[Time: Three Hours]   **[Marks:70]**

Please check whether you have got the right question paper.

N.B: 1. All questions are compulsory.
2. Answer all sub questions together.
3. Figures to right indicate full marks.

Q.1   a. **Explain the terms (Any 5)**   5
i) Electronic configuration   ii) Energy of activation
iii) Symmetry elements   iv) Specific base
v) Activated complex   vi) Charge transfer complex

b. **Fill in the blanks**   5
i) In a first order reaction half-life of reactant is found to be 23 minutes. The rate constant for the reaction is…………………..
ii) Lewis structure for H_2SO_4 is……………
iii) ………………… is an example of phase transfer catalyst
iv) Charge transfer complex example is…………………
v) Ground state electronic configuration for boron is……………………

c. **Match the following.**   5

Column A	Column B
d_{yz}	Electrophilic catalysis
Fe valence electrons (At.No.26)	OH^-
$AlCl_3$	Sp^3 hybridization
Water	pi symmetry
Nucleophilic catalyst	$3d^6 4s^2$

Q.2   a) Draw resonating structures for :   2
i) $H_2PO_4^-$ ii) CO_3^{-2}
b) Explain the formation of ethylene and clearly indicate HOMO and LUMO.   3
c) What is an isotope effect? Mention its significance.   3
d) State different catalysis types and explain any one in detail.   3

Q.3   a) Compare the geometries of NH_3 and BH_3 by using their group orbitals.   3
b) With the help of Walsh diagram explain energies for linear and bent CH_2.   3
c) State Eyring equation. Explain each term involved in it.   3
d) For a reaction following first order kinetics calculate half-life if 30 % reaction gets completed in 1   2
hour.

Q.4 a) Discus salient features pertaining to Molecular orbital theory.   3
b) What is QMOT? State any three rules for QMOT.   3
c) Elaborate on first order kinetics with suitable examples.   3
d) Explain Nucleophilic catalysis in brief.   2

Q.5 a) Draw the resonating structure for the given molecules.   3

1) H_2C^+ —— CH_3 2)
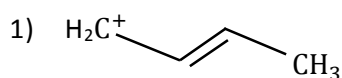
b) Explain the formation of carbanion by molecular orbital theory.   3
c) A plot of lnK vs 1/T is a straight line with a slope -2.8×10^2. Calculate the energy of activation for   2
the reaction.
d) Give the classification of charge transfer complexes with suitable examples.   3

Q.5 a) Complete the following table on the basis of hybridization concept.   3

Molecule	Hybridization state of the underlined atom	Bond angle
$\underline{C}H_4$		
$\underline{B}F_3$		
$\underline{P}Cl_5$		

b) Derive an expression for general base catalysis and show relevant kinetic plots.   4
c) State and explain principle of microscopic reversibility.   2
d) What is Hammond's postulate? Explain it by showing relevant energy profile diagrams.   2