22MCHEH101

CHOICE BASED CREDIT SYSTEM

M.Sc. CHEMISTRY FIRST SEMESTER DEGREE EXAMINATION JANUARY 2024

Inorganic Chemistry - I

Duration: 3 Hours   Max Marks:70

PART - A

1. Answer any TEN of the following :   (10×2= 20 Marks)

a) How does the presence of lone pair distort the regular octahedral geometry of XeF_4?

b) Give the geometry of PCl_5

c) Mention the type of hybridisation in BF_3

d) AgI_2^- is stable while AgF_2^- does not exist. Why?

e) What is Lewis acid? Identify Lewis acids in the following:
   $SnCl_4$, CCl_4, BF_3, $NaCl$

f) Give an example for froth flotation and leaching.

g) Why buffer is added in the complexometric titration?

h) What is t-test? What is its significance?

i) What is masking of ions in complexometric titration? Give an example.

j) Differentiate Frost diagram from Pourbaix diagram.

k) Give any two examples, in which, water is removed during calcination.

l) What are Latimer diagrams?

PART - B

Answer any Five questions selecting at least one question from each unit (5×10= 50 Marks)

UNIT - I

2. a) Draw the molecular orbital diagram of CO.
   b) Indicate the different states of hybridisation and deduce the geometry of the following
      isolated molecules: i) IF_5 ii) SF_6 (5+5)

3. a) Set up Born Haber's cycle for NaBr and MgO.
   b) Give the geometries of PH_3 and NH_4^+ (6+4)

UNIT - II

4. a) Discuss the chemistry of liquid ammonia as a solvent.
   b) Explain the application of solvent system concept of acids and bases.   (6+4)

5. a) Explain the term conjugate acids and conjugate base with suitable examples.
   b) Discuss merits and demerits of Bronsted acid base theory.
   c) Explain briefly the reactions which take place in nitrogen tetroxide.   (4+3+3)

UNIT - III

6. a) Discuss the types of error in quatitative and qualitative analysis.

b) Solve the following equations using the correct number of significant figures.

    i) $34.683 + 58.930 + 68.35112$

    ii) $42.71 + 9.643 + 8.0$

    iii) 98.1×0.03

    iv) $101.2 + 18.702$ (6+4)

7. a) The amount of oxalic acid present in the given solution was determined by two methods, on standard and the other new, when the following results were obtained. Show that there is no significant difference in the two methods. (critical value of t at appropriate confidence level is 0.48)

Standard method: 8.65, 11.70, 7.38, 13.95, 17.26, 12.80

New method: 9.35, 11.06, 8.90, 12.58, 18.99, 11.72

b) Write a note on digestion and filtration of precipitate.   (6+4)

UNIT - IV

8. a) Construct Latimer diagram of oxygen involving the following species:

H_2O_2, H_2O and O_2

The SRP for stepwise conversion are +0.70V and +1.76V respectively. Calculate E^0 O_2/H_2O (skip potential)

b) Explain Pourbaix diagram of water.   (6+4)

9. a) Explain the types of precipitation titration.

b) Differentiate between equivalence point and end point.   (6+4)

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Reg No : ....

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M.Sc. CHEMISTRY FIRST SEMESTER DEGREE EXAMINATION JANUARY 2024

Organic Chemistry - I

Duration:3 Hours   Max Marks:70

PART - A

1. Answer any TEN of the following :   (10×2= 20 Marks)

   a) Discuss the resonance in benzene.

   b) What are the characteristic features of inductive effect?

   c) Maleic acid is much stronger acid than fumaric acid. Give reason.

   d) Benzyl carbocation is more stable than the alkyl carbocation. Give reason.

   e) Among difluoro singlet carbene and difluoro triplet carbene which is more stable. Why?

   f) Define aliphatic nucleophilic substitution. Give example.

   g) What is syn isomer? Give an example.

   h) Write the structure of chiral sulphoxides and chiral sulphenes.

   i) Explain why trans- 1,3-di-t-butylcyclohexane prefers a boat conformation.

   j) What is amino sugars? Give an example.

   k) Give the structures of β-D-furanose and α-D-fructofuranose.

   l) Give the structure of cellulose and sucrose.

PART - B

Answer any Five questions selecting at least one question from each unit (5×10= 50 Marks)

UNIT - I

2. a) Give an account on the synthesis and applications of crown ethers.

   b) Differentiate between hyperconjugation and resonance with suitable example.

                                                                    (6+4)

3. a) Comment on the aromaticity of C-8 and C-14 annulenes.

   b) What is meant by non benzenoid compound? Give any two examples and explain.

   c) Mention the criteria required for a compound to be aromatic and antiaromatic. Give suitable example for each.   (4+3+3)

UNIT - II

4. a) Explain the factors influencing the mechanism of aliphatic nucleophilic substitution reactions.

   b) Explain $S_N i$ mechanism by taking an appropriate example.   (6+4)

5. a) Explain the structure, reactions and stability of carbanions.

   b) Write a note on trapping of reaction intermediates. (6+4)

UNIT - III

6. a) Discuss various methods of racemization.

   b) Explain the optical activity in substituted biphenyls. (6+4)

7. a) Briefly explain the different methods of resolution of racemic mixture.

   b) Explain (R,S) configuration taking suitable examples. (6+4)

UNIT - IV

8. a) Write a note on cyclic hemiacetal forms of D-glucose.

   b) Discuss the formation of glucose oxime from glucose.

   c) Name and complete the following reaction

   Glucose $\xrightarrow[\text{water}]{\text{Bromine}}$ A $\xrightarrow{\text{HNO}_3}$?
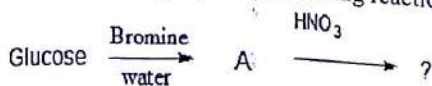
   (4+3+3)

