

**CHOICE BASED CREDIT SYSTEM**  
**M. Sc. SECOND SEMESTER DEGREE EXAMINATION SEPTEMBER 2020**  
**INORGANIC CHEMISTRY THEORY-II**

Duration: 3 Hours

**Part - A**

1. Answer any TEN of the following:

- a) Calculate the number of framework electron pairs in  $B_6H_{10}$ .
- b) Acidic character of dioxides of Group 14 elements decreases as we move down the group.
- c) What is the basic unit of pyrosilicate?
- d) Give the structure of pyrophosphorous acid. Mention the hybridization in it.
- e) Arrange  $H_2X$  ( $X=O, S, Se, Te, Po$ ) compounds in order of increasing i)boiling point ii)reducing character
- f) Mention the hybridisation & Geometry in  $SO_2$
- g) Why is the bond angle FOF in  $F_2O$  smaller than the bond angle ClOCl in  $Cl_2O$
- h) Give the reaction of chlorine trioxofluoride with alkali.
- i) What prompted Bartlett to conjecture that it is possible to prepare the fluorides of xenon
- j) Why does the second and third row of transition elements resemble each other than the first row elements?
- k) Calculate spin only magnetic moment of  $M^{2+}_{(aq)}$  ion ( $Z=27$ )
- l) Discuss the stereochemistry of complexes with coordination number 3 with examples.

**Part - B**

Answer any Five questions.

Select at least one question from each unit.

**Unit I**

2. a) Give reasons for the following:
  - (i) Boron trichloride is monomeric while aluminium trichloride is dimeric.
  - (ii)  $BF_3$  is a weaker Lewis acid than  $BCl_3$  and  $BBr_3$
- b) Discuss in details the bridge structure of diborane. Bring out clearly the nature of bonds in hydrogen bridges (6+4)
3. a) Classify the following Carboranes according to Wade's rule
  - i)  $C_2B_{10}H_{12}$  ii)  $C_2B_4H_8$  iii)  $C_2B_7H_{13}$
- b) Compare & contrast the structure of borazine with benzene (6+4)

**Unit II**

4. a) Name the hydrides of group 15 elements. Discuss the variation in their properties with references to
  - i) Basic character ii) Thermal Stability iii) Reducing character iv) Bond angle (e) Covalent nature.
- b) Write a note on trihalides of group 15 elements (6+4)
5. a) Discuss the preparation, properties and structure of  $H_2SO_5$ .
- b) Explain the structure and preparation of  $S_4N_4$ . (6+4)

**Unit III**

6. a) Differentiate  $HClO_4$  and  $HClO$  with respect to their properties.
- b) Give the hybridisation & geometry of  $HClO_3, HClO_4, HClO_2, HClO$  (6+4)
7. a) Explain the preparation, properties and structure of  $XeOF_2$
- b) Explain the preparation of the following (6+4)
  - i)  $XeO_3$  ii)  $XeOF_4$

Unit IV

8. a. Explain the separation of lanthanides by fractional precipitation and change of oxidation state.  
b. Explain the chemical behaviour of Zr/Hf, Nb/Ta and Mo/W (5+5)
9. a. Explain the optical isomerism in 6-coordinated complexes with examples.  
b. Draw the structures of all possible isomers of  
i.  $[\text{Pt}(\text{SCN})(\text{NH}_3)_3]$  ii.  $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]^{2+}$  (6+4)

## CHOICE BASED CREDIT SYSTEM

M.Sc. SECOND SEMESTER DEGREE EXAMINATION SEPTEMBER 2020

## ORGANIC CHEMISTRY THEORY-II

Duration: 3 Hours

Max Marks: 70

## Part - A

1. Answer any TEN of the following:

(10x2=20 Marks)

- a) Give an example for  $S_N1$  mechanism.
- b) What is meant by Ipso attack? Give an example
- c) Give a detection method for arynes.
- d) Predict the coupling and disproportionation products of each of the following radicals:  
 a)  $\text{CH}_3\text{CH}_2\text{CH}_2\dot{\text{C}}\text{H}_2$     b)  $\text{CH}_3\dot{\text{C}}\text{HCH}_3$
- e) Explain the reactivity of alkyl side chains of aromatic rings for abstraction by free radical.
- f) What is meant by Cope elimination?
- g) Predict the product:  

$$\square \xrightarrow{\text{Br}_2/\text{CCl}_4} ?$$
- h) Write any two applications of Reformatsky reaction.
- i) Give the mechanism of esterification reaction.
- j) Give any one method of synthesising indole.
- k) Give any one method of synthesizing thiazole.
- l) Write a reaction of pyrimidine with nucleophilic reagent and explain the mechanism.

