

Roll No. \_\_\_\_\_

[Total No. of Pages : 2

**PGIS-269 A-21**  
**M.Sc. I Semester (CBCS) Degree Examination**  
**CHEMISTRY**  
**Inorganic Chemistry - I**  
**Paper : HCT 1.1**

**Time : 3 Hours**

**Maximum Marks : 80**

**Instructions to Candidates:**

- i) Answer All Questions
- ii) All questions carry **Equal** marks.

Answer any **Eight** of the following:

**(8×2=16)**

1.
  - a)  $LiCl$  is soluble in alcohol, while all other alkali metal chlorides are insoluble. Why?
  - b) Write Born - Lande equation and explain the terms.
  - c) In edge shared bio octahedra, the metal - metal bond order cannot be more than two Why?
  - d) Among  $[Mn(CO)_5]$  and  $[Mn(CO)_5]^-$  which is more stable? Explain using 18 - electron rule?
  - e)  $NaCl$  do not favour Frenkel defect, while  $AgCl$  does it. Why?
  - f) Calculate the spin - only magnetic moment values for high - spin complexes of cobalt (II) and Iron(II).
  - g) Why square planar complexes do not show optical isomerism?
  - h) What is symbiosis? Give an example.
  - i) How does HF react with anhydrous sulphuric acid and liquid ammonia?
  - j) List out the limitations of non - aqueous titrations in chemical analysis.
2.
  - a) Using VSEPR theory explain the structures of  $PCl_5$  and  $ClF_3$ . **(5)**
  - b) Set up the M.O diagram for  $O_2^-$  and  $N_2^-$  and comment on their bond order and magnetic properties. **(5)**

- c) Derive an expression for lattice energy from Born - Haber cycle and explain the importance of various terms involved their in. (6)

(OR)

Based on band theory, explain how solids can be classified as conductors, semiconductors and insulators?

3. a) Briefly explain the preparation, structure and bonding in metal carbonyls. (5)
- b) Explain the nature of metal - metal bond in  $[\text{Re}_2\text{Cl}_8]^{2-}$ . Comment on its properties. (5)
- c) Outline the preparation and structure of metal nitrosyls. Explain IR spectral studies in the structure of nitrosyls. (6)

(OR)

Write a note on:

- i) Cheveral phases and  
ii) Quadruple bond.

4. a) Discuss the Gouys method for the determination of magnetic moments of the complexes. (5)
- b) Set up M.O energy level diagram for octahedral complex involving sigma bonding. (5)
- c) Explain static and dynamic Jahn - Teller effects, and discuss distortion in the structure of  $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ . (6)

(OR)

In which of the following tetrahedral complexes would you expect contribution from spin - orbital coupling  $d^2$ ,  $d^3$ ,  $d^4$  and  $d^5$  ?

5. a) What are levelling and differentiating solvents? Explain why the levelling effect operates? (5)
- b) Discuss briefly on Pearson's concept of HSAB and explain the basis for the concept. (5)
- c) Explain with examples the types of reactions in liquid  $\text{SO}_2$  and anhydrous sulfuric acid. (6)

(OR)

Write notes on :

- i) Irving William series.  
ii) Determination of carboxylic acids by non - aqueous solvents.

**PGIS-270 A-21**  
**M.Sc. I Semester (CBCS) Degree Examination**  
**CHEMISTRY**  
**Organic Chemistry - I**  
**Paper : HCT - 1.2**  
**(Old And New Syllabus)**

Time : 3 Hours

Maximum Marks : 80

**Instructions to Candidates:**

- i. Answer **all** questions.
- ii. All questions carry **equal** marks.

1. Answer any **Eight** of the following : (8×2=16)

- a) Define the term hyperconjugation with an example.
- b) Comment on aromaticity of cyclopentadienyl anion.
- c) Sketch the mechanism of  $S_Ni$  reaction.
- d) Write two synthetic applications of Fries rearrangement.
- e) What are enamines? How are they generated?
- f) What is the significance of D and L notations in stereochemistry?
- g) Write the reagent(s) and mechanism for the following conversion:



- h) Write the structure of (Z) - 1 - bromo - 1,2 - dichloroethene and (E) - 2 - chloro - 3 - methyl - 2 - pentenoic acid.
- i) What are epimers?
- j) Define Dienone - phenol rearrangement with an example.

2. a) Explain bonding in cyclopropane. (5+5+6=16)
- b) Write short note on hydrogen bonding.
- c) Point out the salient features of Huckel's rule and explain the aromaticity of following compounds :
  - i. [18] Annulene
  - ii. Tropylium cation

(OR)

c) How the heat of reactions and bond order calculated? Explain by taking suitable examples.

