magnetic Induction.
 - 9) Give the methods for determination of magnetic susceptibility.
 - 10) Give the types of Magnetism.
 - 11) What is toxic metal ?
 - 12) Define : Enzymes.
 - 13) What is biological importance of Na and K.
 - 14) Write the definition of trace elements.

M.Sc. Sem.-I

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MSC0C 102 - Organic Chemistry

Time : 3 Hours

[Max. Marks : 70]

- Instruction : (1) Figures to the right indicate full Marks.
(2) Indicate clearly the options you attempt.

1 Answer the following :

- (A) (1) Discuss the E_2 reaction mechanism with its stereo aspects. 4
(2) Explain the effects of solvent and leaving group on Elimination reactions. 3

OR

- (1) Discuss the E_{1cb} reaction with supporting evidence.
(2) Explain Hoffman's and Satzeff's rule of elimination with evidence.

(B) Answer the following:

- (1) Give mixed SN^1 , SN^2 reaction with supporting evidence. 4
(2) What is allylic rearrangement? Explain allylic rearrangement Suitable example 3

OR

- (1) Explain SET mechanism with supporting evidence.
(2) Base catalysed hydrolysis of β -dichloro diethyl sulphide in dioxane Proceeds thousand time faster as compare to β -chloro diethyl ether – Explain.

2 Answer the following:

- (A) (1) Using forst circle method show, why Cyclopentadiene anion is aromatic 4
while Cyclooctatetrane is non aromatic ?

- (2) What is diatropic current? Discuss its role in determining aromaticity. 3

OR

- (1) Explain why Benzene is aromatic while fulvenes is non aromatic.
(2) Discuss aromatic character of azulene.

(B) Answer the following:

- (1) Explain why Maleic acid is strong acid than Fumeric acid ? 4
(2) Discuss the application and limitations of Hammett equation. 3

OR

- (1) Explain with suitable example of hybridization and field effect on the strength of acid.
(2) Succinamide is stronger acid than amide- Explain.

- Q-3 Answer the following:
- (A) (1) Discuss non-classical carbocations. 4
(2) Discuss the structure and stability of carbenes. 3
- OR
- (1) What are free radicals? Discuss their stability?
(2) Discuss the structure and stability of carbocation.
- (B) Answer the following:
- (1) Discuss the mechanism and application of pinacol-pinacolone rearrangement. 4
(2) Discuss migration aptitude in Baeyer-Villiger's rearrangement. 3
- OR
- (1) Discuss the mechanism and application of Curtius rearrangement.
(2) Discuss the mechanism and application of hydroperoxide rearrangement.
- 4 Answer the following :
- (A) (1) What are spirans? Discuss their stereochemistry. 4
(2) Discuss prochiral relationship with suitable examples. 3
- OR
- Discuss the stereochemistry of biphenyl compounds. 7
- (B) Answer the following:
Explain stereoselective and stereospecific reactions. Describe any three method for resolution of racemates. 7
- OR
- Discuss the stereochemistry of allenes.
- 5 Answer the following: 14
- (1) Give cope elimination reaction.
 - (2) What is neighboring group effects ?
 - (3) Give one reaction of carboxylate anion as neighboring group.
 - (4) Giving the reaction show the end product when alcohol is dehydrated.
 - (5) What is homoaromatic system?
 - (6) Protonation of Pyrrole is occurring on carbon and not on nitrogen – Explain.
 - (7) Why compared to [14] annulene, [18] annulene is stable ?
 - (8) Which is more acidic in phenol or acetic acid ? Why ?
 - (9) What are nitrenes?
 - (10) Give mechanism for carbonyl amine reaction.
 - (11) Write principle of Schmidt rearrangement.
 - (12) Define homotropic and enantiotropic atom.
 - (13) What is optical activity ?
 - (14) What is isomerism and give Geometrical isomers structure.
 - (15) How acid chloride is converted to urethane ?

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MSC0C 103 - Physical Chemistry

Time : 3 Hours

[Max. Marks : 70]

Instruction : All questions carry equal marks.

