

[4]

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

Ex/SC/CHEM/PG/CORE/TH/III/2023

M. Sc. CHEMISTRY EXAMINATION, 2023

(1st Semester, CBCS)

PAPER: III

[INORGANIC CHEMISTRY]

Time : Two Hours

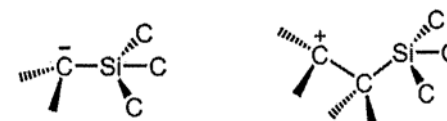
Full Marks : 40

(20 marks for each Unit)

Use a separate answer script for each Unit.

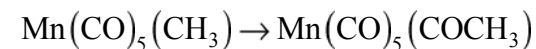
UNIT – 1031

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:



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

[Turn over

[2]

- f) Predict the main product of the following reaction:

$$\text{IrCl}(\text{CO})(\text{PPh}_3)_2 + \text{R}_2\text{C} = \text{CR}_2 \rightarrow ? \quad 1$$
- 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) $\text{Hg}(\text{OAc})_2$ 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?

[3]

- 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 $[\text{IrCl}_6]^{2-}$? $1\frac{1}{2}$

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 $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$ and $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ 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 $^{79}\text{Br}(n, \gamma)^{80}\text{Br}$ 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 $\text{C}_2\text{H}_5^{79}\text{Br}$. $2+2$

[Turn over