M. Sc. Chemistry Examination, 2018

(4th Semester)

Inorganic Chemistry Special

Paper - XVI-I

Time : Two hours Full Marks : 50

(25 marks for each unit)

Use a separate answerscript for each unit.

UNIT - I - 4161

1. Answer ***any two*** of the following questions :

   a) What is Suzuki-Miyaura coupling reaction ? Illustrate the mechanism of this reaction and explain each step. Identify the organometallic species in the catalytic cycle. 3+4+1

   b) What is hydroformylation reaction ? Describe the mechanism of hydroformylation of an olefin($RCH=CH_2$) using a rhodium-catalyst. Comment on the ratio of n- and iso - products. 3+3+2

   c) What is BINAP ligand ?

   Describe the mechanism of asymmetric hydrogenation of methyl acetoacetate using a Ru-BINAP catalyst. Indicate the "enantiomeric excess" for this reaction.

   (3+4+1)

2. Answer the following : 3×3

a) Describe the method of synthesis of Grubbs' first generation catalyst. Indicate the origin of its reactivity.

b) Outline the synthesis of $[Cr^{o}(C_6H_6)_2]$. Describe its structure. Highlight the structural difference, if any, between $[Cr^{o}(C_6H_6)_2]$ and $[Cr^{I}(C_6H_6)_2]^{+}$.

c) Explain i) conversion , ii) Yield, iii) TON and TOF with reference to a catalytic reaction.

d) Write the full form of common analytical tools used for the characterization of materials : (i) EDX (ii) PL (iii) DLS and (iv) AFM; Mention the utility of these tools in the field of material characterizations .

e) Define FWHM and mention its applicability to Scherrer's equation for the calculation of dislocation density, grain size of nanoparticles.

f) Define Janus particle. Why most of the sensing studies were done with the help of Au-NPs ?

UNIT - I - 4162A

3. Answer ***any four*** of the followings : 1×4

   a) What is the main difference between third generation and second generation porous material ?

   b) Write one advantage and one disadvantage of using perchlorate as a counter anion in the synthesis of coordination polymer.

   c) What are the consequences if the metal organic frameworks are synthesized in non-polar solvents ?

   d) What do you mean by "Interpenetration" in framework structure ?

   e) What are the techniques available for the characterization of porous coordination polymers ?

4. a) What do you mean by rigid bridging ligand ? How do the charge of the metal ion and length of the linkers control the formation of an overall structure in metal organic frameworks ? 1+3

   b) Write two important properties of Dendrimer. What are the convenient methods for synthesizing Dendrimers ? How are these classes of molecules utilized in drug delivery process ? 2+1+1

UNIT - I - 4162B

5. Answer ***any five*** : 1×5

   a) What are the various types of nano- clusters ? Give two examples of each.

   b) Discuss the sensing properties of functionalized Au-nanoparticles for heavy metal ions.

   c) What are the different patterns of TEM studies and how it hepls to understan the crystallinity of the samples ?

   d) What are opto-electronic meterials and where are they used ?

   e) How "electron-beam" can damage the sample surface or lattice packing during SEM and TEM studies ?

   f) How can you tailor the bulk materials to nanomaterials ? How can it influence the properties of materials ?

6. Answer ***any four*** : 2×4

   a) What are electrochemical sensors ? How are these types of sensors useful for the detection of different biological fluids ?

   b) Define MEMs. What are the applications of MEMs ?

   c) Why do you need a core-shell system ? What are the advantages of core shell system, in comparison to nanoparticles of core -shell system ?