

KATHMANDU UNIVERSITY
End Semester Examination
June/July 2024

Marks Scored:

Level : B.Pharm.
Year : I

07 JUL 2024

Course : CHEM 104
Semester : II

Exam Roll No. :

Time: 30 mins.

F. M. : 20

Registration No.:

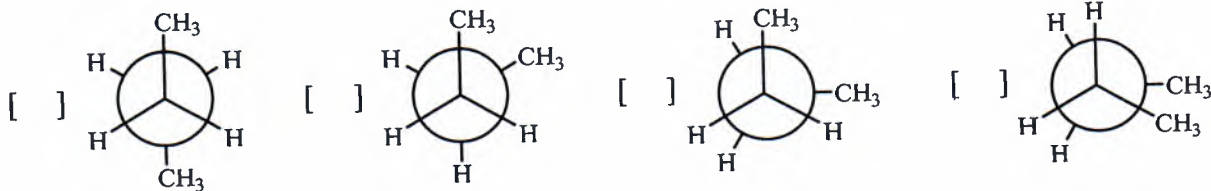
Date :

SECTION "A"

[15Q. × 1 = 20 marks]

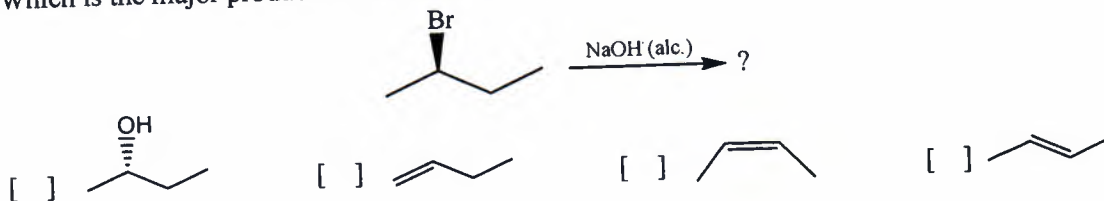
Choose and mark [X] the most appropriate option from each set of choices

- Which is the correct order of priority according to CIP rule to assign configuration?
 -OH > -OPO₃H₂ > -H > -CHO -OH > -OPO₃H₂ > -CHO > -H
 -OPO₃H₂ > -OH > -CHO > -H -CHO > -OH > -OPO₃H₂ > -H
- A sample of 2-methyl-1-butanol has a specific rotation of +1.151. What is the approximate % of (+)-isomer in the sample? Given specific rotation of optically pure (s)-(-)-isomer is -5.756.
 20% 40% 60% 80%
- Which of the following conformations has highest potential energy?

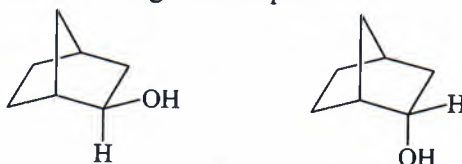


- In the boat conformation of cyclohexane, the most destabilizing interaction is
 Eclipsing 1,3-Diaxial
 Flagpole-flagpole 1,3-Diequatorial
- What mechanism do you expect to follow by the reaction below?

$$\text{CH}_3\text{-Br} + \text{CH}_3\text{ONa} \xrightarrow{\text{DMF}} \text{CH}_3\text{-OCH}_3 + \text{NaBr}$$
 E1 E2 S_N1 S_N2
- Sodium ethoxide (NaOEt) is a suitable reagent to promote which mechanism/s?
I. S_N1 II. S_N2 III. E1 IV. E2
 I and II I and III II and IV III and IV
- Which of the following is the least reactive toward Friedel-Craft alkylation?
 Toluene Nitrobenzene Chlorobenzene Anisole
- Which is the major product of this reaction?



9. What is the relationship between the following two compounds?



- Enantiomers
 Constitutional isomers
 Diastereomers
 Resonance forms
10. Which of the following compounds may be classed as a protic solvent
 N, N-Dimethylformamide
 Ethanol
 Carbontetrachloride
 Tetrahydrofuran
11. For a chiral substrate which of the following reaction mechanism is accompanied by racemization plus some net inversion of configuration?
 S_N1 S_N2 E1 E2
12. The reaction of toluene with $KMnO_4$ followed by nitration gives _____ as a major product.
 o-nitrobenzoic acid
 m-nitrobenzoic acid
 p-nitrobenzoic acid
 m-nitrotoluene
13. Which is the most stable structure?
-
14. Which compound likely undergo a nucleophilic addition?
 2-Methyl-2-butene
 Isopropyl bromide
 Benzaldehyde
 Cyclohexene
15. How may chiral center/s is/are there in a molecule of 2,3-dibromobutan-1-ol.
 1 2 3 4

Fill in the blank.

16. The most stable conformation of ethane is the staggered conformation. It is approximately more stable by _____ kcal/mol than the eclipsed conformation.
17. Electron withdrawing substituent at *ortho* and *para* position _____ reactivity of the benzene ring toward *nucleophilic aromatic substitution*.
18. DMSO stands for _____
19. A planar, monocyclic, continuous system of p orbitals possesses aromatic stability when it contains $(4n+2)\pi$ electrons is the statement of _____ rule.
20. Hydroboration oxidation of 2-methylpropene yields _____ as a major product.

