CENTRAL UNIVERSITY OF HARYANA

Term End Examinations June/July 2023

Programme: M.Sc. Chemistry **Session: 2022-23**

Semester: Semester-IV **Max. Time: 3 Hours**

Course Title: Inorganic Chemistry-V **Max. Marks: 70**

Course Code: SBS CH 010413 DSE 4004

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.
2. Question no. 2 to 5 have three parts and students need to answer any two parts of each question. Each part carries seven marks.

Question No. 1. **(4X3.5=14)**

a) Briefly describe classification of organometallic compounds on basis of nature, bondings and structures.
b) What do you mean by a slipped sandwich?
c) Show the molecular orbital interaction between metal and ethylene in Zeise's salt.
d) How can you explain covalency in transition metal organometallics?
e) Briefly explain the role of zinc in Reformatsky reaction?
f) What do you mean by β-hydrogen elimination?
g) Discuss water gas shift reaction by taking a suitable example.

Question No. 2. **(2X7=14)**

(a) What is Gilman reagent? Discuss 1,2 and 1,4-addition with the organocopper reagent. Also describe the role of the hard-soft base towards α,β-unsaturated substrates. **(7 marks)**

(b) (i) Briefly discuss role of high-low oxidation state of metal ion on Fischer-Schrock carbenes. **(4 marks)**

(ii) We can view $Ph_3P{=}CH_2$ as a carbene complex of a main-group element. Does it show Fischer- or Schrock-like behavior? Explain why it behaves as it does. **(3 marks)**

(c) (i) What do you mean by first and second-generation Grubbs catalysts? How can you synthesize these catalysts? **(4 marks)**

(ii) Cp_2TiCl_2 reacts with $AlMe_3$ to give $Cp_2Ti(\mu\text{-}Cl)(\mu\text{-}Me)AlMe_2$. Suggest a mechanism. **(3 marks)**

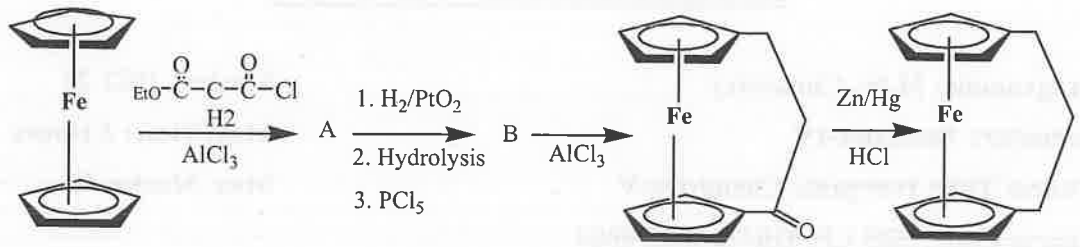
Question No. 3. **(2X7=14)**

a) What are group orbitals for C_5H_5 ligand? Determine which orbitals on iron are appropriate for interaction with group orbitals of C_5H_5 ligands by using sketches of orbitals. **(7 marks)**

b) (i) Develop a qualitative bonding scheme for nickelocene. **(5 marks)**
(ii) What is oligomerization of metallocenes? **(2 marks)**

c) (i) Starting with ferrocene, predict how you could prepare the following. (A) $(C_5H_5)Fe(C_5H_4CH_3)$, (b) $(CH_3C_5H_4)Fe(C_5H_4CH_3)$, (c) $(C_5H_5)Fe(C_5H_4COOH)$ (d) $(C_5H_5)Fe(C_5H_4NO_2)$ and (e) $(C_5H_5)Fe(C_5H_4NH_2)$ **(5 marks)**

(ii) Write the structure of intermediate A and B in the following reaction scheme. **(2 marks)**



Question No. 4. **(2X7=14)**

a) What are differences between Miyaura-Suzuki and Negishi coupling reactions? Discuss role of transition metals in Sonogashira coupling reaction. Also discuss applications of cross-coupling reactions. **(7 marks)**

b) (i) What do you mean by dynamic NMR? How it is important in organometallic compounds? **(3 marks)**

(ii) Briefly discuss decoalescence. **(2 marks)**

(iii) The compound (η^5-allyl)$Mn(CO)_5$ on heating releases a gas and forms a new compound which obeys the 18 electron rule. Identify this new compound and schematically draw its room temperature ^{1}HNMR. Will there be any change in its NMR spectrum when measured at high temperature? Explain. **(3 marks)**

c) (i) Show the sketches of H^{1}NMR peaks in allyl and allene complexes. **(4 marks)**

(ii) What do you mean by ring whizzing and ligand scrambling on metals? **(3 marks)**

Question No. 5. **(2X7=14)**

a) Write the catalytic cycle for the hydroformylation reaction using cobalt catalyst. What changes on the cobalt catalyst can you make so that the major product formed as the normal aldehyde? Also discuss the role of $HRh(CO)_2(PPh_3)_2$ catalyst in the same reaction. **(7 marks)**

b) (i) What are the prerequisites one looks for in a catalyst that can be used to catalyse thermodynamically favorable reactions? Why do most of the transition metal complexes fail to act as good catalysts? **(4 marks)**

(ii) Write short notes on turnover number, turnover frequency and selectivity. **(3 marks)**

c) (i) What are the advantages of using the iridium complex over the rhodium complex in the reaction of methanol to acetic acid process? Also, write the mechanism of the reaction. **(4 marks)**

(ii) A 16e metal complex L_nM is found to react with ethylene to give 1-butene and L_nM. Provide a reasonable mechanism involving oxidative coupling. **(3 marks)**

CENTRAL UNIVERSITY OF HARYANA

End Semester Examinations June 2023

Programme: M.Sc. Chemistry | **Session:** 2022-23
Semester: 4th | **Max. Time:** 3 H
Course Title: Physical Chemistry-V (Polymer & Surface Chemistry) | **Max. Marks:** 70
Course Code: SBS CH 010421 DSE 4004

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.

2. Question no. 2 to 5 have three parts and student need to answer any two parts of each question. Each part carries seven marks.

Q 1. (4×3.5=14)

a) Discuss the factors that influences the Glass Transition temperature (T_g) of polymers. How does T_g affect the properties and applications of polymers?

b) Discuss the differences between homogeneous and heterogeneous polymerization systems. What are the advantages and disadvantages of each system?

c) Define in brief three spectroscopic methods used for the analysis and testing of polymers.

d) How does the thermogravimetric techniques help in the characterization of polymers?

e) Write down the mechanism of adsorption of the solid/liquid interface.

f) Write down the equations of Szyszkiwski and Frumkin's adsorption isotherms.

g) With the help of graph, explain variation of $\Lambda_{eq.}$ with √concentration. Why a sharp break in $\Lambda_{eq.}$ takes place at CMC?

Q 2. (2×7=14)

a) Compare and contrast the different types of polymerization processes in terms of their mechanisms, advantages, and disadvantages.

b) Explain the mechanism and kinetics of radical chain polymerization.

c) Explain the significance of the number average, weight average, and viscosity average molecular weight in determining the properties of polymers.

Q3. (2×7=14)

a) What are organic solids? Discuss the importance of Fullerenes in molecular devices, Organic superconductors, and Magnetism in organic materials.

b) Discuss the nature of charge carriers in conducting polymers, including solitons, polarons, and bipolarons.

c) Briefly explain the tensile strength, fatigue, and tear resistance physical testing methods of polymers.

Q 4. (2×7=14)

a) Discuss in detail the mechanism of adsorption at S/L interface.

b) Discuss in detail the importance of BET equation in adsorption and application of BET equation in determining the surface area of solids.

c) Write a short note on Langmuir-Blodgett film. Also explain their growth techniques and properties.

