2017

M.Sc.

2nd Semester Examination

CHEMISTRY

PAPER—CEM-203

Full Marks : 40

Time : 2 Hours

The figures in the margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.
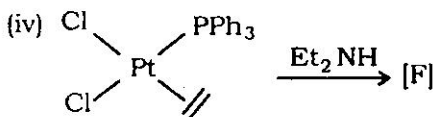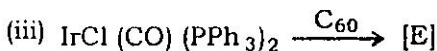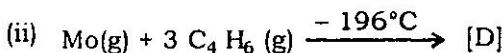
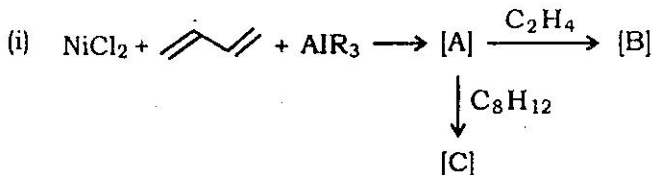*Illustrate the answers wherever necessary.*

(*Inorganic*)

Answer *four* questions,
taking *one* question from each group.

Group—A

Answer any *one* of the following.

1. (a) Predict [A] to [F]

(i) $NiCl_2$ + ⟋⟍⟋⟍ + AlR_3 ⟶ [A] $\xrightarrow{C_2H_4}$ [B]

[A] $\xrightarrow{C_8H_{12}}$ [C]

(ii) $Mo(g) + 3\ C_4H_6\ (g) \xrightarrow{-\ 196°C}$ [D]

(iii) $IrCl\ (CO)\ (PPh_3)_2 \xrightarrow{C_{60}}$ [E]

(iv)

Cl \ Pt / PPh$_3$, Cl /, // $\xrightarrow{Et_2NH}$ [F]

(b) Discuss the phenomenon of 'metallacycle formation' in transition metal alkene complex with a suitable example.

2

(c) What do you mean by 'Tebbe's reagent'? Cite the its most important application.

2

2. (a) Explain 'reversal of polarity' during the reaction of transition metal bound alkene complexes.

3

(b) Discuss the phenomenon of 'Carbonyl scrambling' in $[FeCp\ (CO)_2]_2$ Complex.
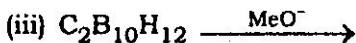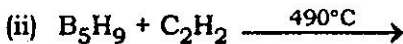
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(c) 'Beryllocene is highly fluxional'—justify the statement.
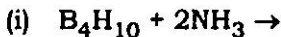
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(d) Complete the following reactions.
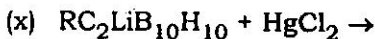
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(i) Ni $\xrightarrow[\text{EtoH}]{\text{Na / Hg}}$
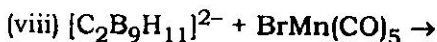
(ii) $Na_2[PdCl_4]$ + $\xrightarrow{Na_2CO_3}$
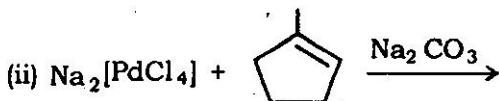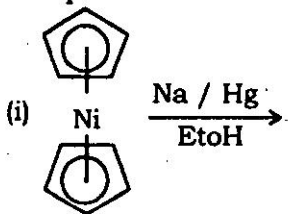
Group—B

Answer any *one* of the following.

3. (a) Complete the following reactions :

5

(i) B_4H_{10} + $2NH_3$ →

(ii) B_5H_9 + C_2H_2 $\xrightarrow{490°C}$

(iii) $C_2B_{10}H_{12}$ $\xrightarrow{MeO^-}$

(iv) $C_2B_4H_8 + NaH \xrightarrow{\text{diglyme}}$

(v) $2Na_2[C_2B_9H_{11}] + FeCl_3 \rightarrow$

(vi) $2RMgBr + C_2H_2B_{10}H_{10} \rightarrow$

(vii) $[C_2B_9H_{11}]^{2-} + BrRe(CO)_5 \rightarrow$

(viii) $[C_2B_9H_{11}]^{2-} + BrMn(CO)_5 \rightarrow$

(ix) $Ph_3PAuCl + C_2RLiB_{10}H_{10} \rightarrow$

(x) $RC_2LiB_{10}H_{10} + HgCl_2 \rightarrow$
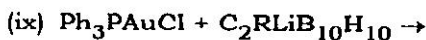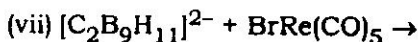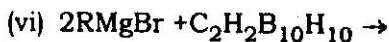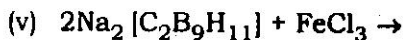
(b) Calculate the styx number of $[B_6H_6]^{2-}$ $[B_5H_9]$ and established the most probable structure. 5

4. (a) Classify the following compounds with respect to closo, nido, arachno and hypo $[B_{12}H_{12}]^{2-}$, B_5H_{11}, B_6H_{10}, $C_4B_2H_6$. 2

(b) What is boron neutron capture therapy ? Give at least two examples of 1st and 2nd generation BNCT agents.

1+2

(c) With the help of styx number 0330 and 2013 draw the probable structures of these boron hydride. 5

Group—C

Answer any *one* of the following.

5. Write down the steps involved for the determination of symmetry of vibrational modes of non-linear molecule using 3N cartesian co-ordinates as base vector.

Obtain the symmetry of vibrational modes of BF_3 using both 3N cartesian co-ordinates and internal co-ordinates as base vectors. comment on your results.

Character table of D_{3h} point group is given below.

2+3+3+2

D_{3h}	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$		
A_1'	1	1	1	1	1	1		$X^2 + Y^2, Z^2$
A_2'	1	1	−1	1	1	−1	R_z	
E'	2	−1	0	2	−1	0	(X, Y)	$(X^2 - Y^2, XY)$
A_1''	1	1	1	−1	−1	−1		
A_2''	1	1	−1	−1	−1	1	Z	
E''	2	−1	0	−2	1	0	(R_x, R_y)	(XZ, YZ)

6. (a) Write down the properties of Irreducible Representations of point groups. Deduce the character table for C_{2v} point group. 2+3

   (b) Use group theoretical principle to obtain the IR and Raman activity of the vibrational modes of H_2O. 2+3

Group—D

Answer any *five* of the following.   2×5

7. (a) How will you synthesize Tebbe's reagent ?

    (b) Draw the orbital overlap in Schrock's carbene complex.

    (c) IR spectroscopy of olefin complexes is un usefull probe
         of π – bonding than IR spectroscopy of CO complexes –
         explain.

    (d) Complete the following reaction :
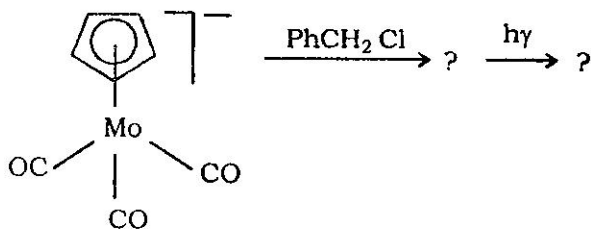
    (e) Why NMR technique is applied to detect fluxional
         behaviour ?

    (f) Compare Fischer's and Schrock's carbene complexes with
         respect to bonding and reactivity.

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