3. a) Discuss the mechanism and stereochemistry of  $S_N1$  reaction. (5+5+6=16)

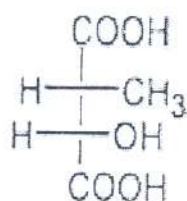
b) Explain the structure and stability of carbanions.

c) Describe any two methods for the determination of reaction mechanism.

(OR)

c) Account on generation, structure and stability of carbonations.

4. a) Convert the following Fisher projection formula into Sawhorse and Newman projection Formulae : (5+5+6=16)



b) Explain the terms enantiomers, diastereomers and racemization with examples.

c) Give an account of conformational analysis of butane molecule.

(OR)

c) Write a note on R/S nomenclature.

5. a) Predict the product with possible mechanism. (5+5+6=16)



b) Explain the mechanism and synthetic applications of Beckmann rearrangement.

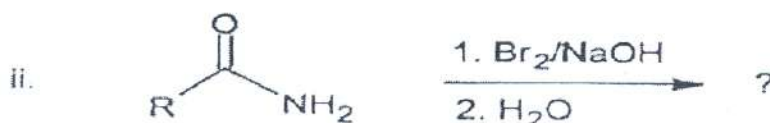
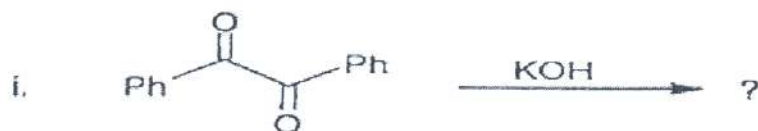
c) Discuss the mechanism of following rearrangement :

i. Baker - Venkataraman

ii. Baeyer - Villiger

(OR)

c) Give the product with plausible mechanism.



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**PGIS-271 A-21**  
**M.Sc. I Semester (CBCS) Degree Examination**  
**CHEMISTRY/ORGANIC CHEMISTRY**  
**Physical Chemistry - I**  
**Paper : H.C.T 1.3**  
**(New and Old)**

**Time : 3 Hours**

**Maximum Marks : 80**

**Instructions to Candidates:**

- 1) *All questions are compulsory.*
- 2) *All questions carry equal marks.*

Answer any **Eight** of the following:

**(8×2=16)**

1.
  - a) State Heisenberg's Uncertainty principle.
  - b) Explain Del and linear operators.
  - c) What is the ionic strength of 0.002M  $\text{KNO}_3$ .
  - d) Define - pH, calculate the pH of 0.01M of  $\text{H}_2\text{SO}_4$  aqueous solution.
  - e) Name the polymers used in contact lens.
  - f) Explain polydispersity index.
  - g) Give applications of polymers.
  - h) State steady state approximations.
  - i) Explain order of reaction and molecularity of reaction.
  - j) What are fast reactions? In what respect they differ from conventional reactions.
2.
  - a) If  $f(x)$  is an Eigen function of the linear operator  $\hat{A}$  and  $\lambda$  is constant. Show that  $\lambda f(x)$  is a Eigen function of  $\hat{A}$  with same Eigen value as  $f(x)$ . **(5)**
  - b) Define operator. Explain addition and subtraction operator. **(5)**
  - c) State the postulates of quantum mechanics. **(6)**

**(OR)**

- c) Explain:
- If particle in ring and kroneckers delta.
  - Calculate uncertainty product for a moving electron of mass is  $9.1 \times 10^{-28} \text{ gm}$ . (6)

3. a) Discuss general procedure for preparation of universal buffer solutions. (5)
- b) Explain nature of binding and interaction in supramolecules. (5)
- c) State the Debye - Huckel limiting laws. (6)

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- c) What are buffer solutions? Calculate the ratio of concentrations of lactic acid and lactate in buffer system whose pH is 4.49 and pKa of lactic acid is 3.86. (6)
4. a) Explain how polymers are useful to mankind with suitable examples. (5)
- b) What are glass transition and melt temperature of Polymers? Discuss the Osmotic pressure method of determining polymer molecular weight. (5)
- c) Explain different types of polymer molecular weights. Calculate number average molecular weight of a polymer if equal masses of polymers with molecular weights 10000 and 50000 units are mixed. (6)

(OR)

- c) Discuss biomedical applications of polymers. (6)
5. a) Discuss the Kinetic theory of unimolecular reaction rates. (5)
- b) Derive the expression  $k = Ae^{\frac{-Ea}{RT}}$ . (5)
- c) What are Maxwell's relations? Derive any one relation. (6)

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- c) Discuss the Kinetics of primary salt effect. Find the ratio of rates  $\frac{k}{k_0}$  for a reaction in presence of 1N KCl salt, if  $Z_A Z_B = -2$ . (6)