Q 5. (2×7=14)

a) Briefly describe the following: i) Micellar aggregation number and ii) Kraft temperature.

b) Derive different thermodynamics parameters of adsorption at the L/G and L/L Interface.

c) Write down different factors that affects CMC in aqueous media.

CENTRAL UNIVERSITY OF HARYANA

Term End Examination, June 2023

Programme: M.Sc. Chemistry **Session: 2023**

Semester: IV **Max. Time: 3 Hours**

Course Title: Organic Chemistry–V (Organic Synthesis) **Max. Marks: 70**

Course Code: SBS CH 010417 DSE 4004

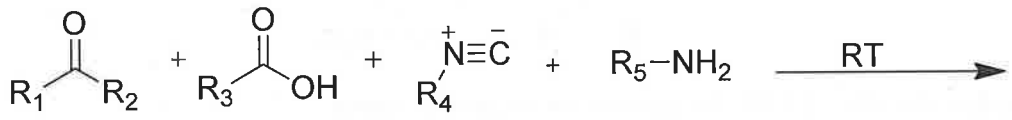
Instructions:

1. Question no. 1 has seven parts and students are required to answer any four. Each part carries three and half Marks.
2. Question no. 2 to 5 have three parts and students are required to answer any two parts of each question. Each part carries seven marks.

Question no. 1 **(4X3.5=14)**

a) Describe the Passerini reaction by taking a suitable example. In addition, illustrate the mechanism.

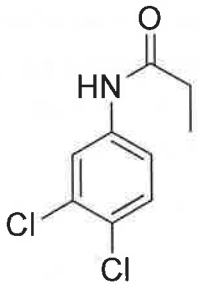
b) Identify the product of the following conversion



Ketone/ Aldehyde | Carboxylic acid | Isonitrile | Primary amine

c) Illustrate the phenomenon of retrosynthesis with a suitable example.

d) Write down an explanatory note on disconnection approach of



e) How to calculate overall yield of a reaction.

f) Differentiate between EDC and DCC. Why EDC is better than DCC.

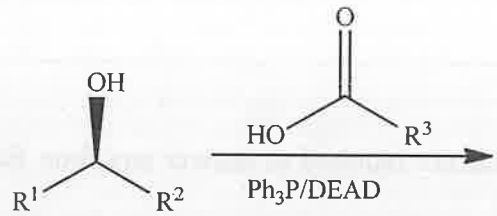
g) Write a note on

i) Macrolactonization
ii) Finkelstein reaction

Question no. 2 **(2X7=14)**

a) Discuss the role of DCC in peptide synthesis.

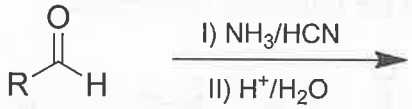
b) Predict the product and mechanism for the following transformation. Also, discuss the stereochemical outcome for the reaction.



c) Explain briefly the application of following reagents in organic chemistry. Illustrate with three examples in each case, giving mechanism of the reactions involved
i) Ohira-Bestmann reagent
ii) Diazomethane reagent.

Question no. 3 **(2X7=14)**

a) **i)** Briefly discuss the Biocatalysis.
ii) Write down the nature of product and mechanism for the following conversion



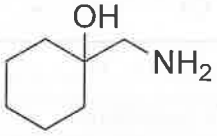
b) **i)** Explain the role of NHC in asymmetric organocatalysis.
ii) Describe biomimetic synthesis.

c) **i)** What is Click Chemistry? Discuss its applications in organic chemistry.
ii) What is Domino process? Explain the reaction with suitable example.

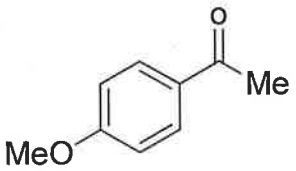
Question No. 4. **(2X7=14)**

a) **i)** Discuss one group C-X disconnection with suitable examples.
ii) Describe the application of functional group interconversion in retrosynthesis.

b) **i)** Illustrate two group C-X disconnection in 1,3-difunctionalized compounds.
ii) Suggest a suitable pathway for the synthesis of the following compound starting from cyclohexanone



c) **i)** Propose all possible retrosynthesis analysis of the following compound. Explain which route is more favourable and why?



ii) How the following protecting groups can be removed? (a) ester of a carboxylic acid; b) and methyl ether of an alcohol.

Question No. 5. **(2X7=14)**

a) Discuss the Stille cyclisation approach to Periplanone-B.

b) Write a note on

i) Formal synthesis

ii) Semi synthesis

c) Describe the total synthesis of quinone.

CENTRAL UNIVERSITY OF HARYANA

Term End Examination, June 2023

Programme: Integrated B.Sc - M.Sc. Chemistry; Semester: IV **Session: June-July 2023**

Course Title: Intellectual property Rights **Max. Time: 3 Hours**

Course Code: SBS CH 020405 SE 4004 **Max. Marks: 70**

Instructions:

1. Question no. **1** has seven parts and students are required to answer any four. Each part carries three and half Marks.
2. Question no. **2** to **5** have three parts and student are required to answer any two parts of each question. Each part carries seven marks.

Question no. 1

a) Write down the Historical Prospective of Intellectual Property.

b) Write down a short note on Collective marks.

c) What are software Patents? Describe it.

d) Write down a short note on Traditional Knowledge.

e) What is the full form of WIPO? How it works?

f) Compare and contrast the TRIPS agreement and the Berne Convention in terms of their impact on intellectual property rights in international trade.

g) Discuss the main objectives and functions of the General Agreement on Trade-related Services (GATS) in the context of the World Trade Organization (WTO).(3.5 X 7 marks)

Question no. 2

a) What are Intellectual Property? Write down the importance of protecting the Intellectual Property. (7 marks)

b) i) Differentiate the Patent from copyright.

ii) What are Trade names. Discuss it in short. (3.5 X 2 marks)

c) Describe Trademarks in detail. Differentiate it from copyright. (7 marks)

Question no. 3

a) What is PCT system? Describe it in detail. (7 marks)

b) How Patent is correlated with healthcare. How it promotes the innovation in public health? (7 marks)

c) Define Industrial Design. What are the features of industrial design? (7 marks)

Question no. 4

a) Intellectual property rights have become a significant issue in international trade. Explain the various international agreements related to intellectual property rights and analyze their impact on international trade. Compare and contrast the Berne Convention and the Budapest Treaty. (7 marks)

b) The TRIPS agreement has generated significant debate among policymakers and academics. Critically evaluate the TRIPS agreement and its impact on developing countries. Discuss the various provisions of the agreement and analyze their implications for developing countries. (7 marks)

c) The General Agreement on Trade-related Services (GATS) is a crucial agreement under the World Trade Organization (WTO). Discuss the objectives and principles of GATS and explain how it relates to international trade. Analyze the impact of GATS on service sectors in developing countries. (7 marks)

Question no. 5

a) Discuss Plant Breeder Rights in detail. (7 marks)

b) Write down a descriptive note on Intellectual Property in Indian context (Various laws in India Licensing). (7 marks)

c) Describe the role of Judiciary in IP Infringement issue and its enforcement. (7 marks)

CENTRAL UNIVERSITY OF HARYANA

Term End Examinations June 2023

Programme: Integrated B.Sc.- M.Sc. Chemistry **Session: 2022-23**

Semester: IV **Max. Time: 3 Hours**

Course Title: Inorganic Chemistry-III: Coordination Chemistry **Max. Marks: 70**

Course Code: SBS CH 020401 C 4004

Instructions:

1. Question no. 1 has seven parts and students are required to answer any four. Each part carries three and half marks.

2. Question no. 2 to 5 have three parts and students are required to answer any two parts of each question. Each part carries seven marks.

