PG/IIS/CH - 1203/10

M.Sc. 2nd Semester Examination, 2010

CHEMISTRY

(*Inorganic*)

Paper—CH-1203

Full Marks : 40

Time : 2 hours

Answer any **four** questions

The figures in the right-hand margin indicate marks

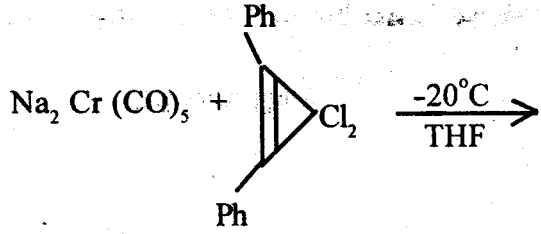
1. (*a*) Predict the product of the following reactions : 6

(*i*) $C_{60} \xrightarrow[\text{toluene}]{[Ni(PEt_3)_4]}$

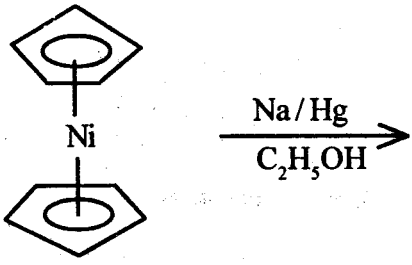
(*ii*) $Cp\,Fe(CO)_2\,I + AgBF_4 + C_2H_4 \longrightarrow$

(*iii*) $Mo(g) + 3C_4H_6(g) \xrightarrow{-196^\circ C}$

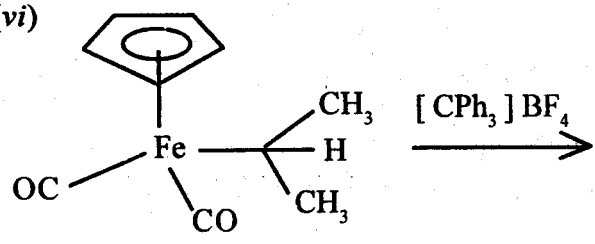
(*iv*)



(*v*)



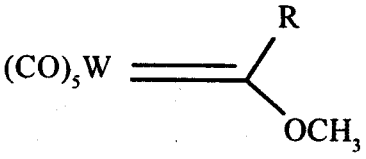
(*vi*)



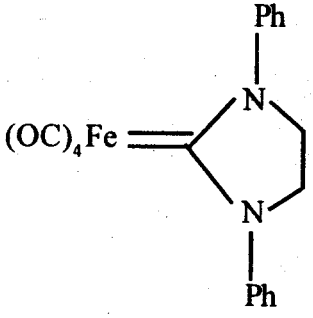
(*b*) How will you synthesize the following carbene complexes ? 3

(*i*) $Cp_2Ta{=}CH_2$
CH_3

(*ii*)



(*iii*)



(*c*) Write down the possible binding modes of an allyl ligand. 1

2. With the help of "Great Orthogonality Theorem" complete the following character table: 4+4+2

C_{4v}	E	$2C_4$	C_2	$2\sigma_v$	$2\sigma_d$		
A_1						Z	x^2+y^2, z^2
A_2						R_z	

C_{4v}	E	$2C_4$	C_2	$2\sigma_v$	$2\sigma_d$		
B_1							$x^2 - y^2$
B_2							xy
E						(x, y) (R_x, R_y)	(xz, yz)

What are the allowed transitions, and their polarization of a B_1 electron in a C_{4v} molecule? Reduce the following representation into its components:

C_{4v}	E	$2C_4$	C_2	$2\sigma_v$	$2\sigma_d$
Γ	18	2	–2	4	2

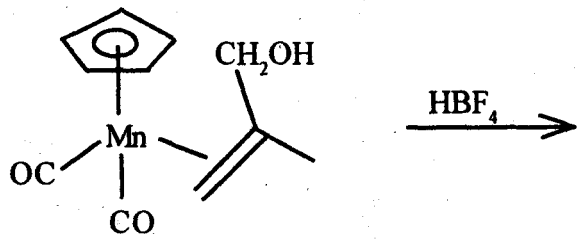
3. What is cyclic voltammetry? Why it is so called? What is its applications? Explain why dissolved O_2 is to be removed from the polarographic cell before experiment? 3 + 2 + 2 + 3

4. (*a*) How will you synthesize $Zr(C_3H_5)_4$? 1

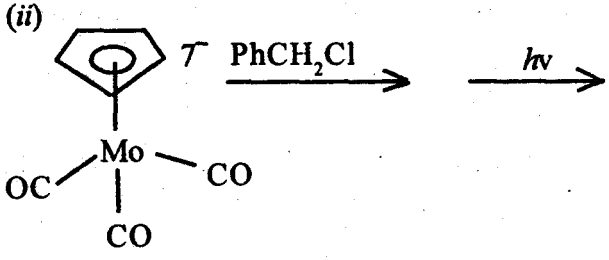
   (*b*) Discuss *cis-*/*trans*-isomerization of $Cp_2Fe_2(CO)_4$ in the light fluxionality. 4

(*c*) Predict the product of the following reactions: 4

(*i*)

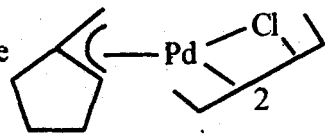


(*ii*)



(*iii*)

$ZrCl_4 + Na/Hg + C_7H_8 \longrightarrow$

(*d*) How will you synthesize 

starting from $Na_2[PdCl_4)$? 1

5. What is the basic difference between atomic emission and atomic absorption ? How do you estimate trace amount of mercury by AAS technique ? 5 + 5

6. (*a*) Establish the relation : 3

$$a_j = \frac{1}{h} \sum_R X(R)\, X_i(R).$$

(*b*) For cubic molecule or molecule of heigher symmetry the radiation with an electric vector in any direction will excite the transition, if it is allowed. Explain. 2

(*c*) ClO_2 molecule is trapped in a solid. Its ground state is known to be B_1. Polarised light parallel to the *y*-axis (parallel to oxygen-oxygen separation) excites the molecule to an upper state. What is the symmetry of that state ? 3

C_{2v}	E	C_2	$\sigma_v(xz)$	$\sigma_v(yz)$		
A_1	1	1	1	1	z	x^2, y^2, z^2
A_2	1	1	-1	-1	R_z	xy
B_1	1	-1	1	-1	x, R_y	xz
B_2	1	-1	-1	1	y, R_x	yz

(*d*) The energy integral $\int \psi_i H \psi_j \, d\tau$ may be non zero only if ψ_i and ψ_j belong to the same irreducible representation of the molecular point Group. Explain. 2

7. (*a*) Discuss 'A' and 'I' mechanism. 2 + 2

(*b*) What is 'macrocyclic effect' ? 2

(*c*) How will you synthesize 2

(*i*) *s*-diamino dichloroptatinum

(*ii*) starting from $[PtCl_4]^{2-}$

(*d*) What do you mean by zero field splitting ? 2