

**DEPARTMENT OF CHEMISTRY**  
**RANI RASHMONI GREEN UNIVERSITY**

**M.Sc Course in Chemistry**  
**Semester- IV Final Examination-2025**  
**Course ID: CHEM-CB41**

**Full Marks: 40**

**Time: 2 Hrs**

*Answer any one question from each unit in your own words with proper scientific justification.*

**Unit-1: Inorganic Chains, Rings, Cages and Clusters**

**Q(1) (a)** Determine the probable geometry with appropriate electron counting rule of  $\text{Re}_4\text{H}_4(\text{CO})_{12}$ .

**(b)** Explain the spatial arrangement of  $\text{Os}_7$  core in  $\text{Os}_7(\text{CO})_{21}$  with the PSEPT capping principle.

**(c)** Draw the schematic formation of different types of silicate through condensation.

**(d)** Explain why  $\text{Re}_2(\text{CO})_{10}$  adopts a staggered conformation in the solid state, whereas  $[\text{Re}_2\text{Cl}_8]^{2-}$  adopts an eclipsed conformation.

**(e)** Explain the core structure and disposition of  $\text{Cl}^-$  in  $[\text{Nb}_6\text{Cl}_{12}]^{2+}$

**[1+2+1+2+2]**

**Q(2) (a)** The molybdenum compounds  $[\text{Mo}_2(\text{p-Tol})_3]_2(\mu\text{-OH})_2$ , **(1)**, and  $[\text{Mo}_2(\text{DTolF})_3]_2(\mu\text{-O})_2$ , **(2)**, have similar core structures, ( $\text{DTolF} = [(\text{p-tolyl})\text{NC}(\text{H})\text{N}(\text{p-tolyl})]^-$ ). The molybdenum–molybdenum distance in **2** (214.0 pm) is slightly greater than the comparable distance in **1** (210.7 pm). Suggest an explanation for this difference.

**(b)** Using PSEPT capping principle determine the structure of  $\text{Os}_8(\text{CO})_{22}^{2-}$

**(c)** Explain the core structure and disposition of  $\text{Cl}^-$  in  $[\text{Mo}_6\text{Cl}_8]^{4+}$ .

**(d)** Explain the magnetic property of  $\text{Re}_3\text{Cl}_9$  cluster.

**(e)** State the mno rule taking ferrocene as the example.

**[2+2+2+1+1]**

**Unit-2: Polymer Chemistry**

**Q(3) (a)** Describe with example the mechanism of carbanion addition polymerization.

- (b) Discuss how to determine molecular weight of polymer by osmometry.
- (c) Define polydispersity index and distinguish polydispersion and monodispersion of polymeric system. [3+3+2]

**Q(4) (a)** Describe Flory Huggins theory and calculate enthalpy change of polymer solution.

(b) Define copolymerization reaction with an example.

(c) Describe types of polymer based on tacticity. [4+2+2]

### **Unit-3: Biophysical Chemistry**

**Q(5) (a)** Define secondary, tertiary and quaternary structures of protein with proper diagram and examples.

(b) What is alpha-helix ? Who discovered it?

(c) Draw rough sketches of Ramachandran's plot for Ala-Ala and Gly-Gly dipeptides. [3+2+3]

**Q(6) (a)** What is Ramachandran's plot of dipeptides?

(b) Define fluorescence anisotropy.

(c) Show that it can be used to study the rotational dynamics of a fluorophore.

(d) Write a short note on Green fluorescence of Protein. [2+1+3+2]

### **Unit-4: Materials Chemistry and Nanochemistry**

**Q(7) (a)** Explain 0D, 1D, 2D and 3D nanomaterials.

(b) Give examples for the different dimensional structures.

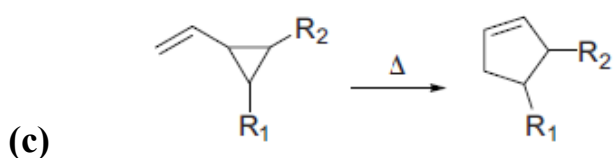
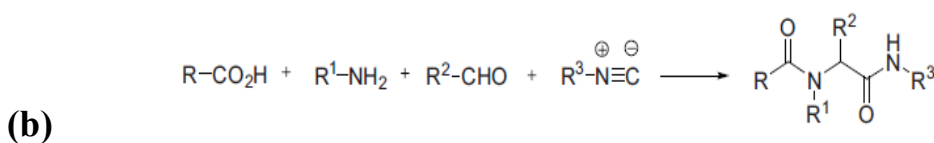
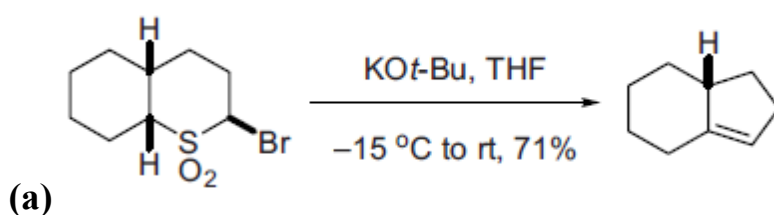
(c) Write the difference between bottom up and top-down approach of nanomaterials synthesis. [2.5 + 2.5 + 3]

**Q(8) (a)** Define Quantum dots.

- (b) Give one example of Quantum dot.  
 (c) How does size change affect the optical properties of nanoparticles.  
 (d) Explain surface plasmon resonance.  
 (e) Explain Mie theory. [2+1+2+2+1]

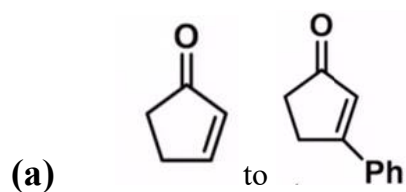
### Unit-5 Organic Name reactions and Reagents

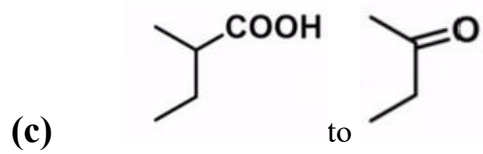
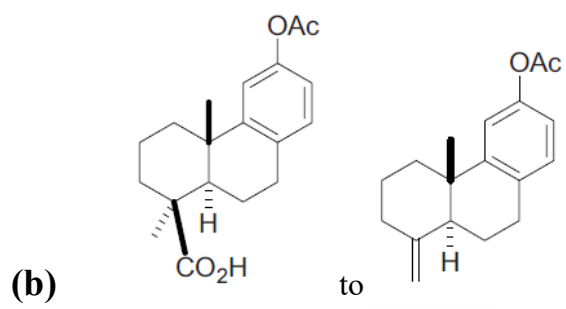
**Q(9). Predict the plausible mechanism for the following transformations:**



[3+ 2.5 + 2.5]

**Q(10) Carry out the following conversions:**





[2.5 + 3 + 2.5]