

Post Graduate Teaching Department of Chemistry (AUTONOMOUS)
Rashtrasant Tukadoji Maharaj Nagpur University, Nagpur

Semester I: End Semester Examination (February 23, 2022)

Paper II (Code: 1T2): Organic Chemistry

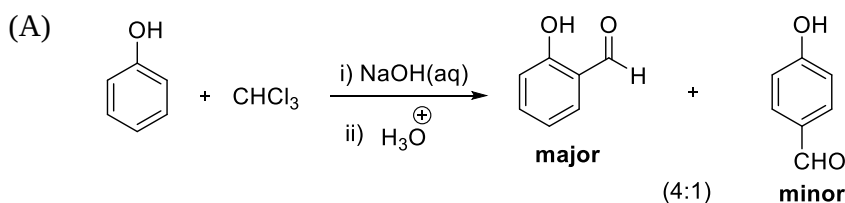
Time: 3 h

Max. marks = 60

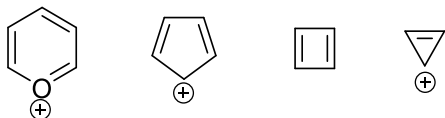
Note: 1) All the questions are compulsory.

2) Figures to the right indicates marks assigned to each question.

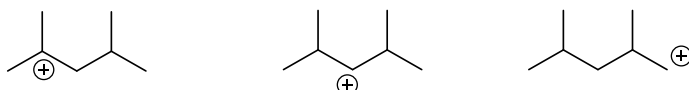
Q. 1 Suggest a plausible mechanism for the following reaction. 4



(B) Classify the following molecules as aromatic, nonaromatic and antiaromatic with suitable reasons. 4

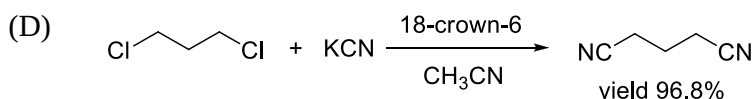


(C) Rank the following carbocations in order of increasing stability with suitable justification. 4



OR

Q. 1 Define crown ethers with suitable examples. Explain its role in the following reaction. 4



(E) Predict the product(s) and its stereochemistry in the following reactions. Justify your answer. 4



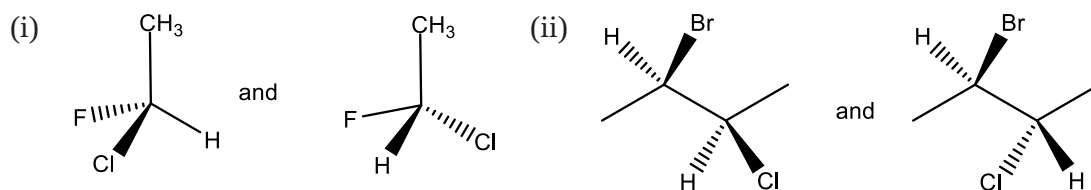
(F) Give any two examples of nitrene generation reactions. 4

Q. 2 i) Draw all the staggered and eclipsed conformers that result from rotation about the C-2 -C- 4

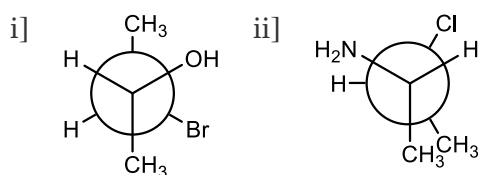
(A) 3 bond of pentane.

ii) Draw a potential-energy diagram for rotation of the bond of pentane through 360° , starting with the least stable conformer.

(B) For each pair of structures shown, indicate whether the two species are constitutional isomers, enantiomers, diastereomers of one another, or identical molecules. 4



(C) Convert the following Newman Projections into Fischer Projections 4



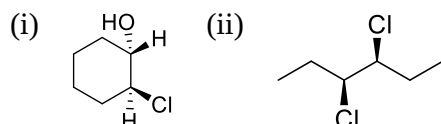
OR

(D) Which isomer in each pair of compounds is lower in energy? 4

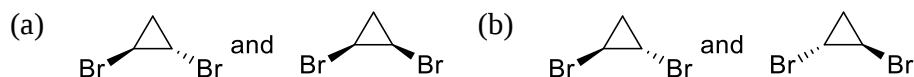
i) *cis*- or *trans*-1,2-diethylcyclohexane

ii) *cis*- or *trans*-1-ethyl-3-isopropylcyclohexane

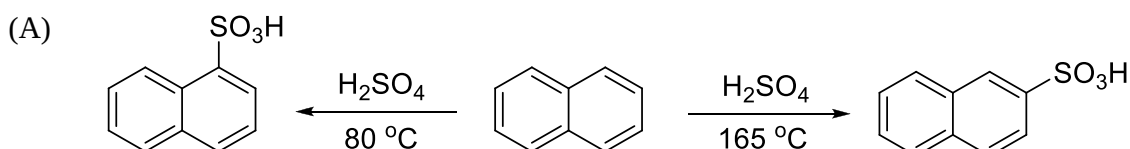
(E) Assign *R* or *S* configuration to the chirality center in each of the following molecules: 4