Q 1. (4X3.5=14)

a) Can a thermodynamically unstable compound be inert? Justify with example.

b) Discuss the drawbacks of valence bond theory.

c) What is a latimer diagram? Explain with example.

d) Write a short note on Ziegler–Natta catalyst.

e) Discuss the basic principle of ion exchange method of separation of lanthanides.

f) Write a short note on the active site of carbonic anhydrase and the relevant catalytic cycle.

g) What are essential and trace elements?

Q 2. (2X7=14)

a) (i) What are inner and outer orbital complexes? Give examples. **(4 marks)**

(ii) Write a short note on the electroneutrality principle. **(3 marks)**

b) (i) What will be the differences between magnetic properties of $[Fe(H_2O)_6]^{3+}$ and $[Fe(CN)_6]^{3-}$? Explain your answer using crystal field theory with relevant crystal field splitting diagrams. **(4 marks)**

(ii) Between octahedral (Oh) and tetrahedral (Td) geometries, Ni^{2+} complexes have preference Oh geometry, while Co^{2+} prefers Td geometry. Justify this using their octahedral site selection energy. **(3 marks)**

c) (i) What is Jahn-Teller distortion and why such distortion occurs? Explain with examples. **(4 marks)**

(ii) Write the IUPAC name of the following coordination compounds: $[Co(NH_2CH_2CH_2NH_2)_2Cl_2]^+$ and $[CoCl_2(NH_3)_4]^+$ **(3 marks)**

Q3. (2X7=14)

a) (i) The transition elements can show a variable oxidation states compared to the s and p block elements. Why? **(3 marks)**

(ii) Write down the electronic configuration of Re and Pd. **(2+2 marks)**

b) (i) What are the criteria for orbital contribution to magnetic moments? Give examples of transition metal ions having (i) orbital contribution and (ii) no orbital contribution to magnetic moment. **(3+ 1+1 marks)**.

(ii) Give an example of an important catalyst having Ti and write down it's structure. **(2 mark)**

c) (i) Write down the electronic configuration of Rh^{3+} ion and calculate it's spin only moment. **(4 marks)**

(ii) Arrange the atomic radii of Ti, Zr and Hf in increasing order and explain. **(3 marks)**

Q 4. (2X7=14)

a) (i) What is lanthanide contraction? Explain with examples. **(3 marks)**

(ii) Lanthanide ions show sharp absorption bands compared to the transition elements. Why? **(4 marks)**

b) (i) Write down the electronic configuration of Pm, Gd and Lu. **(2+2+2 marks)**

(ii) What is the most stable oxidation state of majority of lanthanide ions? **(1 mark)**

c) (i) The colours of the Ln complexes do not change with ligand field but for transition element it varies widely. Justify this statement. **(4 marks)**
(ii) Ce^{3+} ion shows a broad and intense band in UV. Why? **(3 marks)**

Q 5. (2X7=14)

a) (i) Explain the cooperative mechanism during dioxygen binding in Hemoglobin. **(5 marks)**

(ii) What is Bohr effect? **(2 marks)**

b) (i) Discuss the toxicity of following metal ions: Pb and Hg. **(4 marks)**

(ii) Give example of a chelating agent in medicine. Write down its structure and briefly mention its role. **(3 marks)**

c) (i) Write a short note on Na/K pump. **(4 marks)**

(ii) Discuss the active site structure of carboxypeptidase. **(2 marks)**

(iii) Give example of an iron storage protien. **(1 mark)**

CENTRAL UNIVERSITY OF HARYANA

Term End Examinations June 2023

Programme: Integrated B.Sc.-M.Sc. Chemistry **Session: 2022-23**

Semester: IV **Max. Time: 3 Hours**

Course Title: GE:Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy **Max. Marks: 70**

Course Code: CH 020401 GE 4004

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.

2. Question no. 2 to 5 have three parts and students need to answer any two parts of each question. Each part carries seven marks.

Question No. 1. **(4X3.5=14)**

(a) Explain the Bohr's effect.

(b) What is the importance of metal ion in biological systems? Discuss with examples.

(c) What are d-block elements? Why are these called transition elements?

(d) Explain the Synergic effects in CO.

(e) Chloromethane absorbs at 172 nm, bromomethane at 204 nm, and iodomethane at 258 nm. What types of transitions are responsible for each band? How can the trend of absorptions be explained?

(f) Explain the aromatic behavior of pyrrole and benzene. Which of these is most stable?

(g) Explain Keto-enol tautomerism.

Question No. 2. **(2X7=14)**

(a) Explain the preparation and structure of potassium permanganate.

(b) (i) Why do the transition metal compounds are coloured? Also account for the colourless nature of Zn and Cd compounds.

(ii)Give the significance of magnetic and spin quantum number.

(c) What are ferrocene compounds? Explain the preparation of ferrocene and its reaction towards acetylation, sulphonation and mercuration.

Question No. 3. **(2X7=14)**

(a) Describe in detail the Na^+-K^+ pump in biological systems.

(b) Explain the structure and functioning of hemoglobin. Also discuss the cooperative effect in it.

(c) (i) Explain the poisoning effect of carbon monoxide and other ligands.

(ii) Inorganic Fe(II) salts are easily oxidized when kept open in air, whereas Hb and Mb that also contain Fe(II) ions do not get easily oxidized, why?

Question No. 4. **(2X7=14)**

(a) (i) What happens when naphthalene is treated with nitrating mixture? Explain with suitable mechanism.

(ii) Discuss Claisen ester condensation with mechanism involved.

(b) Give suitable reasons for the following:

(i) Furan is less aromatic than pyrrole and benzene.

(ii) What happens when pyridine is treated with sodamide? Give mechanism also.

(c) (i) What are active methylene compounds? Give two examples. What happens when ethyl acetoacetate is treated with sodium ethoxide?

(ii) What happens when ethyl acetoacetate is treated with sodium methoxide followed by the treatment with ethyl chloro acetate? What will you get if final product is treated with conc sodium hydroxide followed by acidification?

Question No. 5. **(2X7=14)**

(a) Discuss the various factors that influence the C=O stretching vibrations.

(b) (i) How will you differentiate the following pairs:

Propanone and Propanal, Methylamine and *N*-Methylamine, Ethanol and Dimethyl ether

(ii) Explain the effect of polar solvents on $n \longrightarrow \pi$ and $\pi \longrightarrow \pi^*$ transitions.

(c) Define the following terms with suitable examples:

(i) Blue shift

(ii) Red shift

(iii) Chromophore

CENTRAL UNIVERSITY OF HARYANA

Term End Examinations June 2023

Programme: M.Sc. Chemistry **Session: 2023**

Semester: IV **Max. Time: 2 Hours**

Course Name: Chemistry of Industrially Important Products **Max. Marks: 35**

Course Code: SBS CH 010404 DCS 2002

Instructions:

1. Question no. 1 has four parts and students need to answer any two. Each part carries three and half Marks.
2. Question no. 2 to 5 have three parts and students need to answer any two parts of each question. Each sub part carries three and half marks.

Question No. 1. **(2X3.5=7)**

(a) What is 'leuco base' and how it is converted into dye?
(b) Differentiate between thermal cracking and catalytic cracking on the basis of temperature and catalyst used.
(c) What are herbicides and fungicides? Explain giving one example of each.
(d) Describe various techniques used for dyeing of polypropylene.

Question No. 2. **(2X3.5=7)**

(a) Give a brief account on chemistry and applications of optical brightening agents.
(b) Describe the synthesis, properties and application of following classes of dyes
   i. Disperse dyes
   ii. Vat dyes
(c) Discuss the detail classifications of organic and inorganic pigments with suitable examples.

