BINDURA UNIVERSITY OF SCIENCE EDUCATION

CHEMISTRY DEPARTMENT

HBSCED AND BSC CHT

JUN 2025

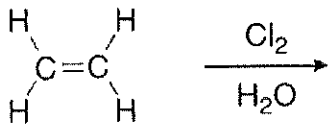
COURSE: CH103 ORGANIC CHEMISTRY 1

2 HOURS

ANSWER QUESTION ONE AND FOUR OTHER QUESTIONS TWO FROM EACH OF THE SECTIONS A AND B. EACH QUESTION CARRIES 20 MARKS

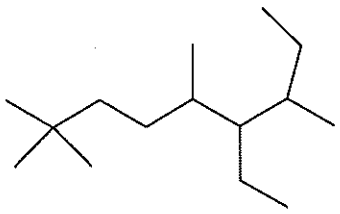
1. (a) Define the following terms:
   (i) Regiospecific
   (ii) Chiral center
   (iii) Enantiomer (3x2 marks)

   (b) Show with mechanisms the product of the following reaction:



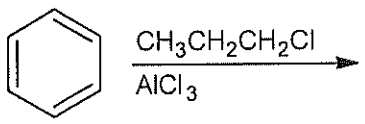
(6 marks)

   (c) Give IUPAC name of following compound?



(4 marks)

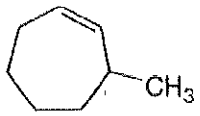
   (d) Predict the products of the following reaction:



(4 marks)

SECTION A: ANSWER TWO QUESTIONS

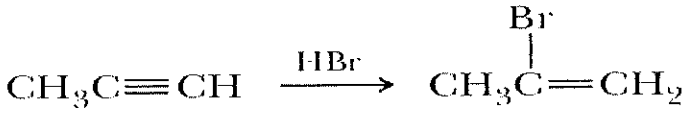
2. (a) Give the IUPAC name for the following compound:



(2 marks)

(b) Give the mechanisms for the catalytic hydrogenation of alkenes. (4 marks)

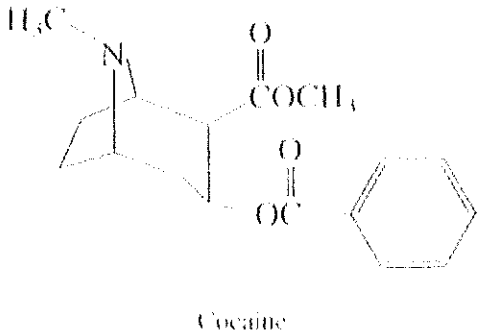
(c) Show the mechanism of the following transformation:



(4 marks)

(d) Draw all Newman Projections of butane showing all possible stereo-isomers. (8 marks)

(e) Identify and name all functional groups present in cocaine below:



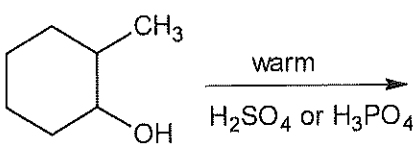
Cocaine

(3 marks)

3. (a). State Zaitsev's rule (2 marks)

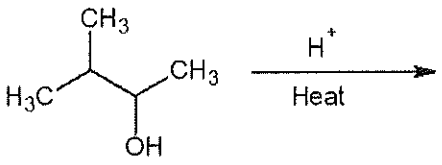
(b) Use Zaitsev's rule to predict the major and minor products of the following reactions:

(i)



(4 marks)

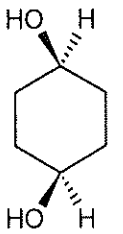
(ii)



(4 marks)

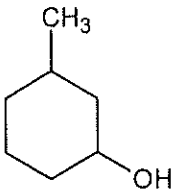
(c) Give the IUPAC names of the following alcohols:

(i)



(2 marks)

(ii)



(2 marks)

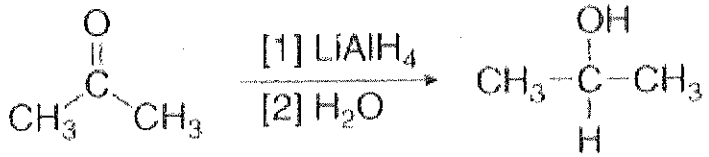
(d) (i) Assign R/S configuration to the chiral center in the following molecule:

(3 marks)

(ii) Draw the structure of (*R*)-3-chloro-1-pentene (3 marks)

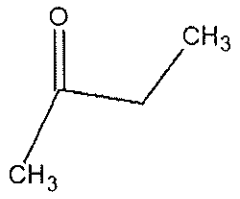
4. (a) Explain why aldehydes are more reactive than ketones towards nucleophilic attack. (4 marks)

(b) Illustrate the mechanism of the following conversion:



ketone 2° alcohol (4 marks)

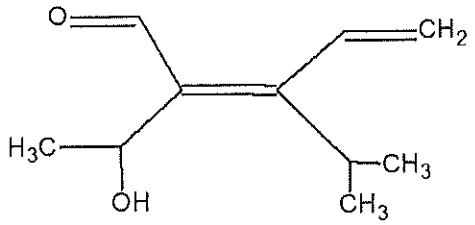
(c) Draw the structures and give the names of the hydride (H^-) reduction of the achiral ketone below:



(6 marks)

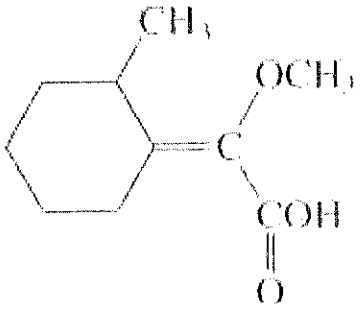
(d) Derive the E/Z designation for each of the following compounds:

(i)



(3 marks)

(ii)



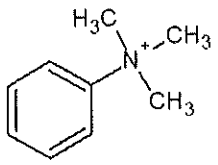
(3 marks)

SECTION B: ANSWER TWO QUESTIONS

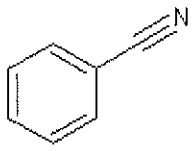
5. (a) Give the type of groups that are ortho-para directors when attached to the benzene ring (2 marks)

(b) Predict major products of the following reactions:

(i) Mononitration of the compound below:



(ii) Monobromination of compound below:



(iii) Monochlorination of phenol

(iv) Monobromination of aniline (4x2 marks)

(c) The rate of S_N1 reaction of alkylhalides/halogenoalkanes depends on three factors.

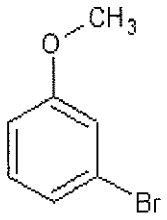
(i) What do you understand by S_N1 reaction?

(ii) State the factors that affect S_N1 reactions of alkylhalides.

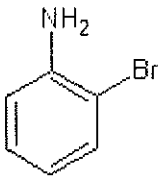
(iii) Explain how any two of the stated factors in (c)(ii) affect $S_N1$reactions of alkylhalides (1+3+6 marks)

6. (a) Show the structures of the products you would obtain from mononitration of the following compounds. Explain your answer.

(i)



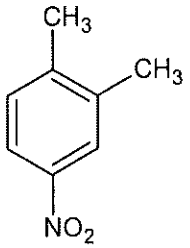
(ii)



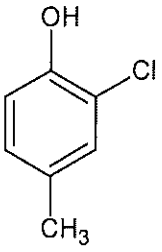
(4+4 marks)

(b) How would you synthesize the following compounds starting from Benzene? Assume that ortho and para isomers can be separated.

(i)



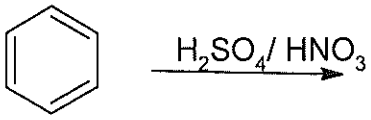
(ii)



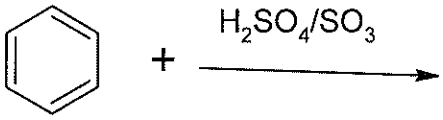
(2x6 marks)

7. (a) Show with mechanisms the products of the following reactions:

(i)



(ii)



(2x8 marks)

(b) Which aldehyde would you expect to be more reactive toward nucleophilic addition p-methoxybenzadehyde or p-nitrobenzadehyde? Explain. (4 marks)

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