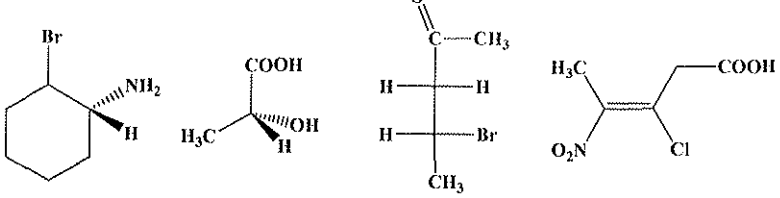
(3 Hours)

N.B.: 1. All questions are compulsory **Total Marks: 80**
2. Answer all subquestions together
3. Figures to right indicate full marks

Q.1 A) Assign R/ S, E/Z or D/L notations and nomenclate the following as per IUPAC rule. [4M]



(i) (ii) (iii) (iv)

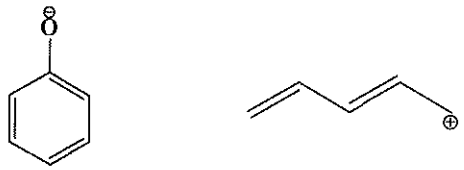
B) Give suitable structures for the following compounds. [4M]

i. (Z)-3-chlorohex-3-en-1-yne
ii. (S)-Ethyl 4-cyano-3-oxopentanoate
iii. 3-nitrocyclohex-2,5-dienoic acid
iv. 3-cyclopropyl-1-butene

C) Answer the following questions **(ANY SIX)** [12M]

i. Draw and identify the HOMO and LUMO of Acetone.

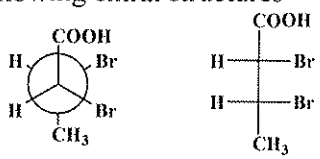
ii. Draw resonating structure of the following molecules



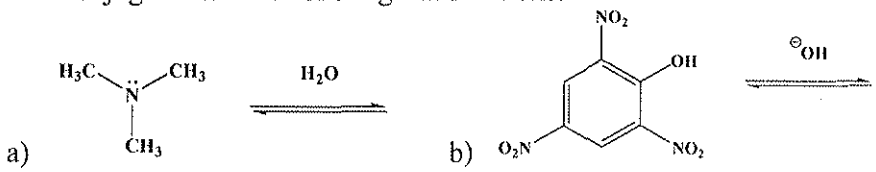
(i) (ii)

iii. Represent 2(R)-2-Hydroxypropanoic acid using Fischer and Newmann projection formulae.

iv. Identify the relationship between following chiral structures



v. Write conjugate acid/base of the given reactions.

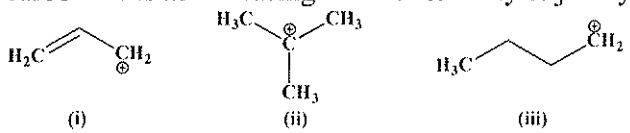


a) b)

vi. Identify the electrophiles and nucleophiles in the given reaction.

$$CH_3COOH + \ddot{N}H_3 \longrightarrow NH_4^+ + CH_3COO^-$$

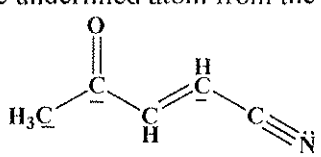
vii. Arrange the following carbocations in increasing order of stability & justify the same.



(i) (ii) (iii)

Q.2. i. Draw the molecular orbital energy diagram for acetaldehyde & Label the orbitals. [2M]

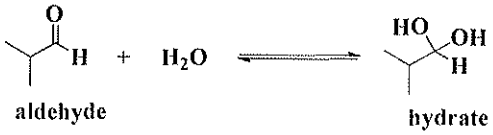
ii. Identify the hybridization state of the underlined atom from the given molecule. [2M]



iii. Complete the following table [4M]

Type of reaction	Order of reactivity of substrate (Alkyl halide)	Nucleophile	Type of solvent & Example of solvent	Stereochemistry
SN1				
SN2				

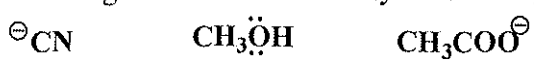
iv. Draw the energy profile diagram to depict the following reactions and identify the transition states, identify whether the reaction is endothermic or exothermic. [4M]



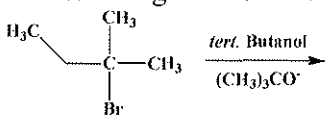
aldehyde hydrate

Q.3 i. Discuss Pitzer strain in cycloalkane [2M]

ii. Arrange the order of reactivity of following nucleophiles [2M]

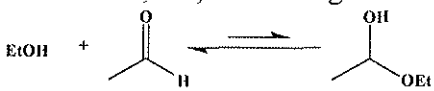


iii. What is Hoffmann rule? Complete the following reaction and suggest the mechanism (E1/ E2) [4M]



iv. Write a note on bromination of trans 2-butene and comment on the stereochemistry of the product. [4M]

Q. 4 i. Define Enthalpy. Comment on the ΔG, ΔH, ΔS of the given reaction. [4M]



ii. Which one of the following pair is expected to exhibit H-bonding and why. Justify your answer

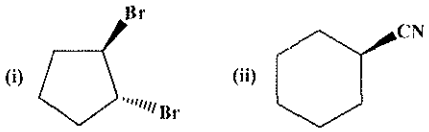
Methaneamine and Methanethiol [2M]

iii. On the basis of solubility, justify the increasing order of logP for the following compounds [2M]

Neopentyl alcohol (logP= 1.31), Neopentylbromide (logP=3.03), Neopentane (logP=3.11)

iv. Identify the best leaving group TsO^-, I^-, OH^- and justify. [2M]

v. Identify whether the given molecules are chiral or achiral and Justify. [2M]



Q.5 i. Arrange the following compounds in increasing order of acidity & Justify. [2M]

Benzoic acid, p-aminobenzoic acid, p-nitrobenzoic acid

ii. Arrange the following compounds in increasing order of basicity & Justify. [2M]

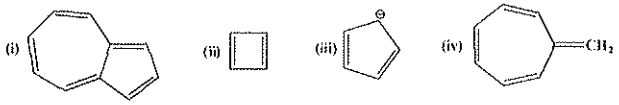
Aniline, Cyclohexylamine, N-methylaniline

iii. With the help of energy profile diagram draw various conformers of n-butane. Comment on their relative stability. [4M]

iv. Give the scheme for acid degradation/ base degradation of Paracetamol. [4M]

Q.6 i. Distinguish between the terms - intermediates and transition states giving suitable examples and support your answer by drawing energy profile diagram. [4M]

ii. Identify whether the given molecules are aromatic, nonaromatic or antiaromatic. [4M]



iii. Give the product [4M]