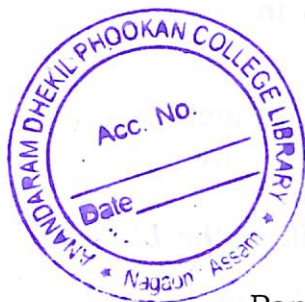


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3 (Sem-6/CBCS) CHE HC 1

2026

CHEMISTRY

(Honours Core)

Paper : CHE-HC-6016

(Inorganic Chemistry-IV)

Full Marks : 60

Time : Three hours

***The figures in the margin indicate
full marks for the questions.***

1. Answer the following : **(any seven)** $1 \times 7 = 7$
 - (a) Name the metals that are used as catalysts in the Fischer-Tropsch synthesis of gasoline.
 - (b) Give the chemical formula and geometry of Vaska's complex.
 - (c) What are aquation reactions ?
 - (d) Why is Zn not precipitated as its sulphide in acidic medium ?

(e) Find the hapticity of C_5H_5 (cyclopentadienyl) rings in $Fe(C_5H_5)_2(CO)_2$.

(f) The total number of metal-metal bonds in $Ru_3(CO)_{12}$ and $Co_4(CO)_{12}$ are _____ and _____ respectively.

(Fill in the blanks)

(g) Give the structure of the following organometallic compound :
Bis[(tricarbonyl)(η^5 -cyclopentadienyl)]dimolybdenum.

(h) Arrange the metallocenes of Ti, V, Cr, Mn, Fe, Co and Ni, in the increasing order of their stability.

(i) In qualitative analysis of basic radicals, hydrochloric acid is preferred to nitric acid for preparing a solution of given substance. This is because —

- (i) nitric acid contains nitrogen
- (ii) chlorides are easily converted to sulphides
- (iii) hydrochloric acid is not an oxidising acid
- (iv) nitrates are not decomposed to sulphides

(Choose the correct option)

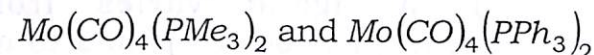
(j) Name the co-catalyst used in Wacker process.

2. Answer the following questions : (**any four**)

2×4=8

(a) Why are transition metal aryls more stable than the transition metal alkyls ?

(b) Which of the following complexes have lower ν_{CO} value in the IR spectrum? Rationalize your answer.



(c) Why is it essential to add dil. HCl before proceeding to the test for the basic radicals of group II ?

(d) The Ni—C bond length in nickelocene is longer than the Fe—C bond length in ferrocene. Explain.

(e) $[Mn(CO)_4NO]$ and $[Fe(CO)_4CN^-]$ both have trigonal bipyramidal structure. In the Mn complex, NO occupies an equatorial position while in the Fe complex, CN^- is at axial position. Explain.



(f) Distinguish between thermodynamic stability and kinetic stability.

(g) Give examples of two oxidation-reduction reactions occurring through the transfer of atoms or groups of atoms.

(h) What is π -acidity ?

3. Answer **any three** of the following :

5×3=15

(a) What is meant by hapticity of a ligand ? Show clearly that the hapticity of a ligand varies from one organometallic compound to another.

2+3=5

(b) How will you establish that the substitution in square planar complexes proceeds through an associative mechanism ? Why are $Ni(II)$ and $Pd(II)$ square planar complexes more labile than square complexes of $Pt(II)$?

3+2=5

(c) What are metal olefin complexes ? Discuss the bonding and structure of Zeise's salt.

1+4=5

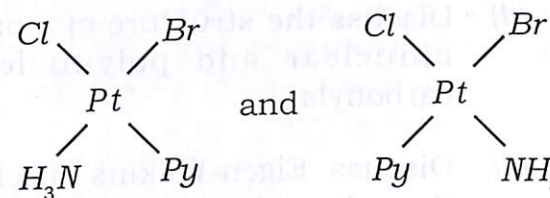
(d) What do you mean by labile and inert complexes ? How does the d -electron configuration affect the labile/inert nature of complexes ?

2+3=5



(e) Explain Zeigler-Natta polymerization reaction.

(f) What is trans effect ? Using the concept of trans effect, how will you arrive at the following products ? 1+4=5



(g) Discuss the role of Wilkinson's catalyst in hydrogenation of alkenes.

(h) How does vibrational spectra help to understand bonding in metal carbonyls ?

4. Answer **any three** of the following :

10×3=30

(a) What are interfering radicals and how do they interfere in qualitative tests while performing salt analysis ? Discuss the methods of removal of phosphate and oxalate anions during salt analysis.

2+3+5 =10

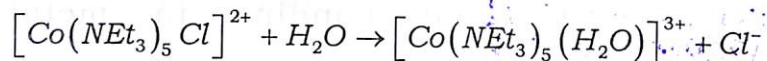
(b) Discuss the inner sphere and outer sphere mechanism in electron transfer reactions giving suitable examples.

5+5=10

(c) Describe various reactions of ferrocene, which establish its aromatic character. How can you say that aromaticity of ferrocene is even more than that of benzene ?
 $8+2=10$

(d) Discuss the structure of mononuclear, binuclear and polynuclear metal carbonyls.

(e) Discuss Eigen-Wilkins mechanism of ligand substitution reaction in octahedral complexes. Sketch the reaction profile for the reaction



Clearly indicate intermediates and transition states.
 $5+5=10$

(f) Give the methods of preparation and properties of organometallic compounds of aluminum. Discuss the structure of organoaluminium compounds. $5+5=10$

(g) Write notes on the following :
 $2\frac{1}{2} \times 4 = 10$

(i) Reductive carbonylation

(ii) Synergic effect

(iii) 18 electron rule

(iv) Polarization theory of trans effect

(h) What is hydroformylation reaction? Name *three* catalysts used in this reaction. Discuss the mechanism of a hydroformylation reaction using a suitable example. Why is such a reaction industrially important ?

$1+3+4+2=10$

