CHECP-3

Ph.D Course Work Examinations, July-2023

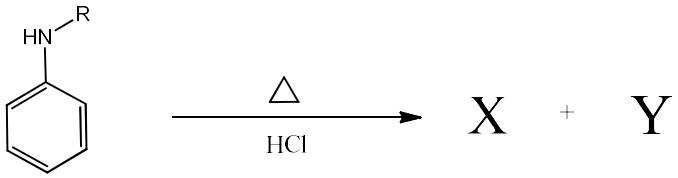
CHEMISTRY

Course-III: Selected Topics in Chemistry

Time: 3 Hours **Max.Marks: 70**

Instructions: All sections are compulsory

1. **Answer any SEVEN questions of the following:** **7X2M=14M**
   - **a.** State general principle of chromatography.
   - **b.** What are the limitations of mass spectrometry?
   - **c.** Discuss briefly the disadvantages of electrochemical sensors.
   - **d.** Write an equation for the relationship between standard free energy change (ΔG°) and the equilibrium constant (K) of a reaction.
   - **e.** Predict the products X and Y:



   - **f.** Write the general reaction scheme for the *Wolf* rearrangement.
   - **g.** State any two advantages of Homogeneous catalysis?
   - **h.** Write any two Industrial applications of organometallic compounds.

2. **a)** Discuss various types of fragmentations occur in mass spectrometry.
   b) What is the importance of fingerprint region in IR spectroscopy? Write the limitations of IR spectroscopy.
   c) Determine the structures of the following organic compounds by interpretation on the basis of following spectral data. (MASS: m/z (% Relative Abundance); 110(0.2 M+2); 104(0.3 M+1); 108(0.6 M+);107(1); 73 (100); 63(0.144); 45(25); 27(24). IR: Absorption: 2985-2850; 1720; 690. HNMR: Absorption (multiplicity); 2.85(Triplet); 3.75(Triplet); 12.2(Singlet). UV: No λ max above 220 nm.) **[5+5+4=14M]**

   OR

   Explain the different detectors used in Gas Chromatography.

3. **a)** Discuss in brief the activated complex theory with suitable examples.
   b) What are first order reactions? Explain briefly the kinetics of unimolecular reactions with suitable examples.
   c) Write a note oncommercial electro synthetic processes and explain how these processes contribute to the development of sustainable and energy-efficient chemical manufacturing practices? **[5+5+4=14M]**

   Or

   Write a note on electrochemical sensors.

4. **a)** Write a note on spectroscopic, electronic, and structural properties of charge transfer complexes with suitable examples.

b) Sketch the synthetic rout for the *Oppenauer* oxidation mechanism and explain briefly how metal catalystinfluence the selectivity and efficiency of the reaction?

c) Write the synthesis of the following compounds with mechanism:

1. *Furan and* ***2***. *Thiophene.* **[5+5+4=14M]**

Or

Describe the electrophilic substitution reactions of pyrrole.

5. a) Why heterogeneous catalysis is more commonly used in large-scale industrial processes? Discuss The Wacker process for the synthesis of acetaldehyde with reactions.

b) How structure, stability, and biological activity is affected by interaction of metal complexes with DNA and RNA? Write a brief notes on metal complexes as drugs and therapeutic agents.

c) When a sample of bismuth nitrate hydrate, $Bi(NO_3)_3.nH_2O$, of mass 100 mg was heated to 500°C anddryness, the loss in mass observed was 18.56 mg. Determine n. **[5+5+4=14M]**

Or

Explain: i) Applications of Ziegler Natta catalysts

ii) Hofmann-Markus rearrangement.

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