

CHUKA



UNIVERSITY

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**UNIVERSITY EXAMINATIONS****EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF SCIENCE  
CHEM 436: ADVANCED STEREOCHEMISTRY AND REACTION MECHANISMS****STREAMS:****TIME: 2 HOURS****DAY/DATE: WEDNESDAY 4/12/2019****11.30 A.M – 1.30 P.M**

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**INSTRUCTIONS****ANSWER QUESTION ONE AND ANY OTHER TWO QUESTIONS****QUESTION ONE (30 MARKS)**

- a) Draw the cis and trans isomer of the following compound
- i) 1-bromo-3-chlorocyclobutane
  - ii) 1,4-dimethyl cyclohexane (2marks)
- b) Which of the following compounds have an asymmetric carbon (4marks)
- c) Define the following terms i) Chiral molecule ii) Achiral molecule iii) conformations (3mks)
- d) Explain the following terms briefly i) Angle strain ii) Torsional strain iii) Steric strain (3mks)
- e) i) Draw the chair and boat conformers of cyclohexane (2marks)  
ii) Draw the Newmann projection of the boat and chair conformers (2marks)
- f) Write the mechanism of the following reactions (3marks):

- g) 5-methyl-1,3-cyclopentadiene rearranges to give a mixture of 5-methyl-1,3-cyclopentadiene, 1-methyl-1,3-cyclopentadiene and 2-methyl-1,3-cyclopentadiene. Show how the three products are made (4marks)
- h) i) Define a carbonium ion (1mark)
- ii) Give three methods for the generation of a carbonium ions (3marks)
- iii) Explain why benzyl cations are more stable than primary ions (3marks)

**QUESTION TWO (20 MARKS)**

- a) Draw the two chair conformers of methyl cyclohexane and with reason indicate which one is the most stable (3marks)
- b) Differentiate between the following terms:
- i) Suprafacial and antarafacial (2marks)
- ii) Symmetry allowed pathway and symmetry forbidden pathway (2marks)
- c) Predict the products of the following reactions and indicate whether the product have the cis or the trans configuration (6marks).
- d) Using an example give the two classification of carbonium ions (4marks)
- e) Explain why 1,3-hydrogen shifts do not occur under thermal conditions but occur under photochemical conditions (3marks)

**QUESTION THREE (20 MARKS)**

- a) Draw the cis and trans isomers of 1,2-dimethyl cyclohexane (2marks)
- b) Using an example give the three kinds of pericyclic reactions (6marks)
- c) Compare the reaction of 2, 4, 6-cycloheptatrienone with cyclopentadiene to that of ethane. Explain why 2, 4, 6-cycloheptatrienone uses two  $\pi$  electrons in one reaction and four  $\pi$  electrons in the other as shown in the following equation (i) and (ii). (6 marks).

- d) Write the mechanism of the following reaction and indicate the type of sigmatropic rearrangement (6marks)

**QUESTION FOUR (20 MARKS)**

- a) Using an equation give two examples of the various possible reactions types of a carbonium ion (4marks)
- b) Explain why a [2+2] cycloaddition reaction as shown in the following figure does not occur under thermal conditions but does take place under photochemical conditions (6marks)
- c) Determine the mode of ring closure in the following reactions (3mks)
- d) Differentiate between a photochemical and a thermal reaction (2marks)
- e) Determine whether the conformer of 1,2-dimethylcyclohexane with one methyl group in an equatorial position and the other in an axial position the cis isomer or the trans isomer (4 marks).
- f) Draw the product of the following reaction (1mark)
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