

FACULTY OF SCIENCE

M. Sc. II – Semester Examination, May / June 2019

Subject : Chemistry

Paper – I : Inorganic Chemistry

Time : 3 Hours

Max. Marks: 80

Note : Answer all questions from Part–A and Part–B. Each question carries 8 marks in Part–A and 12 marks in Part – B.

PART – A (4 x 8 = 32 Marks)

(Short Answer Type)

- 1 (a) What are the salient features of inner sphere mechanism?
 (b) Explain SN^1 CB mechanism with an example.
- 2 (a) Explain j – j coupling scheme.
 (b) Define microstate. Calculate the number of microstates possible for d^2 configuration.
- 3 (a) Explain the total electron count theory with examples.
 (b) Write a note on Hoffman's isolable analogy.
- 4 (a) Discuss the effect of metal ion concentration on physiological effects.
 (b) Write the geometric aspects of oxygen binding in Hemocyanin and Hemerythrin.

PART – B (4 x 12 = 48 Marks)

(Essay Answer Type)

- 5 (a) Discuss the factors affecting acid hydrolysis reactions.
 (b) What is Trans effect? Explain the π -bonding theory of Trans effect.

OR

- (c) Explain the mechanism of nucleophilic substitution reaction without breaking metal – ligand bond.
 (d) Discuss outer sphere electron transfer mechanism with suitable example.

- 6 (a) How do you arrive at the microstates of p^2 configuration? List out all the microstates of p^2 configuration and derive its terms.
 (b) What is an Orgel diagram? Draw the Orgel diagram for d^3 , d^7 octahedral and tetrahedral complexes.

OR

- (c) Write a note on :
 (i) Inter electron repulsion parameters
 (ii) Spin orbit coupling parameters
 (d) Explain the effect of weak cubic crystal fields on S, P and D terms.
- 7 (a) Explain structural features of low nuclear $M_3(Co)_{12}$ and $M_4(Co)_{13}$ clusters.
 (b) What is capping rule? Discuss the structural pattern in monocapped and bicapped metal clusters.

OR

- (c) Discuss metal-Metal bonding features in face sharing bioctahedra with suitable examples.
 (d) Explain structure and bonding in $[Mo_6(Cl)_8]^{4+}$ at $[Nb_6(Cl)_{12}]^{2+}$.

- 8 (a) Write the electronic and magnetic aspects of dioxygen binding in Hemoglobin.
 (b) Discuss the basic principles in the biological selection of elements.

OR

- (c) Explain the reaction mechanism of decarboxylation and dealdolization with vitamin B₆ model system.
 (d) Write the Core structure of chlorophyll and explain 'Z' scheme.

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M. Sc. II – Semester Examination, May/June 2019

Subject: Chemistry

Paper – II: Organic Chemistry

Time: 3 Hours

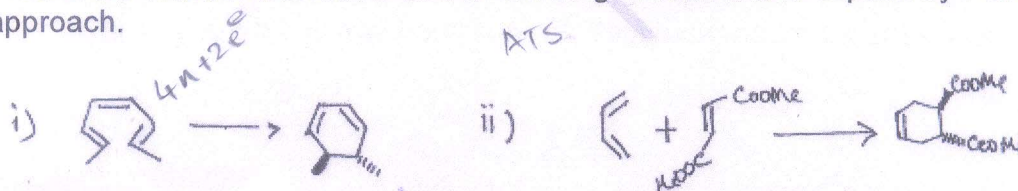
Max. Marks: 80

Note: Answer all questions from Part-A and Part-B. Each question carries 8 marks in Part-A and 12 marks in Part – B.

PART – A (4 x 8 = 32 Marks)
(Short Answer Type)

1. (a) m-Bromoanisole and o-Bromoanisole, both give some product when reacted with $\text{NH}_2^-/\text{NH}_3$. Explain.
 (b) Give an Account of Non-classical carbocations.

2. (a) Predict the reaction condition for the following reactions and explain by PMO approach.



- (b) What are Frontier Molecular orbitals? Explain their use in the $\pi^2s + \pi^2s$ cycloaddition.
3. (a) What is Di- π -Methane rearrangement? Explain with suitable example.
 (b) Explain Norrish Type-II cleavage of carbonyl compounds with suitable example.
4. (a) How are the carbenes and Nitrenes generated?
 (b) What is Smiles rearrangement? Suggest possible mechanism for it.

PART – B (4 x 12 = 48 Marks)
(Essay Answer Type)

5. (a) Differentiate between S_{E}^1 and S_{E}^2 electrophilic substitutions with suitable examples.
 (b) Suggest Mechanism for the following conversion.



