CHOICE BASED CREDIT SYSTEM

M.Sc. CHEMISTRY FOURTH SEMESTER DEGREE EXAMINATION MAY 2025

Organometallic and Bioinorganic Chemistry

Duration:3 Hours   **Max Marks:70**

PART - A

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

     a) Give examples for symmetrical and unsymmetrical organometallic compounds.

     b) Benzyne and cyclohexyne form strong bond with metals.Why?

     c) Give the 18 electron rule, Give an example of a complex which follows the rule and of a complex which doesn't follow the rule.

     d) Homogenous catalysts are used over heterogenous catalysts in hydrogenation of alkenes. Why?

     e) What is the difference between Tsuji- wacker process and wacker process?

     f) What is the significance of turnover frequency?

     g) Give the biological function of carboxypeptidase.

     h) Depict the active site of alcohol dehydrogenase. Explain its importance.

     i) What is ligand gated protein ? Explain briefly.

     j) Indicate the oxidation state of iron and O_2 ligand in oxyhemerythrin.

     k) Give any two examples for synthetic oxygen carriers.

     l) What are metalloporphyrins? Give an example.

PART - B

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

UNIT - I

2. a) How does the Fischer carbene and Schrock carbene complexes differ in their structure? Explain.

    b) List the systhesis of Fischer type carbene complexes.   (6+4)

3. a) Explain the synthetic methods of

      i) organolithium compounds ii) metal complexes of butadiene

    b) Explain the structure of aluminium alkyls.   (6+4)

4. Explain oxo process with mechanism using **a)** Cobalt and **b)** Rhodium catalysts.

(5+5)

5. a) Explain the role of metal carbene complex as catalysts.
   b) Describe the regioselectivity and stereo selectivity of Zigler-Natta Catalyst. (6+4)

UNIT - III

6. a) Draw and explain dose - response curve of an essential element.
   b) Explain the functioning of Magnesium, Calcium, Potassium, Iron and Iodine.

(5+5)

7. a) Explain the structure and features of Vitamin B12 coenzyme.
   b) Discuss the types of blue copper protein. (5+5)

UNIT - IV

8. a) What is ceruloplasmin? Illustrate its structure and biological functions.
   b) Write a note on metal toxicity. (5+5)

9. a) What are Iron – Sulphur proteins? Explain the structures of Rubredoxin and Ferredoxin proteins.
   b) Write a note on structural features of hemocyanin. (6+4)

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M.Sc. CHEMISTRY FOURTH SEMESTER DEGREE EXAMINATION MAY 2025

Synthetic methods in Organic Chemistry

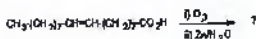Duration: 3 Hours   Max Marks:70
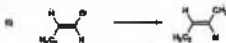

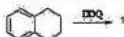
PART - A

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

a) Complete the following:

$$CH_3(CH_2)_7-CH=CH-(CH_2)_7-CO_2H \xrightarrow[\text{a) } Zn/H_2O]{\text{i) } O_3} \ ?$$
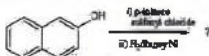
b) Predict the reagents:

c) Complete the following reaction:

d) Mention the applications of Lithium aluminium hydride in organic synthesis.
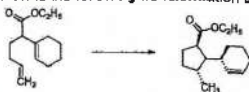
e) Predict the products in the following:

f) Give synthetic utility of Birch reduction.

g) With suitable example write the mechanism of a reaction which involves C=C bond insertion.
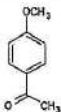
h) Give an example for Ene reaction.

i) How is the following transformation achieved? Write the mechanism.

j) Give any two examples for hydroxyl protecting reagents.

k) Explain two group C-X disconnection taking acetal as an example.

l) Perform the retrosynthetic analysis of the following:

PART - B

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

UNIT - I

2. a) Discuss the applications of phase transfer catalyst in permanganate oxidation.
    b) Explain the oxidation of vicinal diols with HIO_4 and give its mechanism.   (5+5)

3. a) Give an account on the following reagents in organic synthesis:
       i) Baker's yeast   ii) DCC   iii) Osmium tetroxide
    b) How do you achieve the cis-hydroxylation of alkenes-using $KMnO_4$? Explain
       with mechanism.   (6+4)

UNIT - II

4. a) Discuss the mechanism of heterogenous catalytic hydrogenation.
    b) What is hydrogenolysis? Explain taking suitable example.
    c) Write a note on Wolf-Kishner reduction.   (4+3+3)

5. a) What is homogeneous catalytic hydrogenation? Write its mechanism for
       reduction of alkenes with Wilkinson's catalyst.
    b) Discuss the synthetic application of sodium borohydride in organic synthesis
       taking suitable examples.   (5+5)

UNIT - III

6. a) Discuss the mechanism of Thorpe condensation and Benzoin condensation
       reactions.
    b) Outline the synthesis of 6-methoxy-1-tetralone.   (5+5)

7. a) Briefly explain i) Wittig reaction ii) Dieckmann cyclisation.
    b) Illustrate the synthesis of Iswarane.   (5+5)

UNIT - IV

8. a) Illustrate one group disconnection with suitable examples.
    b) What are synthons and synthetic equivalents? Explain with examples. (6+4)

