M. Sc. (Chemistry) Examination, 2022

(4th Semester, CBCS)

Inorganic Chemistry Special

Paper – XVI-I

Time : Two hours Full Marks : 40

Use a separate answer script for each Unit.

UNIT: I-4161

1. Illustrate the mechanism of Buchwald-Hartwig C-N coupling reaction using a palladium catalyst, and explain each step. Identify the organometallic species involved in the catalytic cycle. 5+1
2. What is olefin metathesis? Describe the Grubbs' catalyst, and show how it catalyzes the metathesis reaction. 2+2+4
3. State the structural difference between $[Cr(C_6H_6)_2]$ and $[Cr(C_6H_6)_2]^+$, and explain the reason behind it. 2
4. Cite an example of asymmetric catalysis using a metal complex as catalyst. Describe the catalyst and its role in the catalytic reaction. 2+2

UNIT: I-4162

Answer ***all*** questions: 2×5

5. a) What is a modified GC electrode? How will you clean the different electrodes before performing electrochemistry?

b) What is Faradic and Non-Faradic process in electrochemical phenomenon? How does inert electrolyte affect the transportation of ions at the vicinity of electrode-electrolyte interface?

c) How will you calculate HOMO-LUMO position of a redox active material by applying simple electrochemical experiment?

d) Between cyclic voltammetry and spectrophotometry which one is a better method for determining the antioxidant activity of biological extracts?

e) What is the relation between charge-transfer resistance and Helmholtz double capacitance during EIS analysis? How are they affected if the electrochemical reaction has been performed in the presence of light for photoactive reactants?

6. Answer ***any five*** of the following questions: 2×5

a) Write a brief note on the Debye-Scherrer formula for size determination of nanoparticles.

b) What is quantum confinement? How does band gap change with the size of nanoparticles?

c) Write down the basic differences Scanning tunnelling microscopy (STM) and atomic force microscopy (AFM).

d) Write down the sol-gel synthesis of ZnO nanoparticles **Or** green synthesis of Ag nanoparticle.

e) Briefly describe Surface Plasmon Resonance (SPR) with an example.

f) Write a short note on ***any one*** of the following:

i) Scanning Electron Microscope

ii) Dynamic Light scattering