KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2009/2010 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF SCIENCE IN EDUCATION SCIENCE

COURSE CODE: **CHEM 412**

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

STREAM: **Y4S1 & SESSION IV**

DAY: **THURSDAY**

TIME: **9.00 – 11.00 A.M.**

DATE: **04/12/2009**

INSTRUCTIONS:

- **Attempt all Questions**
- **Total Marks = 70 (Each question = 17.5 marks)**

PLEASE TURN OVER

1. (a) (i) Explain the difference between enantiomers and diastereomers. Give examples. (3 mks)

(ii) Discuss the optical activity of stereoisomers. (1 mk)

(iii) What are meso-compounds? Give examples. (1.5 mks)

(b) Draw perspective formulae for the following compounds: (4 mks)

(i) (*R*)-2-butanol (ii) (2*S*, 3R)-3-chloro-2-pentanol

(iii) (2R, 3R)-2,3-dibromopentane (iv) (S)-1,2-dibromobutane

(c) Draw and name the four stereoisomers of (i) 1,3-dichloro-2-butanol

(ii) 2, 3-dichloropentane (8 mks)

2. (a) (i) Explain why the chair conformer of cyclohexane is more stable than the boat conformer. (2 mks)

(ii) Explain with use of an Energy level diagram how ring inversion of chair conformer of ohexane takes place. (3 mks)

(b) (i) Draw and name the two conformational stereoisomers of methylcyclohexane

(ii) Which conformation is the most stable? Explain. (5 mks)

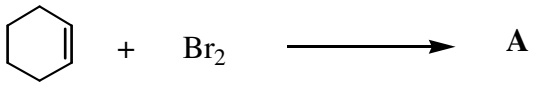
(c) (i) Bromocyclohexane undergoes nucleophilic substitution reaction with sodium cyanide to give two products. Name the products and identify the major product. (2.5 mks)

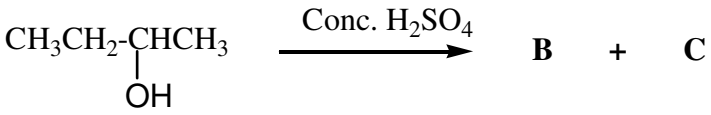
(ii) Explain why the rate of substitution of axial bromide in (c) (i) above is higher than the rate of substation of equatorial bromide. (3 mks)

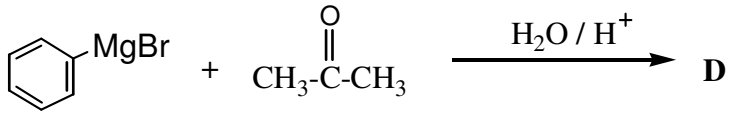
(iii) Give a major factor that determines the highest percentage yield of the product formed in nucleophilic substitution of monosubtituted cyclohexane. (2 mks)

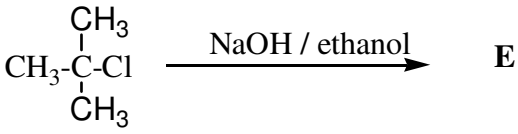
3. (a) Define the following terms: (i) Electrophile (ii) Nucleophile. Give examples (2 mks)

(b) Using curly arrows show all steps and mechanisms for the following reactions and name the products. (8 mks)

(i) 

(ii) 

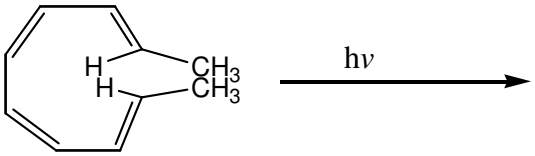
(iii) 

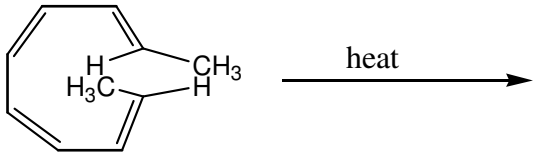
(iv) 

(c) In the reactions 3(b) (i) – (iv) above, identify the LUMO and HOMO orbital and show the mechanisms of the reactions using molecular orbital interaction. (7.5 mks)

4. (a) What product is formed from (i) a concerted photochemical cyclization of Cis,trans-2,4-hexadiene? (ii) a concerted thermochemical cyclization of Cis,trans-2,4-hexadiene? (3.5 mks)

(b) The following 2, 4, 6, 8-decatetraenes undergo ring closure when heated or irradiated. Draw and name the products formed in each reaction? (6 mks)

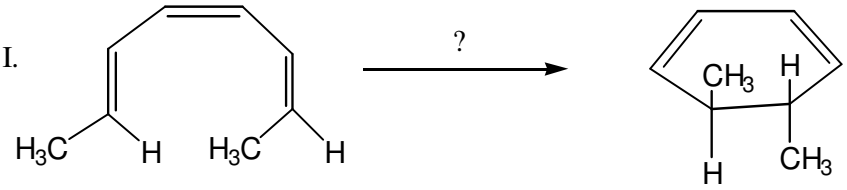
(i) 

(ii) 

(c) For each of the following reactions;

(i) state whether controtatory or disrotatory motion of the group is involved. (4 mks)

(ii) State whether the reaction can occur under the influence of heat or light. (4 mks)

I. 

II.