

KABARAK



UNIVERSITY

**UNIVERSITY EXAMINATIONS
2008/2009 ACADEMIC YEAR
FOR THE DEGREE OF BACHELOR OF EDUCATION
SCIENCE**

COURSE CODE: CHEM 412

**COURSE TITLE: ADVANCED STEREOCHEMISTRY AND
REACTION MECHANISM**

STREAM: SESSION VII & VIII

DAY: THURSDAY

TIME: 2.00 – 4.00 P.M.

DATE: 13/08/2009

INSTRUCTIONS TO CANDIDATES:

Attempt all questions.
Each question = 17 ½ Marks

PLEASE TURN OVER

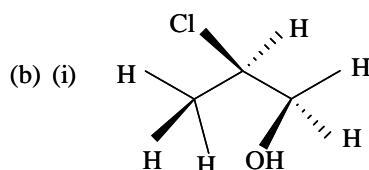
QUESTION ONE [17 ½ Marks]

(a) Define each of the following terms:

[4 Mks]

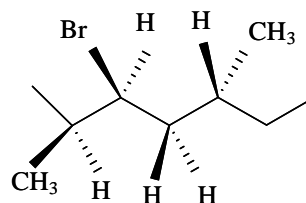
- (i) Enantiomer
- (ii) Stereocentre
- (iii) Racemic mixture
- (iv) Optical activity

(b) Identify the chiral centres of the following molecules (Use asterisk *) [4 Mks]



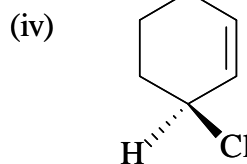
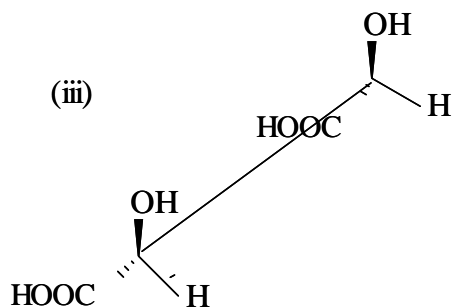
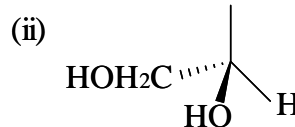
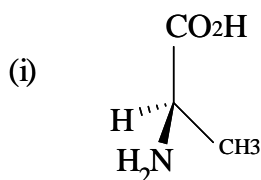
(ii) 3 - Methylcyclopent-1-enol

(iii) 2-Bromo-2-methylbutane (iv)



(c) Assign R and S configurations to the following molecules:

[8 Mks]



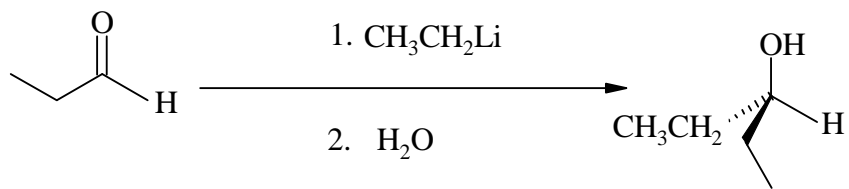
- (d) Briefly explain the effect of plane-polarized light when it is passed through a 50:50 racemic mixture [1 ½ Mks]

QUESTION TWO [17 ½ Marks]

- (a) Define the following terms: [3 Mks]
- (i) Conformations
 - (ii) Conformational analysis
- (b) (i) Draw the axial and equatorial conformations of methylcyclohexane [1 Mk]
- (ii) With a reason state the most stable configuration of methylcyclohexane [1 ½ Mks]
- (c) Sketch the boat and staggered conformations of cyclohexane. Which conformation is more stable? Explain your answer with reasons [6 Mks]
- (d) Using an energy level diagram show the positions of the boat and chair conformations of methyl cyclohexane [6 Mks]

QUESTION THREE [17 ½ Marks]

- (a) Define the following terms [5 Mks]
- (i) HOMO
 - (ii) Curly arrow
 - (iii) Electrophile
 - (iv) Leaving group
 - (v) Mechanism
- (b) (i) Using molecular orbitals explain how acetone, $(\text{CH}_3)_2\text{C} = \text{O}$, can act as both an electrophile and a nucleophile [4 Mks]
- (c) Consider the following reaction



(i) State the importance of the reagents H₂O and THF in the reaction.

