



## Faculty of Health Sciences

BSC. (HONS) INDUSTRIAL PHARMACEUTICAL SCIENCES BSC. (HONS) COSMETIC SCIENCES

BCS 2143 Organic Chemistry  
End Semester Examination SEQ  
2<sup>nd</sup> Year 1<sup>st</sup> Semester  
6<sup>th</sup> BatchDate: 1<sup>st</sup> of March 2024

Time: 09.00 am – 12.00 pm - Three Hours

## INSTRUCTIONS TO CANDIDATES Page

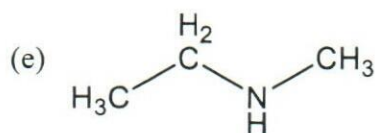
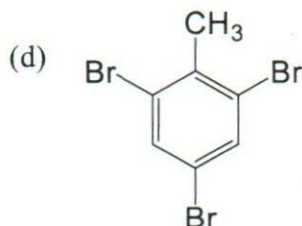
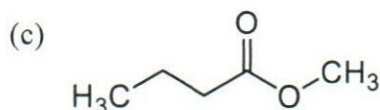
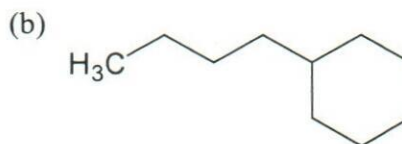
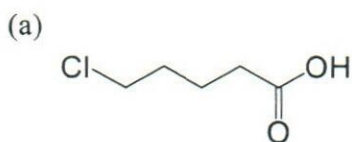
- This question paper consists of **SIX** questions.
- Answer **ALL** questions.
- You should write legibly in black or blue ink.

## Question 01

(100 marks)

1.1 Name the following structures in IUPAC nomenclature.

(20 marks)



1.2 Draw the structures corresponding to the following IUPAC names.

(20 marks)

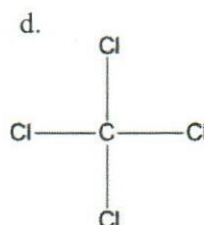
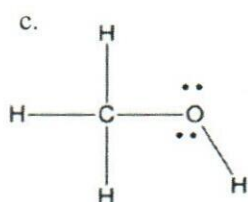
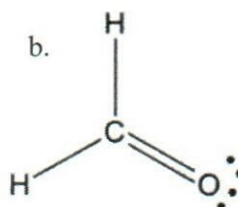
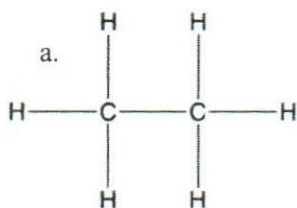
- (a) 3-(N-methylamino) butanoic acid  
(b) 3-methyl-2-phenyloctane

- (c) 2,4,6-Trinitrotoluene  
 (d) 3-hydroxyprop-2-enal  
 (e) 2-methylheptan-3-one

1.3 Identify the alkene obtained on dehydration of following alcohols. (You may draw the structure of the product in your answer sheet) (20 marks)

- a. 3-ethyl-3-pentanol  
 b. 2-propanol

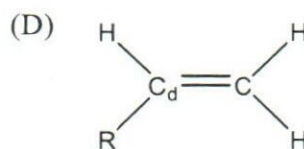
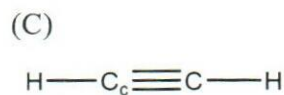
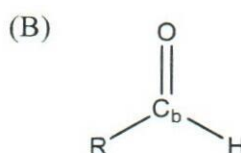
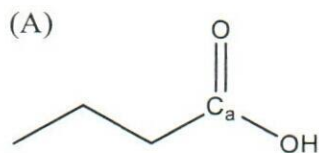
1.4 Comment on the polarity of the molecules given below and briefly indicate the reason for your answer for each molecule. (40 marks)



## Question 02

(100 marks)

2.1. Determine the oxidation states on the carbon atoms ( $C_a$ ,  $C_b$ ,  $C_c$ ,  $C_d$ ) of following organic molecules. (10 marks)



