

KABARAK



UNIVERSITY

UNIVERSITY EXAMINATIONS

2009/2010 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: CHEM 412

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

STREAM: SESSION VII

DAY: THURSDAY

TIME: 2.00 – 4.00 P.M.

DATE: 12/08/2010

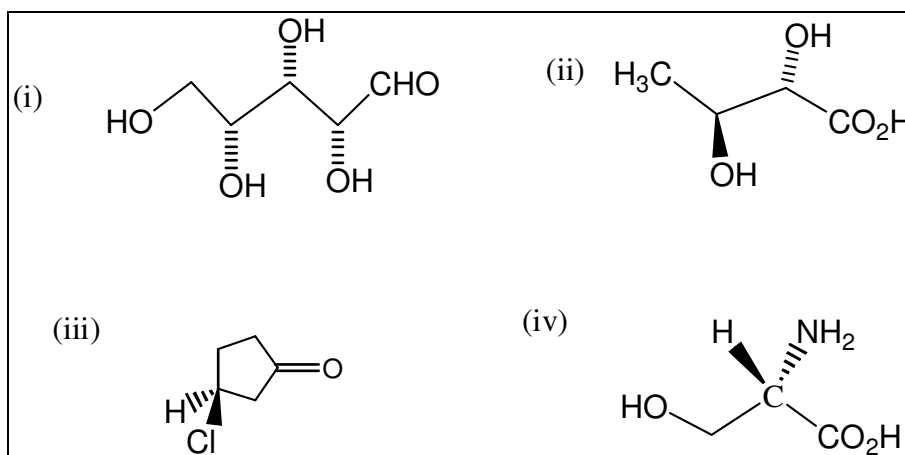
INSTRUCTIONS:

Attempt all questions

Total marks = 70 (each question = 17.5 marks)

PLEASE TURNOVER

1. (a) Define the following terms and give an example of each:
- (i) Enantiomers (ii) Diastereomers (iii) meso compound
 (iv) Conformational isomers. (5.5 mks)
- (b) Draw a three-dimensional structural formula for each of the following compounds: (6 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. (6 mks)



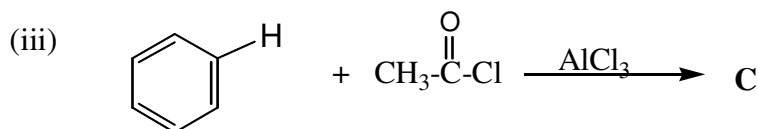
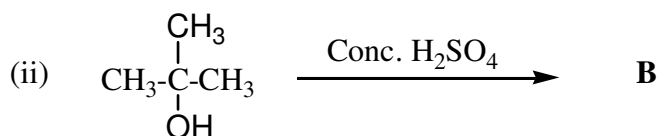
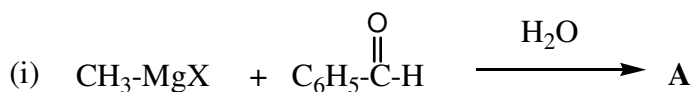
2. (a) (i) Use the wedge –broken wedge convention to draw the three-dimensional model of the two conformational stereoisomers of cyclohexane.
- (ii) Use one of the conformational stereoisomer for cyclohexane to explain what is ring inversion of cyclohexane.
- (iii) Explain the difference in the energies of two conformers of cyclohexane. (6mks)
- (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. (5mks)

(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) In the following reactions give the curly arrow mechanism and names of the products formed: (9 mks)



(b) In each of the above reaction 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. (8.5 mks)

4. (a) 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. (5 mks)

(b) Explain the following terms:

(i) Conrotatory motion (ii) Disrotatory motion (6 mks)

(c) Give the stereochemistry of the products that are expected from each of the following electrocyclic reactions. (6.5 mks)

