BIRLA INSTITUTE OF TECHNOLOGY AND SCIENCE, PILANI, PILANI CAMPUS
DEPARTMENT OF CHEMISTRY
II SEMESTER 2021-22
COMPREHENSIVE EXAM PART-B (OPEN BOOK)

ADVANCED INORGANIC CHEMISTRY (CHEM G552) **DATE:** MAY 20, 2022
MAX MARKS: 50 **TIME:** 4-7PM

Instructions: There are FIVE questions in all. Attempt all the questions. Start answering each question on a fresh page and answer all parts of the question together. Pencil should not be used. Symbols have usual meanings. Do not scribble on the question paper.

Q.1 (a) A compound AB_5 has a square pyramidal geometry. Determine the atomic orbitals of central A atom which will be involved in forming 'in-plane' π-bonding with the B atoms of the square plane (equatorial A-B bonds). **[6]**
(b) Determine the irreducible representation of each of the fundamental vibrations of 1,1-difluoroethylene$^-$. Which of them are IR active? **[4]**

Q.2 (a) Consider the lattice energies of the following dihalides. [Assume octahedral geometry for all compounds with same Δo values; Ignore the contribution of pairing energy] Determine the values of **X**, **Y** and **Z**. **[10]**

Compound	**Lattice Energy (Measured/Experimental) (kJ/mol)**	**Lattice Energy (Calculated) (kJ/mol)**
FeF_2	-2912	-2752
CuF_2	**X**	**Y**
NiF_2	**Z**	-2917

Q.3 Consider a hypothetical case where a transition metal centre forms a complex with cubic geometry, $[ML_8]$, with neutral ligands L. Deduce the LGOs of the complex. Draw properly labeled MO diagram. **[12]**

Q.4 Consider a regular octahedral complex (ML_6) where the valence shell electronic configuration of central metal ion is p^2. Derive the correlation diagram to account for the electronic transitions that may arise due to p-p transition. [Ignore the selection rules for electronic transition] **[8]**

Q.5 Tolman loop for catalysis of a reaction involving Rh(I) catalyst is shown in the diagram. Write down the reactions (Balanced) involved in this catalytic cycle. **[10]**

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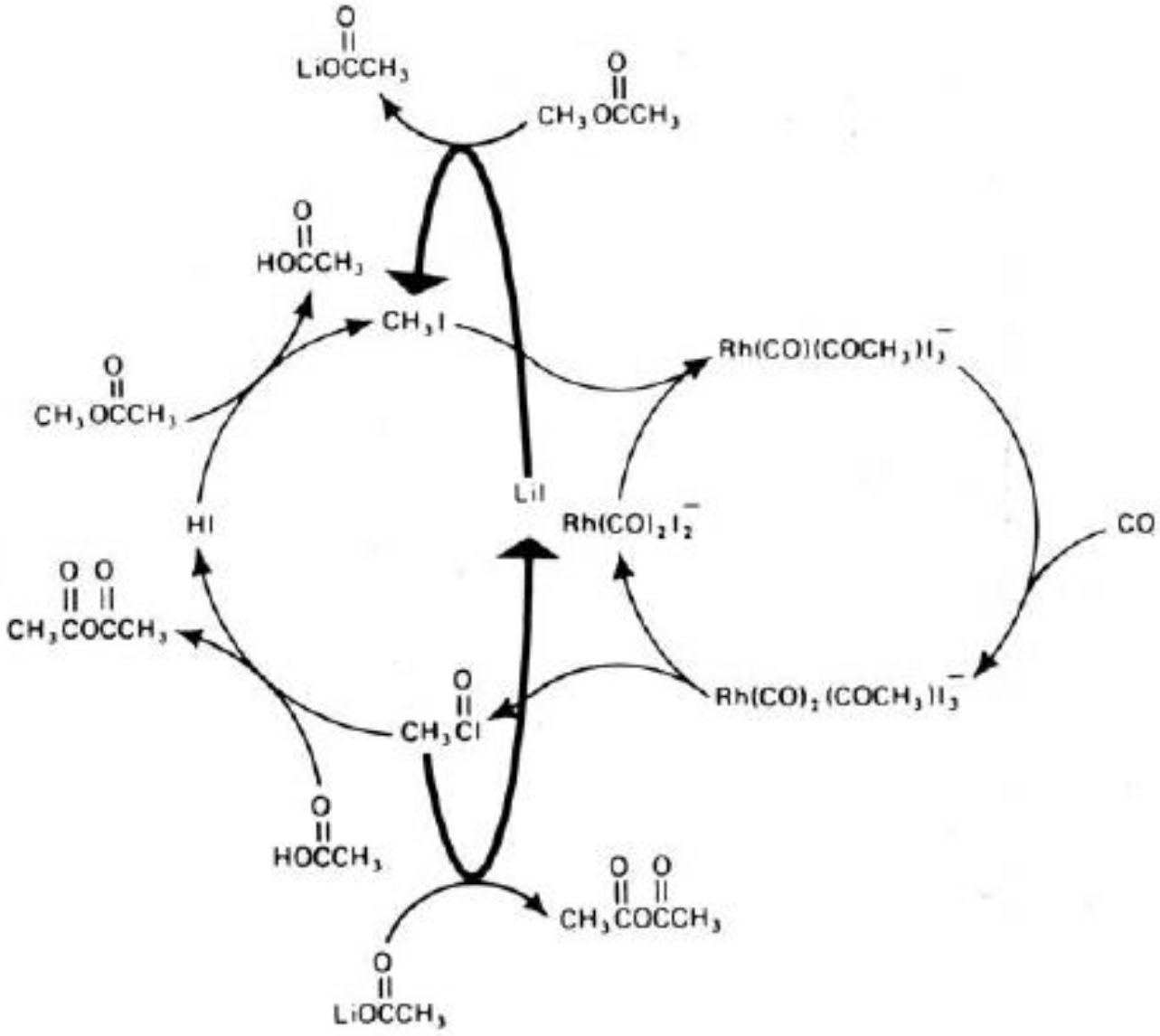
LiOCCH3
CH3OCCH3
HOCCH3
CH3I
Rh(CO)(COCH3)I3−
CH3OCCH3
LiI
Rh(CO)2I2−
CO
HI
CH3COCCH3
CH3COCl
Rh(CO)2(COCH3)I3−
HOCCH3
CH3COCCH3
LiOCCH3