2.2. Classify each of the following reactions as an addition, elimination, substitution, or rearrangement.

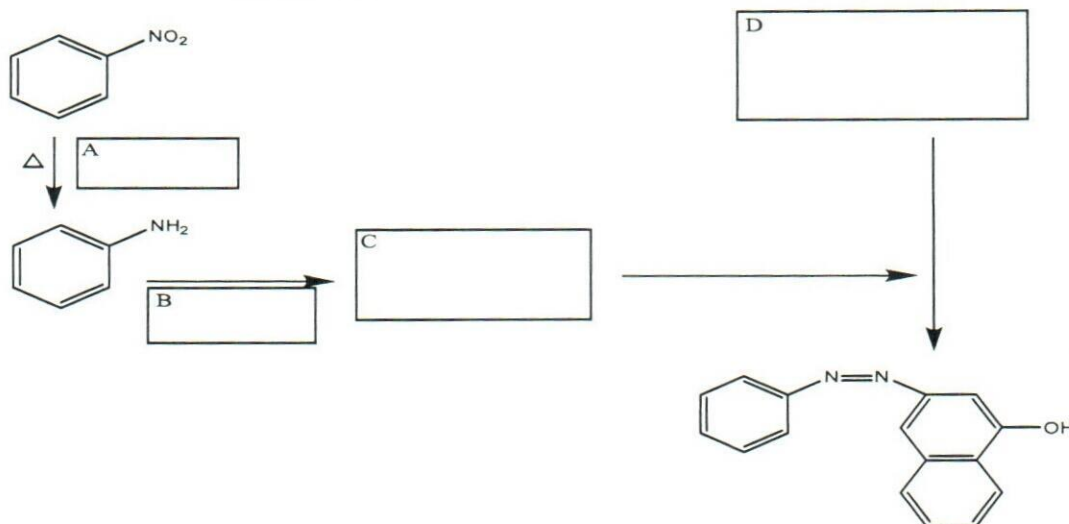
(20 marks)

- (a)  $C_6H_6 + CH_3Cl \longrightarrow C_6H_5CH_3 + HCl$   
 (b)  $CH_3CH_2OH \longrightarrow H_2C=CH_2 + H_2O$   
 (c)  $C_6H_6 + Br_2 + FeBr_3 \longrightarrow C_6H_5Br + HBr + FeBr_3$   
 (d)  $C_2H_6 + Cl_2 \longrightarrow C_2H_5Cl + HCl$   
 (e)  $CH_3CH_2OH + HCl \longrightarrow CH_3CH_2Cl + H_2O$

2.3. Consider the reaction between 2-bromopropane and NaOH. Write down products that you would obtain in following conditions. (30 marks)

- a. Ethanol as reaction medium and high temperature.  
 b. Water as reaction medium when concentration of NaOH is low.

2.4. Predict the structure of (A), (B), (C) and (D) (40 marks)



### Question 03

(100 marks)

3.1 Draw the Newman projection of staggered and eclipsed conformations of the following molecules.

(20 marks)

- a.  $Cl-CH_2-CH_2-Cl$   
 b.  $OH-CH_2-CH_2-CH_3$

3.2 Consider the molecule  $CH_3-CH_3$  (ethane). Sketch the graph of the rotational barrier in ethane as a function of dihedral angle. (20 marks)

3.3 Draw compounds that contain the following. (20 marks)

- A primary alcohol
- A tertiary amine
- Both primary and secondary alcohol
- Quaternary carbon

3.4 Describe the following by giving examples. (30 marks)

- Constitutional isomers
- Stereoisomers

3.5 Draw the structure that make following description. (10 marks)

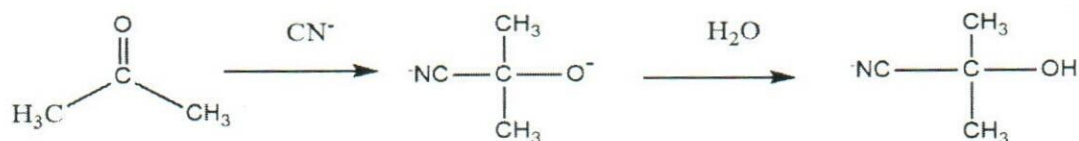
- Three isomers with the formula  $C_8H_{18}$
- Two isomers with the formula  $C_4H_8O_2$

#### Question 04

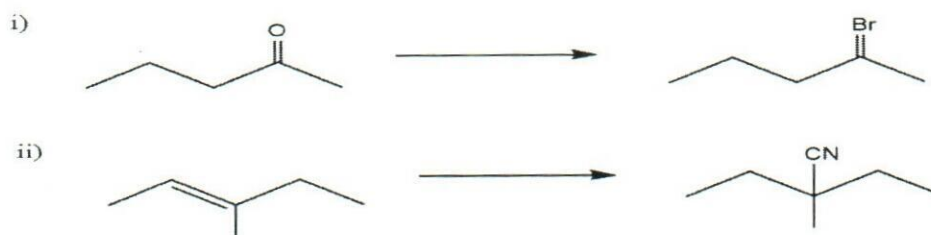
(100 marks)

4.1 Together with its structure define a tertiary alcohol in terms of its valency, charge, bonding and non-bonding electrons. (10 marks)