Necessary Constants:

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

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

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

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

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

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

- 1 (A) State the third law of thermodynamics. Show how the absolute entropy of a substance can be determined with the help of this law. 7
- OR
- Derive Gibbs-Duhem equation.
- (B) Answer the Following questions. 7
- (i) What are partial molar properties? Show how partial molar volume can be determined by density measurements.
- (ii) What is fugacity of a gas when its activity coefficient is 0.936 at 22 atm. Pressure.
- OR
- (i) Determine fugacity using Vander Waal's equation.
- (ii) For reaction $\text{CO}_{2(g)} + \text{H}_2 \rightarrow \text{CO}_{(g)} + \text{H}_2\text{O}_{(g)}$ $\Delta H = 10,000 \text{ cal}$ The chemical constants for H_2 , CO_2 , CO and H_2O are 1.6, 3.2, 3.5 and 3.6 respectively. Calculate K_p at 800°C .
- 2 (A) Discuss Lindemann theory of unimolecular reaction. 7
- OR
- Define Chain reaction and discuss kinetics of chain reaction.
- (B) Answer the Following questions. 7
- (i) Write a note on explosion limit.
- (ii) Calculate the entropy of activation (ΔS^*) for a reaction $\text{H}_2 + \text{I}_2 \rightleftharpoons 2\text{HI}$ at 575°K . The value of frequency factor A is $7.94 \times 10^{10} \text{ sec}^{-1}$

OR

- (i) write a note on energy catalyzed reaction.
- (ii) The energy of activation for the decomposition of N_2O_5 in to NO_2 and O_2 is $24.7 \text{ K.Cal.mole}^{-1}$ If the rate constant is $4.0 \times 10^{-5} \text{ sec}^{-1}$ at 27°C , calculate the frequency factor A in Arrhenius equation. Where $R = 1.987 \text{ cal deg}^{-1} \text{ mol}^{-1}$

3 (A) Discuss defects in solid. 7

OR

Classify materials in to conductors, semi conductors and Insulators
Explain on what basis this classification is made.

(B) Explain Bond theory of metals. 7

OR

Discuss super conductivity.

4 (A) derive BET theory. 7

OR

Derive Gibbs adsorption isotherm equation and explain surface activity from this equation.

(B) Answer the Following questions. 7

- (i) explain Critical Miceller concentration.
- (ii) In the study of adsorption of Nitrogen on $Fe-Al_2O_3$ at 77°K the area occupied by molecular of Nitrogen is 16.2 A^2 If the specific area of Al_2O_3 is $12.46 \text{ M}^2\text{gm}^{-1}$, Calculate the Value of V_m in BET equation.

OR

- (i) write a note on Detergents.
- (ii) According to BET equation, the value of V_m for adsorption of Nitrogen gas on Silica gel at -183°C is 116.2 m/gm^{-1} . The surface area of the Silica get is $506.3 \text{ m}^2\text{gm}^{-1}$..calculate the area covered by one molecule of Nitrogen.

5 Answer the following questions in one or two sentence. 14

1. Write the mathematical form of Nernst's -heat theorem and explain the terms.
2. What is the relation between Joule and erg ?
3. Define Chemical potential.
4. What is fugacity ?
5. What is activity ?
6. Define order of reaction.
7. What is enzyme?
8. Define Unit cell.
9. Define Schottky defects.
10. Define Semi conductor.
11. Define insulator.
12. What is Absorption ?
13. Define surface tension.
14. What are Miceller?

Seat No. : _____

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MSC0C 104 - Analytical Chemistry

Time : 3 Hours

[Max. Marks : 70]

Instruction : All questions carry equal marks.

1 Answer the following.

- (a) Discuss in brief ways to express accuracy and precision and explain types of error. 7

OR

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

- (b) Describe qualitative and quantitative analysis in analytical science with a suitable example. 7

OR

Write a short note on scope of analytical science and its literature.

2 Answer the following.

- (a) What is Sampling ? Explain different sample preparation steps during chemical analysis. 7

OR

Discuss in detail correlation co-efficient and calibration curves.

- (b) How will you find the 'best straight line' using least square linear regression ? 7

OR

Discuss the significance of internal standard and standard addition technique in quantitative analysis.

3 Answer the following.

- (a) Derive Lambert- Beer's law in chemical analysis and state its limitation. 7

OR

Write a brief note on circular dichroism and optical rotator dispersion.

- (b) Explain different components of a UV- visible spectrophotometer. 7

OR

Write a brief note on Ringbomplot.

4 Answer the following.

(a) How will you measure an equilibrium constant using Scatchard plot ? 7

OR

Explain the analysis of a mixture with resolved and unresolved UV- spectra.

(b) Discuss the Job's method of continuous variation for determining the composition of a complex. 7

OR

Write a brief note on Photometric titration.

5 Answer the following. (Short Answer) 14

1. Define : Significant figures.
2. Define : Standard deviation and variance.
3. Give two name of Journal with its publishers.
4. Give definition of Accuracy and precision.
5. Give important of control chart.
6. What does the value of correlation co-efficient $r = 1$, suggest?
7. What is chromospheres?
8. Explain in brief vibrational spectra.
9. Give the wavelength region for UV-visible radiation.
10. Define : Monochromatic light.
11. Give Unit for absorbance and molar absorbance.
12. Define : Molar fraction.
13. What is signified by residues in a calibration.
14. State any two application of spectrophotometry.