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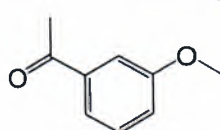
07 JUL 2024

Course : CHEM 104
Semester : II
F. M. : 55

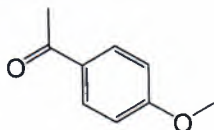
SECTION "B"

Attempt ALL questions.

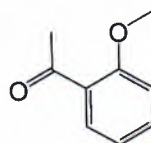
1. a. Consider the following three compounds



A

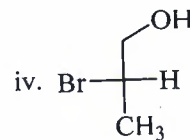
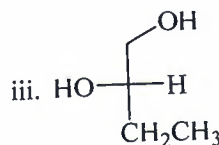
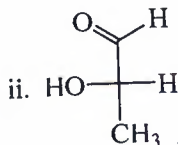
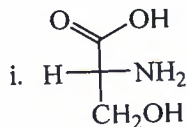


B

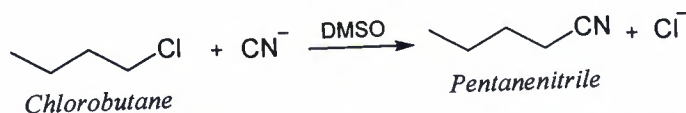


C

- i. Identify which of the two compounds; A and B, has greater resonance stabilization. [3]
 - ii. Would you expect compound C to have a resonance stabilization that is more similar to compound A or compound B [2]
- b. Identify the R, S, configuration of the chiral center in each of the following compounds. [2]



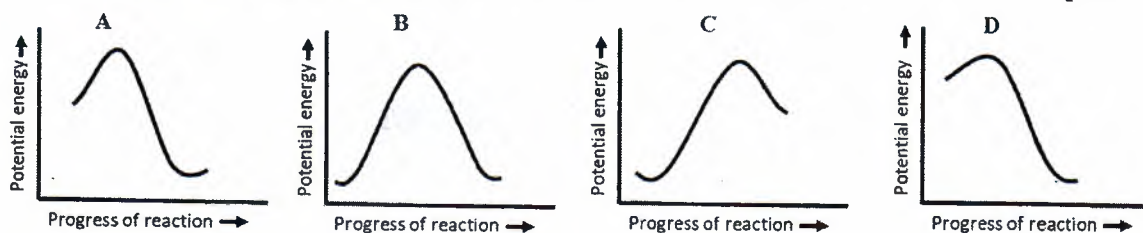
2. a. Consider the following S_N2 reaction.



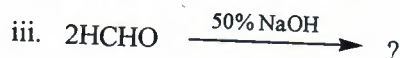
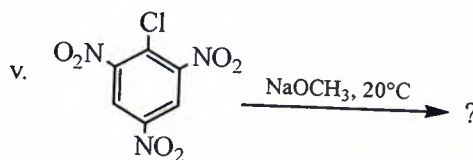
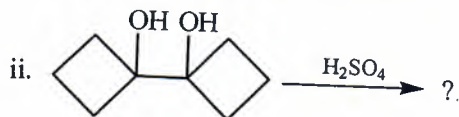
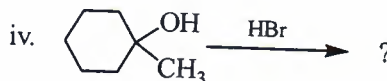
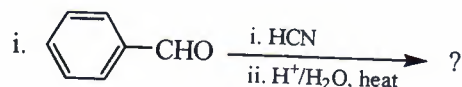
- i. Draw an energy diagram, label the axes, the reactants, products, E_a . Assume that the reaction is exothermic. [2]
 - ii. What happens to the reaction rate in each of the following case? [4]
 - a. The leaving group is changed from Cl^- to I^- .
 - b. The solvent is changed from DMSO to ethanol.
 - c. The alkyl halide is changed from *chlorobutane* to *2-chlorobutane*.
 - d. The concentration of cyanide ion is increased by a factor of five.
- b. Explain the conformational analysis of cyclohexane. [4]
3. Write short notes on (ANY THREE) [3×3=9]
- i. Mesomeric effect and inductive effect
 - ii. Phase transfer catalysis
 - iii. Rearrangement of carbocation
 - iv. Bayer strain theory

P.T.O.

4. Consider the relative energy diagrams for four different reactions. [2+2=4]



- i. Compare energy diagrams A and C. In which case will the transition state resemble reactants more than products? Explain.
 - ii. Compare energy diagrams A and B. Assuming all other factors are identical for the two processes, identify which process will occur more rapidly. Explain.
5. Give the appropriate reasons (*ANY FIVE*) [2×5=10]
- i. Free radical bromination is more selective than that of chlorination.
 - ii. Incomplete racemization is often found in S_N1 reactions. An excess of inversion is generally found.
 - iii. Addition of HCl to 2-methylpropene is more highly regioselective than the addition of HCl to 2-methyl-2-butene
 - iv. Photochemical chlorination of optically active (S)-(+)-1-chloro-2-methylbutane yields optically inactive 1,2-dichloro-2-methylbutane.
 - v. $-CH_3$ is an activating but $-CF_3$ is a deactivating group for electrophilic aromatic substitution.
 - vi. Equatorial methyl cyclohexane is more stable than axial isomer.
 - vii. Pyrrole is aromatic but pyrrolium ion is not
6. Give the major product/s for the following reactions. [5]



7. Propose plausible mechanisms for the following reactions. [2.5 × 4 = 10]