Question No. 3. **(2X3.5=7)**

(a) Define crude oil. How do you classify it? What are the various parameters by which its quality can be assessed?

(b) How will you manufacture acetaldehyde by using acetylene as the starting material? Discuss the process with flow sheet diagram.

(c) What are the general methods of preparation of petrochemicals from components of crude oil?

Question No. 4. **(2X3.5=7)**

(a) Write a short note on dyeing of fibers.
(b) What is mass coloration? Explain in brief the coloration of polypropylene.
(c) Discuss the working principle of fiber dyeing machine.

Question No. 5. **(2X3.5=7)**

a) Define the following terms:
   i. Contact pesticides
   ii. Fumigants
b) What are antistatic agents? How do antistatic agents work? Discuss two applications of antistatic agents.
c) What are insecticides and how are they categorized into different chemical classes?

CENTRAL UNIVERSITY OF HARYANA

Term End Examinations, June 2023

Programme:	**M.Sc. Chemistry**	**Session: 2022-23**
Semester:	**IV**	**Max. Time: 3 Hours**
Course Title:	**Organic Chemistry-VI (Medicinal Chemistry)**	**Max. Marks: 70**
Course Code:	**SBS CH 010418 DSE 4004**	

Instructions:

1. Question no. 1 has seven sub parts and students need to answer any four. Each sub part carries three and half Marks.

2. Question no. 2 to 5 have three sub parts and students need to answer any two sub parts of each question. Each sub part carries seven marks.

Question No. 1 **(4X3.5=14)**

a) Describe the biosynthesis of the cell wall in a bacterial cell.

b) What are the different types of anti-fertility agents, and how do they work?

c) Define structure-based drug design and give a few examples.

d) Categorize anticancer agents based on their mechanisms of action and provide structural examples for each category.

e) What are alkylating agents, and how are they employed? Provide an example to demonstrate.

f) Give an example of how enzymes catalyze reactions by participating as a nucleophile.

g) Explain the differences between irreversible inhibitor and allosteric inhibitor of an enzyme.

Question No. 2 **(2X7=14)**

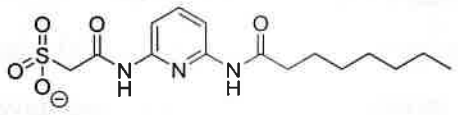
a) i) Explain what receptors are and the mechanisms of action of agonists, antagonists, and inverse agonists on them. **(3.5 marks)**

ii) Define the various drug targets and explain how they bind drugs. **(3.5 marks)**

b) i) Explain the different types of bonding forces that play a role in drug-target binding. **(3.5 marks)**

ii) Describe the similarities and differences between enzymes and receptors. **(3.5 marks)**

c) i) Identify the functional groups in the given hypothetical compound that can participate in hydrogen bonding, electrostatic bonding, pi-pi interactions, and van der Waals interactions with the enzyme. **(3.5 marks)**



ii) Provide a brief overview of the primary structure of DNA. What is meant by feedback control in enzyme catalysis? **(3.5 marks)**

Question No. 3 **(2X7=14)**

a) i) Provide definitions of the terms "pharmacodynamics" and "pharmacokinetics." Also, explain the Lipinski's Rule of Five. **(3.5 marks)**

ii) Explain the concept of suicide substrates, and provide an example illustrating their mechanism of action. **(3.5 marks)**

b) i) Provide a classification of DNA-active drugs and give examples for each class. **(3.5 marks)**

ii) Explain the concept of topoisomerase poison and its function. Also define the term drug tolerance. **(3.5 marks)**

c) i) Define the classes of drugs known as DNA chain cutters and chain terminators, and provide a suitable example for each. **(3.5 marks)**

ii) Describe the role of tubulin as a drug target in chemotherapy. Discuss the mechanism of action of drugs that bind to tubulin and how they affect microtubule dynamics. **(3.5 marks)**

Question No. 4 **(2X7=14)**

a) i) Explain the concepts of lead compound and lead modification in the process of drug discovery and development. Provide a brief overview and include relevant examples. **(3.5 marks)**

ii) Provide a definition of the term SOSA and briefly discuss the process of lead identification through side-effect exploitation. **(3.5 marks)**

b) i) Enumerate the different theories of drug activity and provide a brief explanation of any two of them. **(3.5 marks)**

ii) Define the terms '*in vitro*,' '*in vivo*,' '*in silico*,' and '*HTS*' that are commonly used in the drug discovery process. **(3.5 marks)**

c) i) Explain how chemical modification can be utilized to decrease the toxicity of a drug. Provide an appropriate example. **(3.5 marks)**

ii) Define the terms 'preclinical' and 'clinical trials' and elaborate on why these studies are essential in the process of drug discovery and development. **(3.5 marks)**

Question No. 5 **(2X7=14)**

a) i) Provide examples to explain the meaning of the terms stimulants, depressants, and hallucinogens. (**3.5 marks**)

ii) Define the term "local anesthetic drugs" and explain their mechanism of action. (**3.5 marks**)

b) i) Explain the significant structural characteristics of β-lactam antibiotics. Provide the name and illustrate the structure of one antibiotic utilized for inhibiting bacterial protein synthesis. (**3.5 marks**)

ii) Elaborate on the difference between sedative and hypnotic drugs. Also, discuss the circumstances under which these drugs can lead to a state of coma. (**3.5 marks**)

c) i) Provide a definition of the term "cancer chemotherapy" and explain the common targets in cancer chemotherapy. Also, discuss the role of alkylating agents in treating cancer. (**3.5 marks**)

ii) What are the mechanisms of action of anti-fertility drugs, and what are the different types of anti-fertility drugs available in the market? Additionally, what are the potential side effects of these drugs, and how can they be managed? (**3.5 marks**)

CENTRAL UNIVERSITY OF HARYANA

Term End Examinations June 2023

Programme: M.Sc. Chemistry **Session: 2022-23**

Semester: IV **Max. Time: 3 Hours**

Course Title: Inorganic Chemistry-VI (Frontiers in Inorganic Chemistry) **Max. Marks: 70**

Course Code: SBS CH 010414 DSE 4004

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.

2. Question no. 2 to 5 have three parts and students need to answer any two parts of each question. Each sub part carries seven marks.

Question No. 1. **(4X3.5=14)**

(a) What is the effect of interatomic spacing on atomic energy levels and bands? Explain with the help of chemical approach method.

(b) Write a note on Bloch theorem and Kronig-Penney model.

(c) What are MRI contrast agents?

(d) How monochromatic X-rays are produced in the laboratory for diffraction purpose?

(e) What are screw axes and glide planes?

(f) What are coordination polymers? Compare these materials with classical inorganic materials.

(g) How microwaves help in the synthesis of metal-organic framework/coordination polymer particles?