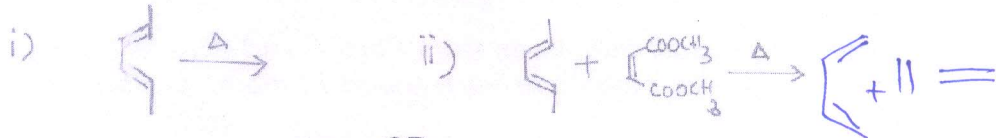
- (ii) Complete the following reaction and give mechanism
 Erythro-3-Bromo-2-butanol $\xrightarrow{\text{HBR}}$?

OR

-2-

- (c) Discuss the S_N^2 - Ar Mechanism.
 (d) What is Neighbouring group Participation (NGP)? Explain with examples involving oxygen and π -bonds.

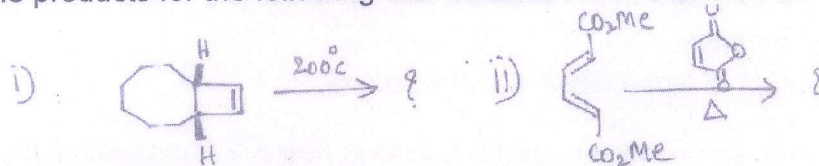
6. (a) Discuss the important features of Pericyclic reactions.
 (b) Give the stereochemistry of the Product in the following and explain by FMO approach.



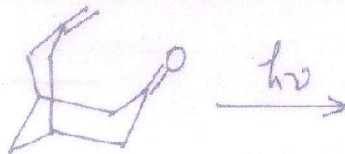
OR

- (c) Construct the correlation diagram for disrotatory ring closure of 1,3-butadiene and explain.

- (d) Predict the products for the following with suitable mechanism.



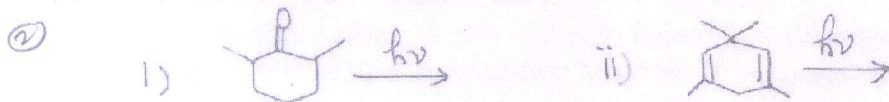
7. (a) What is the Pterno-Biuchi reaction? Predict the product in the following.



- (b) Account the Photochemistry of $\alpha\beta$ - unsaturated carbonyl compounds.

OR

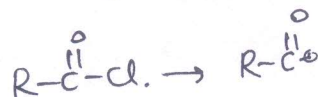
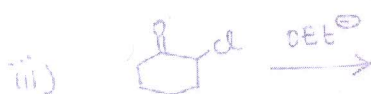
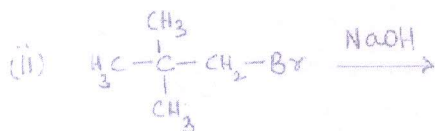
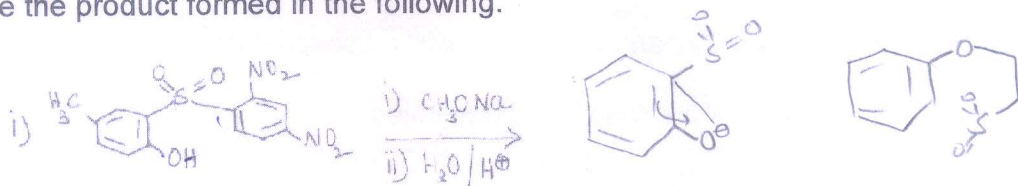
- (c) Complete the following with mechanism



- (d) Explain in detail about photochemical cis/trans isomerisation.

8. (a) Give any two methods of generation of Benzyne. Illustrate its reactions in anomeric nucleophilic substitution.

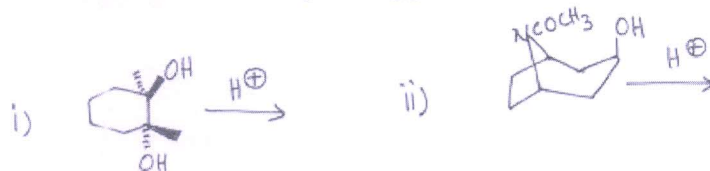
- (b) Write the product formed in the following.



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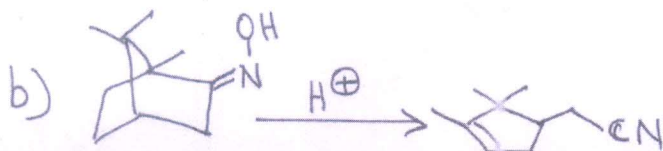
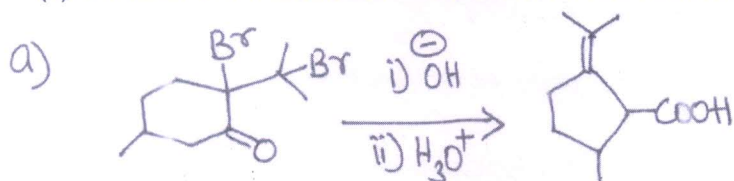
OR

(c) Predict the products for the following? Suggest suitable mechanism.



