

**RANI RASHMONI GREEN UNIVERSITY**  
**DEPARTMENT OF CHEMISTRY**  
**M.Sc. Course in Chemistry**  
**Semester – III, Final Examination – 2025**  
**Course ID: CHEM-CHEM-C33**

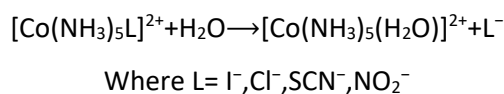
**Full marks: 40**

**Time: 2 hr**

*Answer all the questions. Candidates are required to write answers in their own words and with proper scientific representations, if needed.*

**Unit-1: Inorganic Reaction Mechanism**

1. (a) A thermodynamically stable complex may be kinetically inert- illustrate with example.  
 (b) Consider the following reaction:



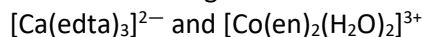
What will be the reactivity order of the reaction?

- (c) Write down the synthesis of three isomers of  $[\text{Pt}(\text{Br})(\text{Cl})(\text{NH}_3)(\text{py})]^-$  from  $[\text{PtCl}_4]^-$ .

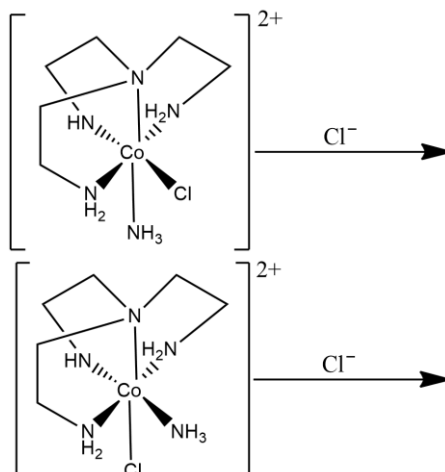
[3+2+3]

Or

2. (a) Comments on the lability or inertness of the following metal complexes on the basis of Molecular Orbital Theory and electronic configuration:



- (b) The first reaction occurs  $10^4$  times faster than that of second reaction- explain the observations.



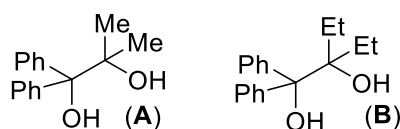
- (c) Discuss polarization theory with suitable example to rationalize 'Trans Effect'.  
 (d) Write down the synthetic route of *cis*- and *trans*- isomer of  $[\text{PtCl}_2(\text{NH}_3)(\text{NO}_2)]^-$  from  $[\text{PtCl}_4]^-$ .

[2+2+2+2]

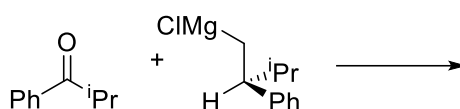
## Unit-2: Organic Reaction Mechanism

3. (a) Discuss on the selectivity of H-abstraction separately by methyl radical and chlorine radical from C-2 and C-3 of  $\text{CH}_3\text{CH}_2\text{CO}_2\text{H}$  and account for your answer.

(b) What product/(s) is/are obtained when an equimolar mixture of compounds **A** and **B** reacted with concentrated sulfuric acid? Comment on the mechanistic implication of the reaction.

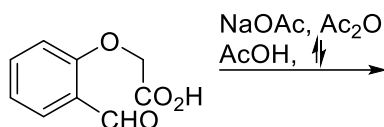


(c) Draw the structure of the **major** product showing proper stereochemistry and account for its formation showing appropriate TS.



(d) Give the structure of the regioisomer formed on reaction of propyl azide with phenyl acetylene in the presence of 2 mol % copper sulphate and 5 mol% sodium ascorbate in aqueous butanol, and depict the corresponding catalytic cycle.

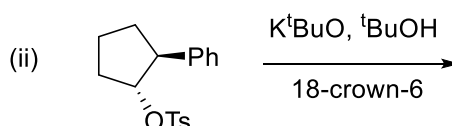
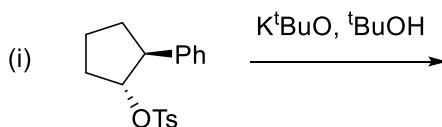
(e) Predict the product of the following reaction, and mention the name of the reaction.