(F) For each pair of structures shown, indicate whether the two species are constitutional isomers, enantiomers, diastereomers of one another, or identical molecules. 4



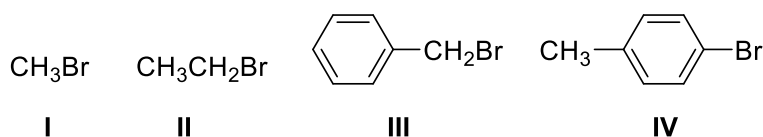
Q. 3 Explain the kinetic and thermodynamic control with respect to the sulphonation of naphthalene: 4



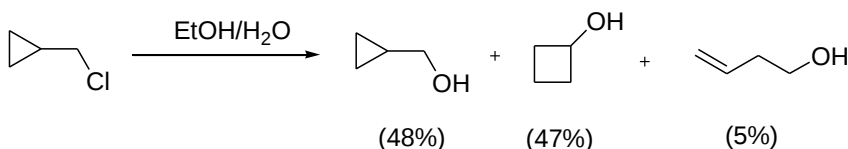
(B) Predict the order of reactivity of the following halides with 4

i) sodium iodide in acetone

ii) aqueous alcoholic silver nitrate



(C) Write a suitable mechanism for the following reaction. 4



OR

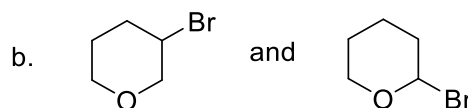
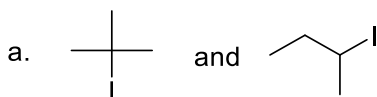
(D) Draw an energy diagram for each reaction. Label the axes, the starting material, product, transition state, ΔH° , and E_a . 4

- A concerted, exothermic reaction with a low energy of activation.
- A one-step endothermic reaction with a high energy of activation.

(E) Draw the structure of the bridged intermediate expected if each of the following were to act as a neighbouring group. 4

- $-\text{N}(\text{CH}_3)_2$
- $-\text{C}_6\text{H}_5$

(F) In each of the following pairs of compounds, which compound will undergo faster $\text{S}_{\text{N}}1$ reaction? 4

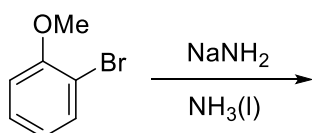


Q. 4 Arrange the following in order of reactivity toward ring nitration, listing by structure the most 4

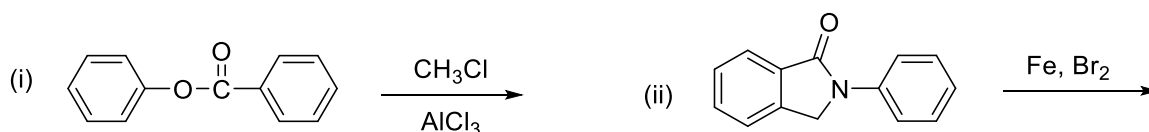
(A) reactive at the top, the least reactive at the bottom.

benzene, mesitylene, toluene, *m*-xylene, *p*-xylene

(B) Predict the major product of the following reaction with suitable mechanism. 4

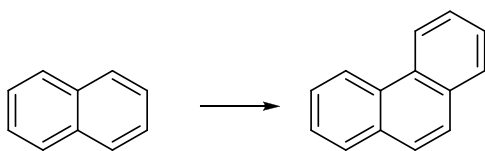


(C) Identify the major product formed in the following reaction with suitable justification. 4

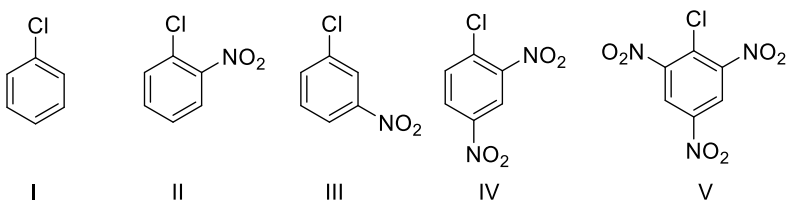


OR

(D) How will you bring the following transformations involving more than one step? 4



- (E) Arrange the following compounds in increasing order of reactivity towards aromatic nucleophilic substitution. 4



- (F) Account for the sign and magnitude of (rho) ρ-values observed for the following reactions: 4

	Reaction	ρ-value
i)	$X-ArH + NO_2^+ \longrightarrow X-Ar-NO_2$	- 7.3
ii)	$X-PhCH_2COOH \xrightarrow[H_2O]{\text{ionization}} X-PhCH_2COO^\ominus$	0.2

Q 5 Attempt any six of the following. (2 x 6 = 12)

- Define substituent constant
- Define reaction constant
- Define primary kinetic isotope effect.
- Define inductive effect
- Define Huckel rule
- State Curtin-Hammett principle
- Define hyperconjugation
- Define conformation of a molecule
- Define chirality of a molecule
- Define nucleophilie