(d) (i) What are Transannular rearrangement? Suggest mechanism with suitable example.

(ii) Discuss the Plausible mechanism for the following.



FACULTY OF SCIENCE
M. Sc. II – Semester Examination, May / June 2019

Subject : Chemistry
Paper – III : Physical Chemistry

Time : 3 Hours

Max. Marks: 80

Note : Answer all questions from Part–A and Part–B. Each question carries 8 marks in Part–A and 12 marks in Part – B.

PART – A (4 x 8 = 32 Marks)

(Short Answer Type)

- 1 (a) Explain Raoult's law of vapour pressure.
 (b) Write about fugacity and fugacity coefficient.
- 2 (a) Explain the Radiative lifetimes of excited states.
 (b) Discuss the light intensity on the rates of photochemical reactions.
- 3 (a) Explain the Radial and angular functions.
 (b) Write the Variational integral for H_2^+ ion.
- 4 (a) Illustrate the effect of temperature on conductivity of extrinsic semi-conductors.
 (b) Explain the optical properties of nanoparticles.

PART – B (4 x 12 = 48 Marks)

(Essay Answer Type)

- 5 (a) Define (i) Fugacity and (ii) fugacity coefficient . Explain one method for the determination of fugacity.
 (b) Explain various thermodynamic properties of dilute solutions.
 OR
 (c) Explain :
 (i) Vapour pressure lowering
 (ii) Freezing point depression
 (d) Write the expressions for translational and rotational partition functions.
- 6 (a) What is Quantum yield and derive the quantum yield of fluorescence.
 (b) What is delayed fluorescence and explain about E-type delayed fluorescence?
 OR
 (c) Write the Kinetics of photophysical Unimolecular reactions.
 (d) Define Quenching and derive Stern-Volmer equations.
- 7 (a) Write about contour plots and boundary diagrams.
 (b) Explain the Variation theorem and its proof.
 OR
 (c) Illustrate the secular equations and secular determinant with example.
 (d) Explain the MO of H_2 molecule by LCAO method.
- 8 (a) Explain the photoconductivity and photovoltaic effect.
 (b) Write the following:
 (i) Meissner effect (ii) Types of super conductors
 OR
 (c) Describe the phase diagram of Y-Ba-Cu-O systems.
 (d) Explain the sol gel method of preparation of nanoparticles.

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M. Sc. II – Semester Examination, May / June 2019

Subject : Chemistry

Paper – IV : Analytical Techniques and Spectroscopy – II

Time : 3 Hours

Max. Marks: 80

Note : Answer all questions from Part–A and Part–B. Each question carries 8 marks in Part–A and 12 marks in Part – B.

PART – A (4 x 8 = 32 Marks)

(Short Answer Type)

- 1 (a) What is the principle involved in Thermogravimetry?
 (b) Write the applications of amperometric titrations.
- 2 (a) Give an account on magic angle spinning.
 (b) Write short notes on Nuclear overhauser Enhancement.
- 3 (a) Explain the significance of ortho effect.
 (b) Write a brief note on isotopic peaks.
- 4 (a) Discuss the principles of Auger Electron spectroscopy.
 (b) Give an account on Kramer's degeneracy.

PART – B (4 x 12 = 48 Marks)

(Essay Answer Type)

- 5 (a) Write the consequences of Ilkovic equation.
 (b) Describe pulse polarography and give its advantages.
OR
 (c) Explain the cyclic voltammetric study of insecticide parathion.
 (d) Explain how Zn^{2+} ion can be estimated by amperometric titrations.
- 6 (a) Explain how enantiomers can be differentiated by chiral lanthanide shift reagents.
 (b) Discuss the applications of ^{19}F NMR involving coupling with ^{31}P .
OR
 (c) Sketch the ^{31}P NMR spectra for
 (i) H_3PO_3 (ii) PH_3 (iii) Ph_3PSe
 (d) Discuss the applications of solid state NMR.
- 7 (a) What is the principle involved in Electrospray Ionization?
 (b) Discuss the applications of Gas chromatography-mass spectroscopy.
OR
 (c) What is the principle involved in liquid chromatography mass spectrometry?
 (d) Write short notes on Retro Diels Alder Fragmentation.
- 8 (a) Write short notes on :
 (i) Koopman's theorem (ii) Instrumentation of XPS
 (b) Explain PES of N_2 molecule.
OR
 (c) Give an account on selection rules in e.s.r. spectroscopy.
 (d) Write short notes on hyperfine coupling constants.