Question No. 2. **(2X7=14)**

(a) (i) Distinguish between amorphous and crystalline solids. **(2 marks)**

(ii) What are extrinsic semiconductors? Write differences between p-type and n-type semiconductors. **(3 marks)**

(iii) Which region of transistor is highly doped? **(2 marks)**

(b) (i) What is a transistor? Explain the circuit of N-P-N transistor and P-N-P transistor. **(4 marks)**

(ii) Distinguish among conductors, semiconductors and insulators? **(3 marks)**

(c) (i) What is Brillouin zone? Discuss region of 1^{st}, 2^{nd} and 3^{rd} Brillouin zones. **(3 marks)**

(ii) What is a superconductor material? Explain type I and type II superconductors. **(4 marks)**

Question No. 3. **(2X7=14)**

(a) Explain the chemosensor design principle. Discuss some applications of chemosensors. **(4 + 3 marks)**

(b) Discuss principles of MRI. Explain the use of gadolinium-chelates as MRI contrast agents. **(4 + 3 marks)**

(c) (i) Explain time-resolved luminescence. **(3 marks)**

(ii) Discuss the importance of water-exchange kinetics in relation to MRI contrast agents. **(3 marks)**

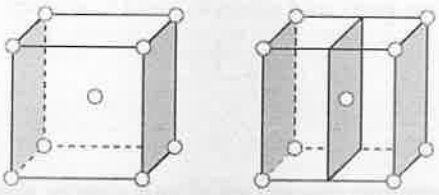
(iii) Provide some examples of new generation MRI contrast agents. **(1 mark)**

Question No. 4. **(2X7=14)**

(a) (i) How $K\alpha$ and $K\beta$ radiations can be produced from a metal target. Explain by taking an example. **(3 marks)**

(ii) Discuss the principle of use of filter in X-ray production. **(2 marks)**

(iii) Make a choice of origin by yourself and name the planes (pink color) for the below unit cells. **(2 marks)**



(b) (i) Write down the Laue equations. Introduce Bragg's Law and discuss it as a modification of Laue equations. **(5 marks)**

(ii) What is Bravais lattice? How many Bravais lattice are there? **(2 marks)**

(c) (i) Discuss systematic absences with respect to crystal structure determination. **(3 marks)**

(ii) What is space group? **(1 mark)**

(iii) Consider the example of the following two space groups: $P2_1/c$ and *Pbca*. Provide the information of crystal systems, axis of symmetry and mirror plane symmetry in the space groups. **(3 marks)**

Question No. 5. **(2X7=14)**

(a) (i) How the connectivity of metal nodes and organic linkers give rise to the formation of coordination polymers (CPs)/metal-organic frameworks (MOFs)? Give examples of nodes and organic linkers used in the formation of CPs/MOFs? **(5 marks)**

(ii) Give examples of some famous MOFs mentioning its compositions. **(2 marks)**

(b) (i) Define secondary building unit in MOF chemistry. What do you mean by topology and interpenetration? **(4 marks)**

(ii) Delineate the hydrothermal synthesis of CPs/MOFs? **(3 marks)**

(c) Discuss the following applications of CPs/MOFs: Catalysis and Drug Delivery. **(3½ + 3½ marks)**

CENTRAL UNIVERSITY OF HARYANA

End Semester Examinations June 2023

Programme: M.Sc. Chemistry | **Session:** 2022-23

Semester: 4th | **Max. Time:** 3 H

Course Title: Physical Chemistry-VI (Applied Electrochemistry) | **Max. Marks:** 70

Course Code: SBS CH 010422 DSE 4004

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.
2. Question no. 2 to 5 have three parts and student need to answer any two parts of each question. Each part carries seven marks.

Q 1. $(4 \times 3.5 = 14)$

a) Why potential of non-polarizable interface does not change significantly with change in current or concentration of electrolyte? Explain with suitable examples.

b) Discuss in detail special case of high field approximation in current potential laws.

c) Discuss in detail construction, working and principle of super capacitors.

d) Why Li-ion batteries are better than supercapacitors. Write down the advantages and disadvantages of LIBs.

e) Differentiate between cathodic and anodic corrosion protection methods.

f) Differentiate between activation and concentration polarization of electrode.

g) Write a short note on optical properties of liquid crystals.

Q 2. $(2 \times 7 = 14)$

a) Derive the non-equilibrium drift-current density.

b) Describe in detail simple picture of symmetry factor.

c) What is the relation between symmetry factor and over-potential. How the value affect the magnitude of over-potential?

Q3. $(2 \times 7 = 14)$

a) Briefly explain the construction, working. and principle of H_2-O_2 fuel cell.

b) Describe the construction, working, principle. and reactions of lead-acid accumulator.

c) Write a short note on the following: i) Na-S cell, and ii) Ag/Zn cell.

Q 4. $(2 \times 7 = 14)$

a) Discuss in detail the anodic and cathodic polarization curve. How the slope of polarization curve affect the rate of corrosion.

b) How impedance spectroscopy help in understanding the mechanism of corrosion.

c) Briefly describe the use of chemical inhibitors, environment modifier technique to prevent corrosion of metals and their alloys.

Q 5. (2 × 7 =14)

a) Briefly describe the following: i) Mesomorphic behavior, and ii) Smectic-Nematic transition.

b) Differentiate between hot and cold emission of electrons from metals in to vacuum.

c) Write down the construction and working of dye sensitized solar cell.

CENTRAL UNIVERSITY OF HARYANA

Term End Examinations June 2023

Programme: Integrated B.Sc.-M.Sc. Chemistry **Session: 2022-23**

Semester: IV **Max. Time: 3 Hours**

Course Title: GE:Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy **Max. Marks: 70**

Course Code: CH 020401 GE 4004

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.

2. Question no. 2 to 5 have three parts and students need to answer any two parts of each question. Each part carries seven marks.

Question No. 1. **(4X3.5=14)**

(a) Explain the Bohr's effect.

(b) What is the importance of metal ion in biological systems? Discuss with examples.

(c) What are d-block elements? Why are these called transition elements?

(d) Explain the Synergic effects in CO.

(e) Chloromethane absorbs at 172 nm, bromomethane at 204 nm, and iodomethane at 258 nm. What types of transitions are responsible for each band? How can the trend of absorptions be explained?

(f) Explain the aromatic behavior of pyrrole and benzene. Which of these is most stable?

(g) Explain Keto-enol tautomerism.

Question No. 2. **(2X7=14)**

(a) Explain the preparation and structure of potassium permanganate.

(b) (i) Why do the transition metal compounds are coloured? Also account for the colourless nature of Zn and Cd compounds.

(ii)Give the significance of magnetic and spin quantum number.

(c) What are ferrocene compounds? Explain the preparation of ferrocene and its reaction towards acetylation, sulphonation and mercuration.

Question No. 3. **(2X7=14)**

(a) Describe in detail the Na^+-K^+ pump in biological systems.

(b) Explain the structure and functioning of hemoglobin. Also discuss the cooperative effect in it.

(c) (i) Explain the poisoning effect of carbon monoxide and other ligands.

(ii) Inorganic Fe(II) salts are easily oxidized when kept open in air, whereas Hb and Mb that also contain Fe(II) ions do not get easily oxidized, why?

Question No. 4. **(2X7=14)**

(a) (i) What happens when naphthalene is treated with nitrating mixture? Explain with suitable mechanism.

(ii) Discuss Claisen ester condensation with mechanism involved.

(b) Give suitable reasons for the following:

(i) Furan is less aromatic than pyrrole and benzene.

(ii) What happens when pyridine is treated with sodamide? Give mechanism also.

(c) (i) What are active methylene compounds? Give two examples. What happens when ethyl acetoacetate is treated with sodium ethoxide?

(ii) What happens when ethyl acetoacetate is treated with sodium methoxide followed by the treatment with ethyl chloro acetate? What will you get if final product is treated with conc sodium hydroxide followed by acidification?

Question No. 5. **(2X7=14)**

(a) Discuss the various factors that influence the C=O stretching vibrations.

(b) (i) How will you differentiate the following pairs:

Propanone and Propanal, Methylamine and *N*-Methylamine, Ethanol and Dimethyl ether

(ii) Explain the effect of polar solvents on $n \longrightarrow \pi$ and $\pi \longrightarrow \pi^*$ transitions.