**Part - B**

Answer any Five questions.

(5x10=50 Marks)

Select at least one question from each unit.

**Unit I**

2. a) Discuss the mechanism and stereochemistry of  $S_E1$  reaction. What are the evidences which support  $S_E1$  mechanism.  
b) Explain the factors affecting aliphatic electrophilic substitution reactions. (6+4)
3. a) Describe the orientation and reactivity of chlorobenzene towards electrophilic substitution reaction.  
b) Write a note on orientation and reactivity in di-substituted benzenes (5+5)

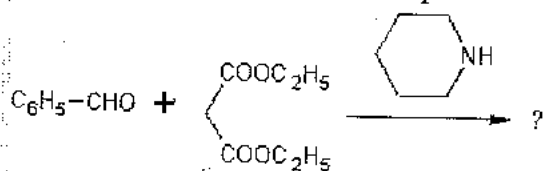
**Unit II**

4. a) What is the effect of substrate, base, solvent and leaving group on elimination reaction?  
b) Compare  $E1$  and  $S_N1$  reactions. (6+4)
5. a) Illustrate Saytzeff rule taking suitable example.  
b) What are the possible products in the elimination reaction of 2-bromobutane? (5+5)

**Unit III**

6. a) Write a note on the following:  
i) Markovnikov's rule ii) Free radical addition reactions  
b) Write a note on nucleophilic addition reactions. (6+4)
7. a) Discuss the mechanism of the following:  
i) Wittig reaction ii) Perkin reaction

b) Predict the product and explain the mechanism: (6+4)



#### Unit IV

8. a. Give synthesis of aziridines and oxiranes.  
b. Show with suitable example and with mechanisms, how alkanes can be obtained from thiophene derivatives? (6+4)
9. a. Explain with mechanism, the electrophilic reactions on indole.  
b. Compare the aromatic and basic characters of furan, pyrrole and thiophene. (6+4)

**CHOICE BASED CREDIT SYSTEM**  
**M. Sc. SECOND SEMESTER DEGREE EXAMINATION SEPTEMBER 2020**  
**PHYSICAL CHEMISTRY THEORY-II**

Duration: 3 Hours

Max Marks: 70

**Part - A**

1. Answer any TEN of the following:

(10x2=20 Marks)

- a) Draw a neat labeled phase diagram of formation of one pair of partially miscible liquids
- b) Draw and explain the energy profile diagram for a reaction with Arrhenius intermediate
- c) Give examples for specific acid-base catalysis
- d) Briefly explain the role of zeolites as support for a catalyst.
- e) Define the terms a) Catalyst sintering b) Catalyst poisoning.
- f) Define critical micellar concentration.
- g) Distinguish between the terms adsorption and absorption.
- h) List out the important characteristics of the enzyme catalysis.
- i) Give an account on the different types of adsorption isotherms.
- j) What are photochemical reactions? How are they distinguished from thermal reactions?
- k) Why the quantum yield for the photochemical reaction of hydrogen ( $H_2$ ) and chlorine ( $Cl_2$ ) is very high?
- l) Mention the factors influencing fluorescence efficiency.

**Part - B**

Answer any Five questions.

(5x10=50 Marks)

Select at least one question from each unit.

**Unit I**

2.
  - a) Draw the phase diagram for 2 component systems in which the two components form the eutectic mixture.
  - b) Define the following terms with an example: i) component ii) phase (6+4)
3.
  - a) Explain function of Catalyst in terms of Gibbs Free energy of activation.
  - b) Classify catalysts and give examples (6+4)

**Unit II**

4. a) Explain the method of bulk catalysis for the preparation of a catalyst.  
b) Explain the role of promoters and stabilisers in the preparation of catalyst. (6+4)
5. a) Catalysts are extensively characterized by XRD techniques-Justify the statement and write the major applications of XRD in the structural analysis of a catalyst material.  
b) Discuss the performance criteria for a catalyst.  
(6+4)

### Unit III

6. a) Discuss the effect of pH and temperature on the rates of enzyme catalysed reactions.  
b) Write a note on industrial applications of catalysis. (6+4)
7. a) Discuss any one mechanism of bimolecular surface reactions.  
b) Derive Gibb's adsorption isotherm for the adsorption of a solute on the surface of a liquid. (5+5)

### Unit IV

8. a) Demonstrate Franck-Condon principle for the electronic transition of a diatomic molecule.  
b) Explain the nature of changes in a molecule on electronic excitation. (5+5)
9. a) Deduce Stern-Volmer equation.  
b) Differentiate between unimolecular and bimolecular processes by considering various photophysical paths that can occur in a molecule. (6+4)

MCHE 204

REG.NO:.....

