7. Determine the parity and nuclear spin of ^{59}Co and ^{60}Co. 2

8. Find out the critical deformation energy (E_{crit}) for the fission of ^{239}Pu by using thermal neutrons. 2

9. Explain the role of resonance capture reactions in breeder reactor. 2

M. Sc. Chemistry Examination, 2023

(1st Semester, CBCS)

Paper: III

[Inorganic Chemistry]

Time : Two Hours Full Marks : 40

(20 marks for each Unit)

Use a separate answer script for each Unit.

UNIT – 1031

1. a) Give the reactions involved in industrial preparation of organosilicon compounds. 1

   b) Give two examples of organosilicon compounds used as alcohol protecting group. 1

   c) Explain how the α-carbonions and β-carbocations are stabilized in the followings: 1

   d) What is Ziegler-Natta Catalysis? What are the catalysts used here? State whether it is a homogeneous or heterogeneous catalytic reaction. 1

   e) In the migratory insertion reactions:

$$Mn(CO)_5(CH_3) \rightarrow Mn(CO)_5(COCH_3)$$

   which group migrates? Give reasons to support your answer. $1\frac{1}{2}$

f) Predict the main product of the following reaction:

$IrCl(CO)(PPh_3)_2 + R_2C = CR_2 \rightarrow ?$ 1

g) What are the essential conditions for β-hydride elimination reactions? Explain with mechanism. $1\frac{1}{2}$

h) What happens when ferrocene is treated with (a) n-Bu-Li and (b) $Hg(OAc)_2$ in the presence of LiCl/ KCl?

i) Give one example of each with structure of the following (any two): 1

(a) Piano-stool complex; (b) bent ferrocene complex and (c) multidecker complex.

2. a) Find out all the Russel-Saunders states-arising from a d^2 configuration. Which one is the ground state term? How does the ground state term split in a weak octahedral crystal field? 3

b) With the help of pictorial representation, describe how different bonding molecular orbitals can be constructed in an octahedral complex of the type ML_6. Also draw the relevant MO diagram for the complex taking into account both σ- and π-interactions.

c) What conclusion can be drawn if one considers the real size of the ligands in ionic CFT model?

Elaborate your answer pictorially by taking into account the outcome of theoretical calculations? $1\frac{1}{2}$

d) How will you explain the multiple lines in the EPR spectrum of $[IrCl_6]^{2-}$? $1\frac{1}{2}$

Unit: 1032

3. Draw and discuss energy profile diagrams for D, A, I_d and I_a activation/mechanistic labels with reference to substitution reactions in octahedral metal complexes. 4

4. With an appropriate example discuss pseudo-substitution reaction in octahedra metal complex with special emphasis on the driving forces of the reaction. 4

5. For dissociative activation which one between $[Co(NH_3)_5Cl]^{2+}$ and $[Co(NH_3)_4Cl_2]^{+}$ will respond faster to aquation? 2

6. Derive the equation to calculate recoil energy of daughter nucleus based on energy of γ-photon mass number related to Szilard-Chalmer reaction. In a $^{79}Br(n,\gamma)^{80}Br$ reaction, the energy of γ - photon is 5 MeV and C-Br bond energy is 2.16 eV. Comment on the formation ^{80}Br from $C_2H_5{}^{79}Br$. 2+2