4.2 Give the mechanism of the nucleophilic addition reaction mechanism (given below) leading to the formation of an alcohol via an alkoxide. (20 marks)

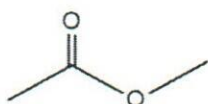


4.3 Propose synthetic schemes for the following conversions. Show all the reagents and the structures of the intermediates involved. (30 marks)



4.4 Write **four** electronic factors which influence the organic reactions. (20 marks)

4.5 Draw the resonance structures of the following organic molecule. (20 marks)

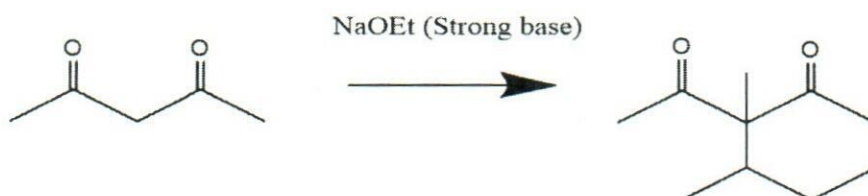




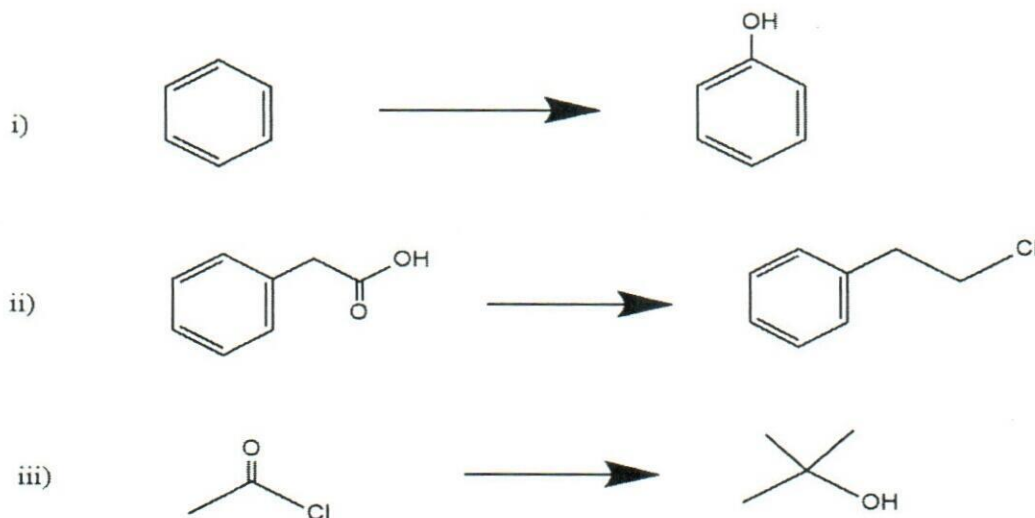
**Question 05****(100 marks)**

5.1. Using resonance structures explain why phenol is “ $\pi$ -excessive” (excessive  $\pi$  electron density) compared to benzene. (15 marks)

5.2 Propose a suitable mechanism for the following reaction. Show all the reagents and the structures of the intermediates involved. (25 marks)



5.3 Propose synthetic schemes for the following conversions. Show all the reagents and the structures of the intermediates involved. (30 marks)



5.4 Briefly explain why phenols have much higher boiling point than their corresponding hydrocarbons. (15 marks)

5.5 State three tests which can distinguish between phenols and alcohols. (15 marks)

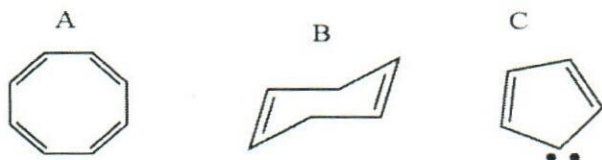
**Question 06****(100 marks)**

6.1. Stability of benzene and related compounds can be compared with fully saturated cyclohexane. Calculate the resonance energy of benzene, based on the heat of hydrogenations ( $\Delta H_h$ ) given below. (20 marks)

Heat of hydrogenation ( $\Delta H_h$ ) of cyclohexatriene = 360 kJ/mol

Heat of hydrogenation ( $\Delta H_h$ ) of benzene = 208 kJ/mol

6.2 Classify the given A, B and C molecules as aromatic, antiaromatic and non-aromatic. Briefly explain the reason for the choice. (30 marks)



6.3 Based on the following structural information draw the correct structure of naphthalene. (15 marks)

2 - hydroxy  
6 - methyl  
8 - nitro

6.4 State two sources of poly aromatic hydrocarbons. (10 marks)

6.5 Draw the structures of intermediates/ reagents, A-E in the following scheme which shows the Haworth Synthesis of naphthalene. (25 marks)