(c) Define the following terms with suitable examples:

(i) Blue shift

(ii) Red shift

(iii) Chromophore

CENTRAL UNIVERSITY OF HARYANA

Term End Examinations June-July 2023

Programme: Integrated B.Sc.-M.Sc. Chemistry **Session: 2022-23**

Semester: IInd **Max. Time: 3 Hours**

Course Title: Physical Chemistry-I **Max. Marks: 70**

Course Code: SBS CH 020201 C 3104

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.

2. Question no. 2 to 5 have three parts and students need to answer any two parts of each question. Each sub part carries seven marks.

Question No. 1. **(4X3.5=14)**

(a) Distinguish between an ideal gas and a real gas and What are the causes of deviation of gases from ideal behaviour?

(b) What is the limitation of the law of equipartition of energy.

(c) Both NaCl and KCl have similar structures, yet their X-ray diffraction patterns are remarkably different why?

(d) At what angles will X-rays of wavelength 1.542×10^{-10} m undergo first order and second order reflection by planes separated by 3.5×10^{-10}m.

(e) A liquid has a definite vapor pressure at a given temperature. Why ?

(f) What are buffer solutions? Explain the terms buffer index and buffer capacity.

(g) A buffer solution contains 0.20 mole of NH_4OH and 0.25 mole of NH_4Cl per liter. Calculate the pH of the solution. Dissociation constant of NH_4OH at the room temperature is 1.81×10^{-5}.

Question No. 2. **(2X7=14)**

(a) What do you mean by Boyle temperature and derive it from vander Waal equation?

(b) What are the postulates of kinetic theory of gases? Derive expression for the pressure exerted by the molecules of a gas or derive Kinetic gas equation.

(c) (i) Derive Reduced equation of state and hence define the law of corresponding states. Give its significance.

Question No. 3. **(2X7=14)**

(a) Derive Bragg's equation for X-ray diffraction by crystal.

(b) Briefly explain each of the following

(i) Law of constancy of interfacial angles.

(ii) Law of Symmetry

(iii) Law of rational indices

(c) (i) Explain the terms 'isomorphism' and 'polymorphism' with suitable examples.

(ii) Define the terms 'crystal lattice' and 'unit cell'. Why a five-fold axis of axis of symmetry cannot be present in any crystal.

Question No. 4. **(2X7=14)**

(a) Define vapour pressure. Explain show the equilibrium is obtained when a liquid is placed in evacuates vessel at constant temperature. Derive the expression giving giving the effect of temperature on vapour pressure.

(b) (i) State and explain Trouton's Law.

(ii) What do you understand by 'optical rotation' and 'specific rotation'?

(c) (i) How can you say that liquid state is intermediate between gaseous state and solid state?

(ii) Explain the cleansing action of detergents.

Question No. 5. **(2X7=14)**

(a) (i) Calculate the pH and the hydrogen and hydroxyl ion conc^{n}. of a 3.2×10^{-3} M solution of $Ba(OH)_2$ in water at 25°C.

(ii) Derive the Henderson-Hasselbalch equation. A buffer solution contains 0.20 mole of NH_4OH and 0.25 mole of NH_4Cl per litre. Calculate the *p*H of the solution. Dissociation constant of NH_4OH at the room temperature is 1.81×10^{-5}.

(b) Define the terms solubility and solubility product of a substance. Explain giving atleast four examples the use of the concept of solubility product in qualitative analysis.

(c) (i) Discuss in detail the phenomenon of 'hydrolysis of salts'. Illustrate your answer taking examples of the salt of (i) a weak acid and strong base, (ii) strong acid and weak base and (iii) weak acid and weak base.

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End Semester Examinations June. 2023

Programme:	**M.Sc. Chemistry**	**Session: 2022-23**
Semester:	**II**	**Max. Time: 3 H**
Course Title:	**Physical Chemistry-II (Quantum Chemistry & Group Theory)**	**Max. Marks: 70**
Course Code:	**SBS CH 010209 C 4004**	

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and a half Marks.

2. Questions no. 2 to 5 have three parts and students need to answer any two parts of each question. Each part carries seven marks.

Q 1. Answer the following in brief: (4×3.5=14)

a) Apply first-order time-independent perturbation theory to calculate energy corrections for non-degenerate states.

b) Describe the rigid rotator model for a rotating diatomic molecule and its energy levels.

c) Explain the Michaelis-Menten treatment of enzyme kinetics and how it is used to study enzymatic reactions with one intermediate.

d) Discuss competitive inhibition and non-competitive inhibition in enzymatic reactions. Explain how these types of inhibition affect the rate of the enzymatic reaction and provide examples of each.

e) Determine the point groups of the following small molecules: Allene, H_2O_2, Benzene, and Ferrocene. Use Schönflies notations for each molecule.

f) Explain the concept of the Great Orthogonality theorem in the context of molecular symmetry. How does it relate to character tables?

g) Explain the general theory of non-equilibrium processes and the concept of entropy production. How is entropy production related to entropy flow in different types of non-equilibrium processes such as heat flow, mass flow, electric current, and chemical reactions?

Q 2. Answer the following in brief: (2×7=14)

a) Describe the line weaver-Burk plot and its significance in evaluating Michaelis's constant for enzyme-substrate binding. Compare and contrast the Dixon and Eadie-Hofstee methods for determining the same constant.

b) Explain the Lindemann-Hinshelwood theory and the Rice-Ramsperger-Kassel-Marcus (RRKM) theory of unimolecular reactions. Compare and contrast these two theories in terms of their assumptions and predictions regarding the dynamics of unimolecular reactions.

c) In enzyme kinetics, explain the concept of a one intermediate enzymatic reaction. Provide an example of such a reaction and discuss its significance in understanding enzyme kinetics.

Q3. Answer the following: (2×7=14)

a) Answer the following

1. Discuss the variation theorem and its application in variation methods. (3)
2. Apply the variation method to find an approximation to the ground state energy of the particle in a box potential. (4)

b) Answer the following

1. Explain the derivation of the radial wave function for the hydrogen atom using the Schrödinger equation. (5)
2. Calculate the radial probability density for the 3p orbital of the hydrogen atom. (2)

c) Answer the following.

1. Derive the equation for the rotational energy levels of a diatomic molecule using the rigid rotator model. (4)
2. Prove the recursion formula for Legendre polynomials and explain its significance. (3)

Q 4. Answer the following: (2×7=14)

a) Explain the concept of point group D_n, where n is equal to 2 and 3. Discuss the symmetry elements and operations associated with this point group.

b) Analyze the symmetry elements and operations in the Td and Oh point groups.

c) Construct the character table for the point group C3v. Discuss the significance of the character table in analyzing the symmetry properties of molecules and predicting their behavior

Q 5. Answer the following: (2×7=14)

a) Explain Onsager's reciprocity relation and its role in describing the behavior of non-equilibrium systems. How does Onsager's reciprocity relation relate to the symmetry of transport coefficients and the reversibility of processes?

b) Describe electrokinetic phenomena in the context of non-equilibrium processes. Explain the factors that influence electrokinetic behavior and its relevance in various applications.

c) Describe Saxen's relation and its significance in the study of non-equilibrium processes. How does it relate to entropy production?

CENTRAL UNIVERSITY OF HARYANA

Term End Examinations June-July 2023

Programme: Integrated B.Sc.-M.Sc. Chemistry **Session: 2022-23**

Semester: II **Max. Time: 3 Hours**

Course Title: GE: Chemical Energetics, Equilibria & Functional Organic Chemistry-I

Course Code: SBS CH 020103 GE 4004 **Max. Marks: 70**

Instructions:

1. Question no. 1 has seven parts and students need to answer any four. Each part carries three and half Marks.

2. Question no. 2 to 5 have three parts and students need to answer any two parts of each question. Each sub part carries seven marks.