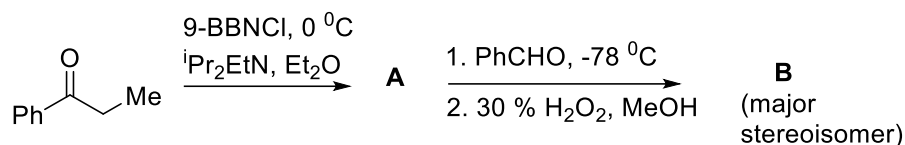
[1.5+1.5+1.5+2.5+1]

Or

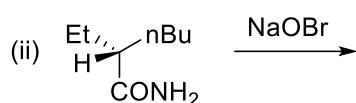
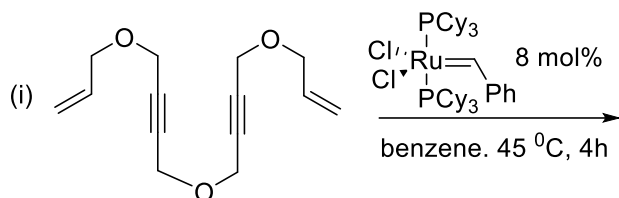
4. (a) Draw the structure of the products with mention of **major** and **minor** as appropriate for the following reactions and the change observed after added 18-crown-6 for the second reaction, and account for your answer in each case.



(b) Predict the product in each of the following steps showing proper stereo-structure of the respective **major** isomer, also explain the formation of **B** with the help of Zimmerman-Traxler model.



(c) Predict the structure of the product for each of the following reactions with mention of proper stereochemical outcome for reaction (ii).



[3+3+(1+1)]

### Unit-3: Supramolecular Chemistry

5. (a) Define the following terms

(i) supramolecular isomerism

(ii) reticular synthesis

(b) Describe halogen bonding interactions in supramolecule with an example.

(c) What is molecular assemblies?

[(2+2)+3+1]

Or

6. (a) Describe different types of hydrogen bonding interactions in supramolecule with an example.

(b) Define the following terms

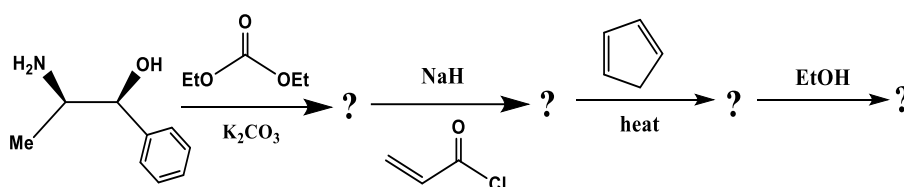
(i) supramolecular devices

(ii) secondary building units in a supramolecular assembly.

[4+(2+2)]

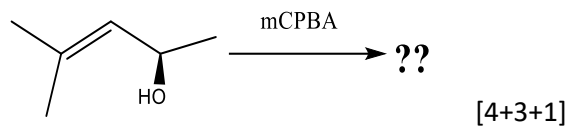
### Unit-4: Asymmetric Synthesis

7. (a) Identify each product from the following scheme and show the mechanism for each step.



(b) What is CBS catalyst? Discuss its application with an example.

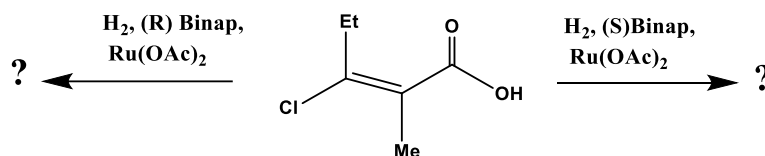
(c) Identify the major and minor product from the following reaction



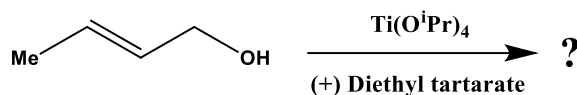
Or

8. (a) Discuss Cram model in asymmetric synthesis with suitable example and with energy profile diagram.

(b) Identify and explain the formation of product from the following reaction scheme.



(c) Identify the product from the following reaction



[4+3+1]

#### Unit-5: Valency and Perturbation Theory

9. Show how the degeneracy of the  $^1P_1$  state of helium atom can be resolved by the application of a magnetic field in the Z-direction. [8]

Or

10. (a) What is the Born–Oppenheimer approximation? Show how the eigen values of the electronic wave function can be determined by solving the Schrödinger wave equation.

(b) Write the expressions for  $\psi_{VB}$  and  $\psi_{MO}$  for the hydrogen molecule ( $H_2$ ). [4 + (2 + 2)]