[2 Mks]

(ii) Using curly arrows propose a mechanism for the above reaction.

[4 ½ Mks]

(iii) With the help of frontier molecular orbitals show the HOMO - LUMO interactions in the above reaction.

[2 Mks]

QUESTION FOUR [17 ½ Marks]

(a) Define the following terms:

[4 Mks]

(i) Electrocyclic reactions

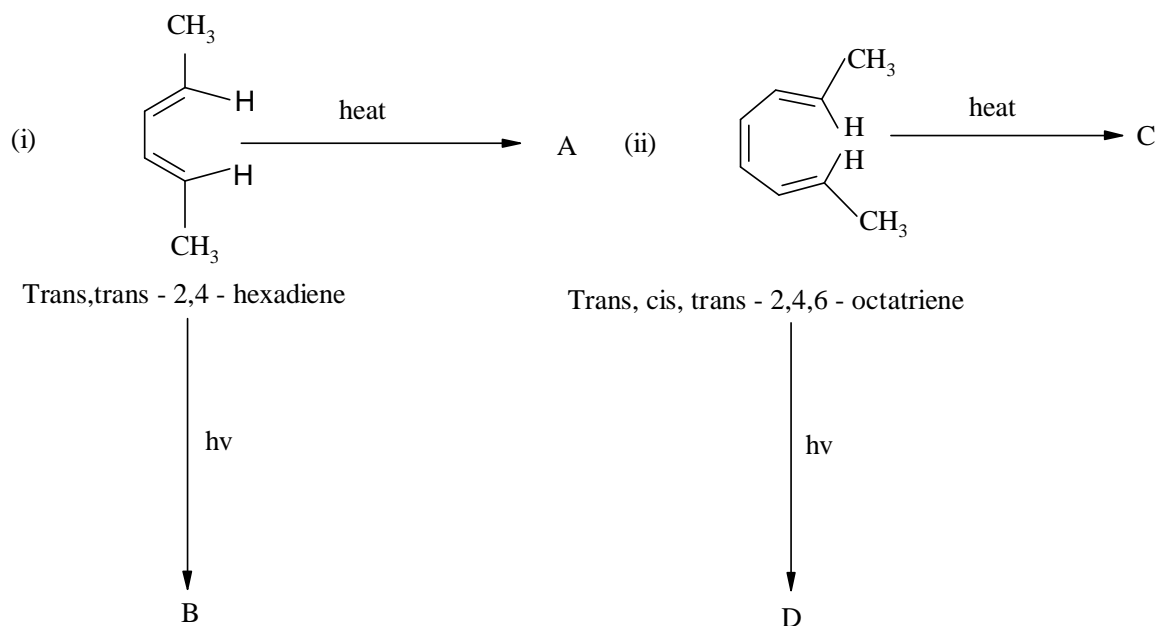
(ii) Concerted reactions

(iii) Stereospecific reaction

(iv) Conrotatory process

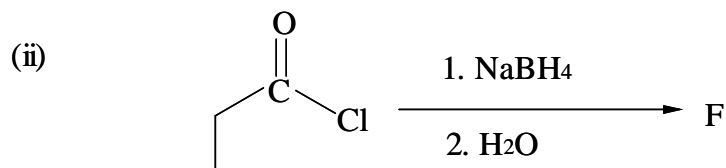
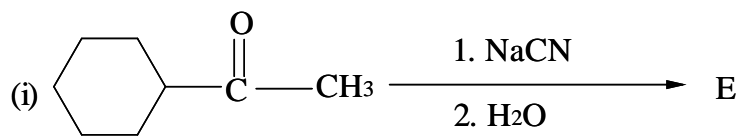
(b) With the aid of orbital diagrams show the products A, B, C and D of the following reactions:

[8 Mks]



(c) State the products of the following reactions:

[2 Mks]



(d) Using NaCN as HOMO and acetone as LUMO explain the term Burgi – Dunitz trajectory. [3 ½ Mks]