CHOICE-BASED CREDIT SYSTEM SECOND SEMESTER M.Sc. DEGREE EXAMINATION,  
SEPTEMBER 2020

M.Sc. CHEMISTRY

**QUANTUM CHEMISTRY**

Time : 3 Hrs

Max. Marks: 80

**PART - A**

**I Answer any TEN of the following:**

**(2x 10 = 20)**

- a) What is Heisenberg uncertainty principle?
- b) Define symmetry operation.
- c) What is direct product of sets of function?
- d) What is photoelectric effect?
- e) State de-Broglie's concept of matter wave.
- f) Write the secular determinant for wave function,  $\psi = c_1\phi_1 + c_2\phi_2$
- g) What are eigen functions and eigen values?
- h) Determine the effective nuclear charge for the 2s electron in carbon atom.
- i) Differentiate between atomic and molecular orbital.
- j) State Pauli's exclusion Principle.
- k) Explain why He<sub>2</sub> is not stable.
- l) State and explain the great orthogonality theorem.

**PART - B**

**UNIT - I**

**Answer any TWO of the following.**

**(10x2 =20)**

2. a) How is blackbody radiation explained by Max-Planck.  
b) Explain the postulates of quantum mechanics. (3+7)
3. a) Explain any three operators used in quantum mechanics.  
b) How is hydrogen spectra explained by Bohr's theory.  
c) Explain the characteristics and significance of quantum numbers. (3+3+4)
4. a) Deduce an expression for energy of an electron in a ring.  
b) Derive an expression for energy of rotation for a rigid rotator applying Schrodinger wave equation. (5+5)



## UNIT - II

Answer any TWO of the following:

(10x2=20)

5. a) Write a note on Spin-Orbit interaction.  
b) Obtain the term symbol for the ground state of nitrogen (N) atom considering L-S coupling.  
c) Show that O<sub>2</sub> is paramagnetic on the basis of Molecular orbital theory and N<sub>2</sub> is diamagnetic. (3+3+4)
6. a) Explain the principle of Born-Oppenheimer approximation.  
b) Mention the conditions of LCAO approach in the formation of molecular orbital.  
c) Formulate secular equation and the secular determinants. (3+3+4)
7. a) Explain the variation theorem and apply to hydrogen atom.  
b) Explain the applications of Hartree-Self consistent field method to many electron systems. (5+5)

## UNIT - III

Answer any TWO of the following:

(10x2=20)

8. a) Based on the concept of hybridisation, show that the bond angle in methane is 109° 28'.  
b) Predict the stability of Cyclopentadienyl anion using HMO theory. (4+6)
9. a) Explain the systematic procedure for symmetric classifications of molecules into point groups. Give an example.  
b) Explain the matrix representation of symmetry operation. (5+5)
10. a) Narrate the importance of character table.  
b) Mention the steps involved in deducing irreducible representation. (5+5)

\*\*\*\*\*



**CHOICE BASED CREDIT SYSTEM**  
**MSc. SECOND SEMESTER DEGREE EXAMINATION, SEPTEMBER 2020**  
**CHEMISTRY IN EVERYDAY LIFE**

Duration: 3 Hours

Max Marks: 70

**PART A**

1. Answer any SEVEN of the following questions: (7×2=14)

- a) What are the three components of a perfume? Explain them
- b) State where tartaric and citric acid is found and what flavour do they impart.
- c) Give any two functions of food additives
- d) What are amphoteric detergents? Give an example.
- e) Builders help the detergents to work better under hard water condition-Give reason.
- f) What is the role of a plasticizer in a nail polish? Give an example.
- g) What is an oligosaccharide? Give examples.
- h) What are symptoms of scurvy?
- i) What is saponification?

**PART B**

Answer any FOUR questions selecting at least ONE from each unit. (4×14=56)

**Unit-I**

2. a) Write a note on the following tastes:  
i) Sweetness ii) Acidity and sourness
- b) Explain caramelisation in detail. (7+7)
3. a) Write a note on natural sources of food colours
- b) Write a short note on the following:  
i) Carotenoids ii) betalain (7+7)

**Unit-II**

4. a) Write a note on preparation and applications of paints and inks.
- b) Discuss the criteria for a good paint.
- c) Discuss the chemistry of varnishes. (5+4+5)
5. a) Discuss the formulations and manufacturing of hair dyes.
- b) Write an account on chemistry of toothpaste.
- c) Give the detailed study of formulations and manufacturing of shampoos. (5+4+5)

**Unit-III**

6. Explain the classification of carbohydrates. (14)
7. a. Give an elementary idea amino acids, peptide bond, polypeptides and proteins.
- b. Write a note on isoelectric point (10+4)