9. a) Perform RSA of 2-methyl-6-methoxyindole-3-acetic acid.
    b) Explain the retrosynthetic analysis of the following: (5+5)

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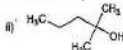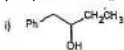
CHOICE BASED CREDIT SYSTEM

M.Sc. CHEMISTRY FOURTH SEMESTER DEGREE EXAMINATION MAY 2025

Physical Chemistry II

Duration:3 Hours   Max Marks:70

PART - A

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

   a) Distinguish between Assymmetry effect and Electrophoretic effect.

   b) Mention the factors that affect the zeta potential in electrophoresis.

   c) What is meant by the transport number of an ion?

   d) Draw the plot and give the expression to show variation of charge density at the semiconductor/solution interface.

   e) Draw and explain the plot of exchange current density with strength of M - H bond.

   f) Write the reactions involved in the electronation of oxygen.

   g) Give any two applications of polymer electrolyte fuel cell.

   h) What is solid oxide fuel cell? Give any two applications.

   i) Construct the lead acid battery.

   j) Define migration current.

   k) Explain the graphical representation for non reducible sample versus reducible reagent in amperometry.

   l) Differentiate between cathodic and anodic stripping voltammetry.

PART - B

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

UNIT - I

2. a) Derive an equation for modified Debye Huckel limiting law.
   b) Calculate the mean ionic coefficient of NaCl at molality of 0.02 in aqueous solution at 25°C.   (5+5)

3. a) Determine the transport number by Hittorf's method.

   b) In the determination of transference number of Li^+ ion by moving boundary method a 0.10M solution of LiCl was taken in a cell having uniform area of cross section of 1.17 cm^2. At the end of the experiment the boundary moved by 2.1cm and 0.083g of silver was deposited on the cathode of silver coulometer. Calculate the transference numbers Li^+ ion. (5+5)

UNIT - II

4. a) Trace the developments in photoelectrochemistry.

   b) Explain in detail the two aspects of electrogrowth with an example. (5+5)

5. a) Explain the principle and working of photovoltaic cell.

   b) Describe the significance of the Mott-Schottky plot. (5+5)

UNIT - III

6. a) Derive Nernst equation. Find reduction and oxidation potential of $Cr(s)/Cr^{3+}$ (0.1M) at 25°C, $E^o_{Cr^{3+}/Cr}$ = -0.75V.

   b) What is phosphoric acid cell? Discuss the advantages and limitations of phosphoric acid fuel cell. (6+4)

7. a) Explain the principle of silver-silver chloride electrode.

   b) Discuss the principle, construction and working of Ni-Cd battery. (5+5)

UNIT - IV

8. a) Write a note on the following electrode used in polarography:
      i) Static dropping mercury electrode ii) Rotating disc electrode

   b) Enumerate the advantages and disadvantages of DC polarography. (6+4)

9. a) Describe the principle and working of rapid scan polarography.

   b) Discuss the role and importance of supporting electrolyte. (5+5)

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PART - A

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

   a) Outline the principle of Gel permeation chromatography.

   b) Define degree of polymerisation.

   c) If the values of α and K are 0.5 and 1×10^{-2} cm^3g^{-1} respectively. What is the average molecular weight of the polymer whose intrinsic viscosity is 150cc/g?

   d) Give the rate equation of free radical polymerisation.

   e) Give examples of initiators used each for the different types of addition polymerisation.

   f) Write the overall polycondensation reaction between adipic acid and ethylene glycol.

   g) List three factors to increase the solid state reactions.

   h) What does glide plane 'd' represents?

   i) What is the difference between diffraction and scattering?

PART - B

II. Answer any Four questions selecting at least one question from each unit.

                                                              (14×4 = 56)

UNIT - I

   2) a) Explain the determination of molecular weight of the polymer by the light scattering method.

       b) Outline the principle of determination of molecular weight of polymer by Osmometric method.

       c) A polymer that contains 15 molecules with each of mass, 8,000 and 15 molecules with each of mass 80,000. Calculate number average molecular mass.   (5+5+4)

3) a) How do you determine the molecular weight of the polymer by viscosity method.

   b) Differentiate between sedimentation velocity & sedimentation equilibrium methods of determination of polymer molecular weights.

   c) Calculate the number average molecular mass of a polymer sample in which 30% molecules have a molecular mass 20,000, 40% have 30,000, and 30% have 60,000. (5+5+4)

UNIT - II

4) a) Explain the structure, properties and applications of PMMA.

   b) Briefly discuss the difference in structure and properties of LDPE and HDPE.

   c) Write a note on polypropene clearly depicting the superiority of PP over PE.

   (5+5+4)

5) a) Explain the kinetics of free radical copolymerisation.

   b) Evaluate the relation between the reactivity ratios and copolymerization behaviour.

   c) Write a note on the significance of Q-e scheme. (5+5+4)

UNIT - III

6) Explain thin film preprations using the methods (i) anodic oxidation,
   (ii) cathodic deposition and (ii) electroless deposition (5+5+4)

7) a) Write a note on **(i)** Zone melting method and **(ii)** Skull melting process.

   b) List the advantages and disadvantages of Czochralski method.

   c) Why crystal growth from melts are important? Explain. (5+5+4)

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