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**Paper : HCT 1.1**

**Time : 3 Hours**

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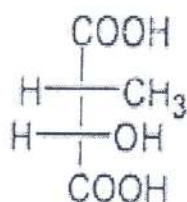
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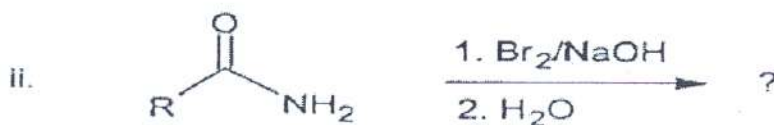
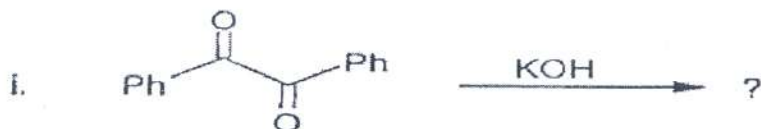
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b) Derive the expression  $k = Ae^{\frac{-Ea}{RT}}$ . (5)

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c) Discuss the Kinetics of primary salt effect. Find the ratio of rates  $\frac{k}{k_0}$  for a reaction in presence of 1N KCl salt, if  $Z_A Z_B = -2$ . (6)

**PGIS-272 A-21**  
**M.Sc. I Semester (CBCS) Degree Examination**  
**CHEMISTRY**  
**Analytical Chemistry - I**  
**Paper : S.C.T 1.1**

Time : 3 Hours

Maximum Marks : 80

**Instructions to Candidates:**

- 1) Answer *All* the questions.
- 2) All questions carry equal marks.

Answer any **Eight** questions:**(8×2=16)**

1. a) What are significant figures? List the significant figures in the following values:
  - i) 0.0486 and                      ii) 0.486
- b) A chemist performed the analysis of calcium in dolomite ore repeatedly and obtained the following results: 38.6; 38.3; 39.1; 36.4; 38.8. Find whether the 4<sup>th</sup> value of the analysis can be retained at 95% confidence level?(Given :  $Q$  at 95% confidence level = 0.710)
- c) Mention any two sampling hazards with example.
- d) Calculate the distribution ratio,  $D$  for an analyte with %E=85, if  $V_{org} = V_{aq} = 10\text{ml}$ .
- e) Define ion exchange capacity of a resin.
- f) Among UV and fluorescence detectors used in HPLC, which is more sensitive? Give reason.
- g) Differentiate between contamination and adulteration.
- h) A 10.0g food sample was dried at 105°C for 3 hrs to obtain weight of 9.1g.  
Calculate the percentage of moisture in the given food sample.
- i) Stripping techniques are more sensitive than voltammetric techniques. Justify.
- j) Sketch the conductometric titration curve for
  - i) Strong acid and strong base and                      ii) Strong acid and weak base.

2. a) What are random errors? Discuss the distribution of random errors.  
b) What is accreditation system? Explain the salient features of six sigma concept.  
c) With the help of statistical equations, illustrate the application of least squares method in deriving the straight line for calibration plot.

(OR)

- c) A chemist obtained following set of results for ascorbic acid analysis in a tablet sample using newly developed method: 98.2, 99.1, 98.4, 100.8 and 99.0 mg. He compared his results with standard method and obtained the following results: 99.7; 99.3; 99.6; 99.8. Find whether the new method is significantly different from standard method when F value is 6.59 at 95% confidence level. (5+5+6)

3. a) Briefly explain the principle and importance of automation of solvent extraction.  
b) Illustrate the principle and applications of HPLC in identification and purification.  
c) Account on different types of detectors used in gas chromatography.

(OR)

- c) Describe the procedure involved in the i) separation of lanthanides and ii) Demineralization of water using ion exchange chromatography. (5+5+6)

4. a) What are sedatives? Explain the procedure for the analysis of Phenobarbital.  
b) Write the importance of calcium in food samples. A 10.0g food sample was crushed and charred and the residue was dissolved, filtered. The filtrate with containing Ca was diluted to 100ml. 10.0ml of this solution consumed 7.0ml standard 0.025 M EDTA solution for Eriochrome black - T endpoint. Calculate the % of calcium present in the given food sample. (Given atomic weight of calcium = 40 amu)  
c) What are preservatives? Discuss the procedure for the detection and determination of sulphites.

(OR)

- c) i) Write the structure of Fenfluramine hydrochloride and explain the procedure for its analysis.  
ii) Application of TLC in drug analysis. (5+5+6)

5. a) What are reference electrodes? Sketch and explain the working of calomel electrode.  
b) Comment on different types of coulometric techniques and their applications.  
c) Explain the principle and applications of polarography in qualitative and quantitative analysis.

(OR)

- c) What is the principle of cyclic voltammetry? Explain the characteristics of the cyclic voltammograms for reversible and irreversible systems. (5+5+6)