9. a) What is Smith degradation? Explain the degradation of polysaccharide with 1,2 and 1,4 linkage.

   b) Explain the structure of Chitin. (5+5)

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M.Sc. CHEMISTRY FIRST SEMESTER DEGREE EXAMINATION JANUARY 2024

Physical Chemistry - I

Duration: 3 Hours   Max Marks:70

PART - A

1. Answer any TEN of the following :   (10×2= 20 Marks)

   a) Write the energy equation for a particle in a ring and explain the terms involved in it.

   b) Give the orthogonality condition with regard to two wave functions.

   c) How would the wavelength of moving objects vary with their masses?

   d) What is meant by state of the system and state variables?

   e) What is meant by partial molar quantities? Write the general expression for the partial molar free energy.

   f) What are correlation diagrams?

   g) Write the expression for entropy in terms of partition function and explain the terms.

   h) Give any two limitations of Einstein's theory.

   i) State Liouville's theorem.

   j) Give reasons for inadequacy of conventional methods to study fast reactions.

   k) State the assumptions of CTST.

   l) Explain secondary salt effect in reactions in solutions.

PART - B

Answer any Five questions selecting at least one question from each unit. (5×10= 50 Marks)

UNIT - I

2. a) Derive time-dependent Schrodinger wave equation.

   b) An electron is confined to an infinite potential well of width 5A°. Calculate the energy and wavelength of an emitted photon of the electron makes a transition from first excited state to ground state.   (6+4)

3. a) What is meant by commutator operator? Given $A^\wedge = d/dx$ $B^\wedge = 3x^2$ $f(x) = \sin x$, find out if A and B commute.

   b) State the eigen value equation. Show that $\sin 2x$ is not an eigen function of the operator d/dx but of d^2/dx^2. What is the eigen value?   (5+5)

UNIT - II

4. a) Illustrate the Nernst heat theorem.

   b) State the third law of thermodynamics. Explain the experimental verification of the third law of thermodynamics. (5+5)

5. a) Discuss the application of variation theorem to H atom.

   b) Explain the principle of perturbation theory. (5+5)

UNIT - III

6. a) Describe microcanonical and grand canonical ensemble with suitable diagrams.

   b) Explain how an ensemble is said to be in statistical equilibrium. (5+5)

7. a) Deduce the Sackur-Tetrode equation.

   b) Derive the translational and rotational partition function for a diatomic molecule. (5+5)

UNIT - IV

8. a) Derive the rate expression for a reaction $A \longrightarrow X \longrightarrow Z$

   b) Explain rate determining steps taking the example of consecutive reactions. (6+4)

9. a) Obtain the expression for the rate constant of a reaction using collision theory of unimolecular reactions.

   b) Derive integrated form of Arrhenius Equation. (5+5)

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CHOICE BASED CREDIT SYSTEM

M.Sc. CHEMISTRY FIRST SEMESTER DEGREE EXAMINATION JANUARY 2024

Analytical Chemistry

Duration:3 Hours   Max Marks:70

PART - A

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

   a) What are ion exchangers? How are they classified?

   b) Determine whether nickel dimethyl glyoxime will be extracted completely or not from 10 mL of an aqueous solution at pH 8 after shaking twice with 5 mL of chloroform. The distribution coefficient is 410.

   c) A solution of 6.0 g of substance A in 50 mL of aqueous solution is in equilibrium at 20 °C with a solution of A in ether containing 108 g of A in 100 mL. Calculate the amount of A extracted by shaking 100 mL of an aqueous solution containing 10 g of A with 100 mL of ether.

   d) Differentiate between nephelometry and turbidimetry.

   e) Give the limitations of flame photometry.

   f) Explain what is meant by line reversal.

   g) What is crystallization peak in DSC and how does DSC identify the type of materials?

   h) What is the function of an anode and why is liquid nitrogen used in a scanning electron microscope?

   i) Mention any four applications of TEM.

PART - B

Answer any Four questions selecting at least one question from each unit.   (14×4 = 56)

UNIT - I

2) a) Discuss various applications of GC in chemistry.

   b) What are the characteristic features of carrier gas used in GC?

   c) Describe the theory and applications of SEC.   (5+5+4)

3) a) Describe in detail the different pumps used in HPLC.

   b) Substances A and B have retention times of 16.40 and 17.63 min respectively on a 30 cm column. An unretained species passes through the column in 1.30 min. The peak widths (at base) for A and B are 1.11 and 1.21 min respectively. Calculate
   i) Column resolution   ii) average number of plates in the column
   iii) plate height   iv) length of column required to achieve a resolution of 1.5

   c) Write a note on normal-phase and reverse-phase HPLC.   (5+5+4)

UNIT - II

4) a) Explain the various types of interferences found in AAS and suggest ways to eliminate them.

b) Describe in detail the construction and working of Hollow cathode lamp.

c) Explain Total consumption and premix burner. (5+5+4)

5) a) State the deviations which could occur from Beer's law?

b) Draw and explain the possible titration curves for spectrophotometric titration.

c) Explain how molar compositions of complexes can be determined using spectrophotometry. (5+5+4)

UNIT - III

6) a) Discuss the types of physical changes that can yield exothermic and endothermic peaks in DTA.

b) Write a note on simultaneous TGA and DTA curves.

c) Outline the principle of DTA. (5+5+4)

7) a) Explain the thermogravimetric curve of copper sulphate pentahydrate and mention any two variables affecting the TG curve.

b) Describe the different types of thermobalances used in thermogravimetric analysis.

c) Discuss the principle and working mechanism of SEM. (5+5+4)

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