

KABARAK



UNIVERSITY

EXAMINATIONS

2008/2009 ACADEMIC YEAR

**FOR THE DEGREE OF BACHELOR OF EDUCATION
SCIENCE**

COURSE CODE: CHEM 412

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

STREAM: Y4S1

DAY: WEDNESDAY

TIME: 9.00 – 11.00 A.M.

DATE: 18/03/2008

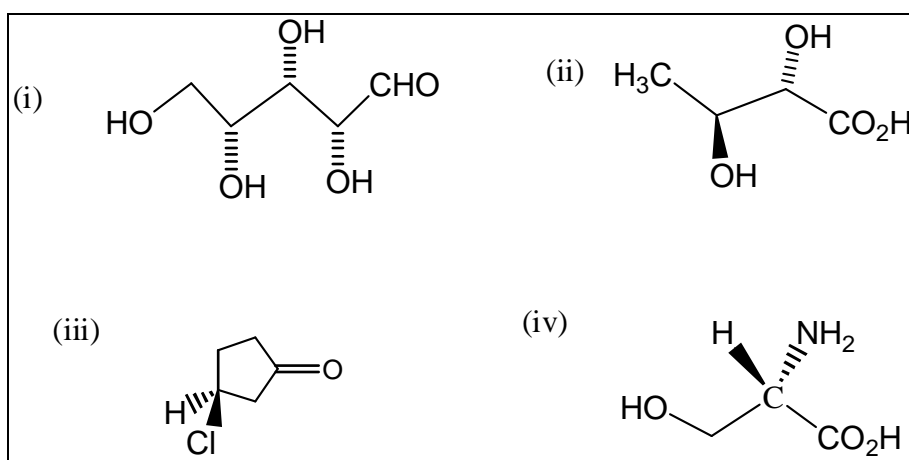
INSTRUCTIONS:

Attempt all questions

Total marks = 70 (each question = 17.5 marks)

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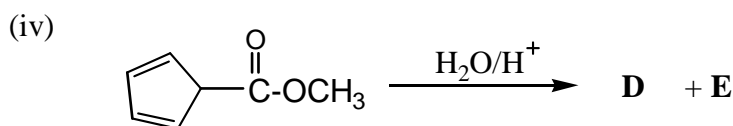
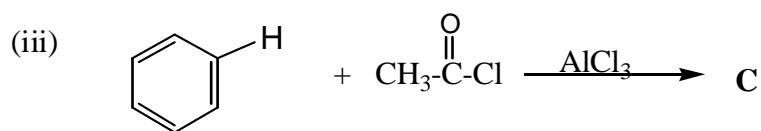
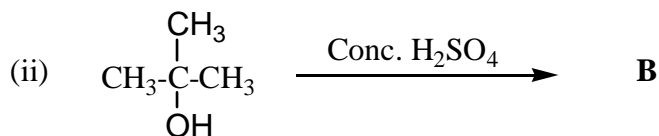
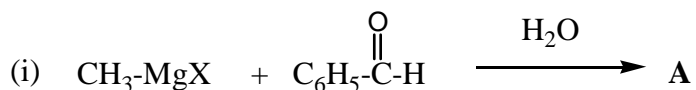
1. (a) Define the following and give an example of each:
- (i) Enantiomers (ii) Diastereoisomers (iii) meso compounds
 (iv) Conformational isomers. (4.5 mks)
- (b) Draw a three-dimensional structural formula for each of the following compounds: (4 mks)
- (i) (R)-2-Hydroxypropanoic acid (ii) (S)-2-Aminopropanoic acid
 (iii) (R)-3-Cyanocyclopentanone (iv) (S)-3-methyl-2-butanol
- (c) In each of the following compounds, identify the chiral centres and assign an ((R) or (S) configuration to each of the centres, Give the IUPAC names including (R) & (S) designation. (5.5 mks)



2. (a) (i) Use the wedge –broken wedge convention to draw the three-dimensional model of the two conformational stereoisomers of cyclohexane. (6mks)
- (ii) Use one of the conformational stereoisomer for cyclohexane to explain what is ring inversion of cyclohexane.
- (iii) Explain the difference in the energies of two conformers of cyclohexane.

- (b) (i) Draw the most stable conformational stereoisomer of methylcyclohexane. Explain why it is the most stable.
- (ii) The rate of nucleophilic substitution reaction of axial-chlorocyclohexane with cyanide ion is higher than the rate of equatorial-chlorocyclohexane substitution. Explain and name the major product formed. (5 mks)
- (c) (i) State two factors that causes a chemical reaction to take place in organic molecules.
- (ii) In the following compounds; Ethyne, HCl, ethanal and cyclohexanol, identify the molecular orbitals present and indicate the LUMO or the HOMO orbital. (6.5 mks)

3. (a) Give the curly arrow mechanism and names of the products formed in the following reactions: (8 mks)



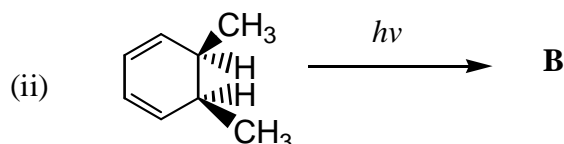
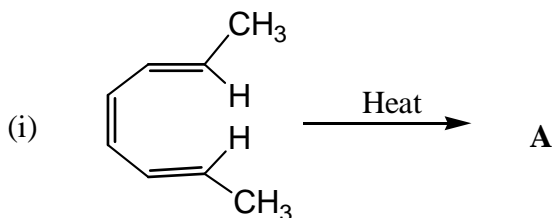
- (b) In each of the above reactions in 3(a) identify the reagent that acts as a nucleophile and an electrophile. Give the HOMO and the LUMO orbitals that take part in the reaction. (8 mks)

(c) In the electrophilic addition reaction of Br_2 to ethene to give 1, 2-dibromoethane, show the mechanism of the reaction using molecular orbital interaction. (1.5 mks)

4. (a) Explain the following terms:

(i) Conrotatory motion (ii) Disrotatory motion (4 mks)

(b) Give the stereochemistry of the products that are expected from each of the following electrocyclic reactions: (4 mks)



(c) (i) State the conditions required for cycloaddition reaction to take place in alkenes. (2 mks)

(ii) Give the reaction mechanism for cycloaddition of two molecules of ethene and name the product formed. (3 mks)

(iii) Give the reaction mechanism for cycloaddition of but-1,3-diene with ethene and name the product formed. (3 mks)

(iv) Complete the following cycloaddition reaction: (1.5 mks)