Question No. 1. **(4X3.5=14)**

(a) The enthalpy of combustion of glucose $C_6H_{12}O_6(s)$ is -2816 kJ/mol at 25°C. Calculate ΔH°_f ($C_6H_{12}O_6$). The ΔH_f° values for $CO_2(g)$ and $H_2O(l)$ are -393.5 and -285.9 kJ/mol, respectively?

(b) What is Residual entropy ? How the concept of residual entropy originated? How is it calculated?

(c) What do you understand by *p*H of a solution? What is the range of the *p*H scale and why?

(d) Describe the preparation of aryl halides, specifically chlorobenzene, through various methods such as Sandmeyer and Gattermann reactions.

(e) Discuss the concept of aromatic nucleophilic substitution reactions.

(f) Discuss the Pinacol-Pinacolone rearrangement.

(g). Describe the preparation of primary alcohols using Grignard reagent. Include the reaction mechanism and an example.

Question No. 2. **(2X7=14)**

(a) State and explain the following terms with suitable examples:

(i) Open, Closed and isolated systems

(ii) Thermodynamic equilibrium

(iii) Extensive and intensive properties

(iv) State and Path function

(b) (i) Define 'Bond energy' for a diatomic molecule and polyatomic molecule. How bond energy data helps to calculate the enthalpy change of a reaction?

(ii) Derive thermodynamic Kirchoff's equation.

(c) Define standard enthalpy of reaction, standard enthalpy of formation and standard enthalpy of combustion. What is Hess's law? What is the thermodynamic basis of Hess's law?

Question No. 3. **(2X7=14)**

(a) State and explain Le Chatelier's principle and with the help of it,

(i) Effect of pressure on the melting of ice.

(ii) Effect of pressure on the boiling point of a liquid.

(iii) Effect of temperature and pressure on the solubility of gases in liquids.

(b) (i) Write Clausius-Clapeyron equation in the integrated form. What are its important applications?

(ii) What are Lewis acids and Lewis bases? Give examples.

(c) Define the terms solubility and solubility product of a substance. Illustrate its application

(i) Predicting precipitation reactions

(ii) Purification of common salt

(iii) Salting out of soap

Question No. 4. **(2X7=14)**

a) Describe the types of nucleophilic substitution reactions exhibited by alkyl halides. Discuss S_N^1, S_N^2, and S_N^i mechanisms.

b) Discuss the Friedel-Crafts reaction, specifically focusing on alkylation and acylation of benzene.

c) Discuss five methods of synthesis of alkyl halides.

Question No. 5. **(2X7=14)**

a) Discuss the Reimer-Tiemann reaction with mechanism.

b) Discuss Aldol Condensation and Cannizzaro's reaction with mechanism.

c) Discuss Clemmensen and Wolff Kishner reductions with mechanism.

CENTRAL UNIVERSITY OF HARYANA

Term End Examination, July 2023

Programme: M.Sc. Chemistry; Semester: II **Session: 2023**

Course Title: Analytical Techniques in Chemistry **Max. Marks: 35**

Course Code: SBS CH 010202 DCS 2002 **Max. Time: 2 Hours**

Instructions:

1. Question no. 1 has seven parts and students are required to answer any two. Each part carries three and half Marks.
2. Question no. 2 to 5 have three parts and student are required to answer any two parts of each question. Each part carries three and half Marks.

Question 1

a) Explain the factors affecting DSC curve of a given compound.

b) Write down the applications of cyclic voltametery.

c) What are electron optics?

d) How corrosion rate can be determined from current density? (3.5 X 4)

Question 2

a) Describe the thermogravimetric analysis curve of calcium oxalate.

b) Explain the advantage of DTA over TGA in chemical analysis.

c) Describe the factors affecting the DSC curve of an analyte. (3.5 X 3)

Question 3

a) What is chronoamperometery? Describe its role in metal analysis.

b) Explain the working of Pulse voltammetry.

c) Describe the role of biosensors in evvironmental pollution detection. (3.5 X 3)

Question 4

a) Illustrate the imaging system of TEM technolody.

b) Write down the specimen preparation steps in SEM technology.

c) Write down a short note on transmission and scanning electron microscope. (3.5 X 3)

Question 5

a) Discuss Impedance spectroscopy in detail.

b) What you mean by aniodic polarization?

c) What is open circuit Potential? (3.5 X 3)

CENTRAL UNIVERSITY OF HARYANA

Term End Examinations July 2023

Programme: M.Sc. Chemistry | **Session: 2022-23**

Semester: Semester-II | **Max. Time: 2 Hours**

Course Title: Computational Chemistry | **Max. Marks: 35**

Course Code: SBS CH 010201 DCS 2002

Instructions:

1. Question no. 1 has four parts and students need to answer any two. Each part carries three and half Marks.

2. Question no. 2 to 5 have three parts and students need to answer any two parts of each question. Each part carries three and half marks.

Question No. 1. **(2X3.5=7)**

a) How computational chemistry is eco-friendly towards environment?

b) How can you correlate energy with space and time?

c) Why Slater type orbital is better than Gaussian type orbital?

d) What do you mean by molecular modelling?

Question No. 2. **(2X3.5=7)**

a) What is unrestricted Hartree-Fock method? Where you can apply it?

b) What do you mean by electron correlation?

c) Show one dimensional potential energy surface for a diatomic molecule.

Question No. 3. **(2X3.5=7)**

a) What are the differences between HF and DFT methods?

b) Write a short note on meta generalized gradient approximation.

c) Briefly discuss Kohn-Sham equation.

Question No. 4. **(2X3.5=7)**

a) What are minimal and double zeta basis sets?

b) Determine the number of basis functions when you use 6-311G basis set on a pyridine molecule.

c) What are polarization and diffuse basis functions?

Question No. 5. **(2X3.5=7)**

a) Is optimized energy is better than single point energy calculation? If yes, justify it.

b) What do you mean by transition state theory?

c) Why is intrinsic reaction coordinate (IRC) calculation important?

CENTRAL UNIVERSITY OF HARYANA

Term End Examination, July 2023

Programme: Integrated B.Sc.-M.Sc. Chemistry **Session: 2023**

Semester: II **Max. Time: 3 Hours**

Course Title: Organic Chemistry-II **Max. Marks: 70**

Course Code: SBS CH 020203 C 3104

Instructions:

1. Question no. 1 has seven parts and students are required to answer any four. Each part carries three and half Marks.
2. Question no. 2 to 5 have three parts and students are required to answer any two parts of each question. Each part carries seven marks.

Question no. 1 **(4X3.5=14)**

a) Why does nucleophilic substitution of chlorobenzene take place through benzyne mechanism and that of p-nitrochlorobenzene proceeds *via* addition elimination mechanism? Explain.

b) Discuss the stereochemistry of S_N^2 reactions.

c) Explain with mechanism, the Beckmann rearrangement reaction in acetophenone.

d) How will you carry out the following syntheses:

i) Maleic acid from malic acid

ii) Fumaric acid from malonic acid

iii) Malonic acid from ethyne

e) Write a note on Pinacol-Pinacolone rearrangement.

f) What do you mean by reactive methylene compounds? Explain with two examples.

g) Giving suitable explanation, arrange the acid derivatives (acid chlorides, esters, acid anhydrides, and amides) in increasing order of reactivity towards nucleophilic substitution reaction.

Question no. 2 **(2X7=14)**

a) i) Differentiate between S_N^1 and S_N^2 reaction.

ii) Explain, why vinyl halides are less reactive than alkyl halides towards nucleophilic substitutions reactions?

b) i) Write the elimination-addition mechanism for conversion of chlorobenzene into aniline.

ii) Describe the benzyne mechanism for the nucleophilic aromatic substitution in aryl halides.

c) How do you account for the following:

i) Bromobenzene does not give precipitate even on prolonged heating with alcoholic silver nitrate.

ii) Nitro group deactivates the aromatic ring towards nucleophilic aromatic substitution and yet it activates aryl halide towards nucleophilic substitution?

Question no. 3 **(2X7=14)**

a) Explain the following reactions with mechanism: (i) Kolbes-Schimdt reaction (ii) Reimer-Tiemann reaction (iii) Fries rearrangement

b) An organic compound [A] on treatment with $CHCl_3$/NaOH gives two products [B] and [C]. On Zn-distillation, both [B] and [C] give the same product [D]. The compound [B] and [C] on oxidation give [E] and [F] which are isomeric having molecular formula $C_7H_6O_3$. On heating with soda lime, [E] and [F] give back [A]. Zinc dust distillation of [A] gives an aromatic hydrocarbon [G]. Identify the compounds [A] to [G] and explain the reactions involved.

c) i) Write down the reaction of epoxides with $LiAlH_4$ and ammonia derivatives? ii) Why phenols are more acidic than alcohols?

Question No. 4. **(2X7=14)**

a) Give the reaction mechanism for the following:
   i) Benzoin condensation
   ii) Benzil–benzillic acid rearrangement

b) Explain why the carbonyl compounds have:
   i) higher boiling points than alkanes of comparable molecular mass?
   ii) lower boiling points compared to alcohols of comparable molecular mass?

c) Write a note on
   i) Michael addition
   ii) Keto-Enol tautomerism

Question No. 5. **(2X7=14)**

a) Discuss the mechanism of acidic and alkaline hydrolysis of esters.

b) i) Why does the presence of base catalyze the nucleophilic acyl substitution in carboxylic acids?

   ii) Give the mechanism for the acid catalyzed nucleophilic acyl substitution in carboxylic acids.

c) Discuss in detail the following:
   i) Curtius rearrangement
   ii) Hofmannbromamide degradation

CENTRAL UNIVERSITY OF HARYANA

Second Semester Term End Examinations

Programme: M.Sc. Chemistry **Session: 2022-23**

Semester: II **Max. Time: 3 Hours**

Course Title: Inorganic Chemistry-II **Max. Marks: 70**

Course Code: SBS CH 010207 C 4004

Instructions:

1. Question no. 1 has seven parts and students are required to answer any four. Each part carries three and half Marks.

2. Question no. 2 to 5 have three parts and student are required to answer any two parts of each question. Each part carries seven marks.

Q 1. **(4X3.5=14)**

a) Write down the Hund's rules for determining the ground state term symbol of a particular electronic configuration.

b) The ligand to metal charge transfer bands increase in energy in series: $[CoI_4] < [CoBr_4]^- < [CoCl_4]$. Explain.

c) What are the differences between diamagnetic and paramagnetic materials? Diamagnetism is an inherent property of all materials-explain why.

d) What are the conditions for orbital contribution to magnetic moment? Explain with examples.

e) Draw the diagrams of free energy *vs* reaction time for associative and dissociative substitution reactions in octahedral complexes.

f) What do you mean by labile and inert complexes?

g) Discuss, with an example, how chelation affects the stability of coordination complexes?

Q 2. **(2X7=14)**

a) (i) Show the splitting of the *S, P, D* and *F* terms in an octahedral field. (3 marks)
(ii) What are correlation diagrams? Discuss the differences between Orgel and Tanabe-Sugano diagrams. (4 marks)

b) (i) Define "Ligand to Metal Charge Transfer" or LMCT complexes. Draw the "Molecular Orbital" or MO diagram of a ML_4 tetrahedral complex and discuss on possible transitions. (5 marks)
(ii) Take an example of an octahedral electronic configuration with *F* term as the ground state and make drawing of the corresponding Orgel diagram. (2 marks)

c) (i) Which optical method involves measuring variation of optical rotation with wavelength? Discuss the usefulness of the method with proper drawing in determining optical configuration of coordination complexes. (5 marks)
(ii) What is nephelauxetic effect? (2 marks)

Q3. **(2X7=14)**

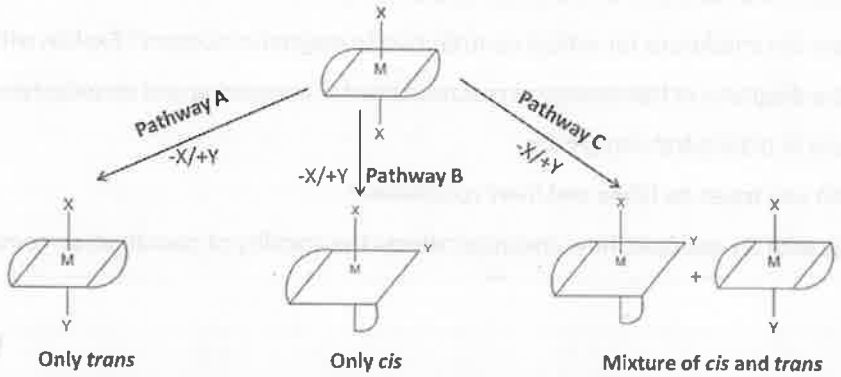
a) (i) What are the conditions for a coordination compound to exhibit spin-crossover? (3 marks)
(ii) By modulating the ligand, it is possible to obtain exclusively high spin, exclusively low spin complexes or spin-crossover compounds. Justify this statement with examples. (4 marks)

b) (i) What are the difference between antiferromagnetism and spin canting? (3 marks)
(ii) Arrange the μ_{eff} values for the four CoX_4^{2-} complexes where X = SCN^-, Cl^-, Br^- and I^-. Explain the order. (4 marks)

c) (i) A 4-coordintaed Ni(II) compound is found to be diamagnetic. What is the geometry? (2 marks)
(ii) What is magnetic induction and magnetic susceptibility? (1½ +1½ marks)
(iii) Draw the *M* vs. *H* plots for an anisotropic material when *H* is applied along the easy axis and along the hard plane. (2 marks)

Q 4. **(2X7=14)**

a) Consider a substitution reaction in an octahedral Rh^{3+} metal complex in a strong ligand field. If the reaction undergoes a dissociative mechanism, predict what will be the correct pathway (A, B or C) as seen in the following picture. A gives only *trans* product, B gives only *cis* product and C gives a mixture. Justify your answer considering the change in CFSE during the reaction. (7 marks)



b) (i) What is the *trans* effect? Explain the reason of a ligand exhibiting of *trans* effect. (2 +3 marks)
(ii) What is the difference between thermodynamically stable and inert complex? (2 marks)

c) (i) Write short notes on inner sphere and outer sphere reactions (2½ +2½ marks).
(ii) Consider three different electron transfer reactions between $[Fe(CN)_6]^{3-}$ and $[Fe(CN)_6]^{4-}$, where the cations are Cs^+, Rb^+ and Na^+. The rate of the reactions are found to be in the order $Cs^+ > Rb^+ > Na^+$. Explain the order. (2 marks)

Q 5. **(2X7=14)**

a) (i) What do you mean by stepwise and overall formation constants? Explain in detail by taking an example of an octahedral complex. (5 marks)

(ii) What is Irving-Williams series? (2 marks)

b) (i) Elaborate thermodynamic and kinetic stability with examples of metal cyanide compounds. Is there any relation of the same with reactivity of the compounds? (4 marks)

(ii) What is the effect of entropy on stability of the complexes? (3 marks)

c) (i) Write a short note on the determination of formation constant by pH-metry. (4 marks)

(ii) Explain macrocyclic effect in coordination complexes with suitable examples. (3 marks)