



MACHAKOS UNIVERSITY

University Examinations 2016/2017

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

THIRD YEAR FIRST SEMESTER EXAMINATION FOR BACHELOR OF
EDUCATION

SCH 303: STEREOCHEMISTRY, CONFORMATIONAL STUDIES AND REACTION
MECHANISMS

DATE: 2/8/2017

TIME: 2.00-4.00 PM

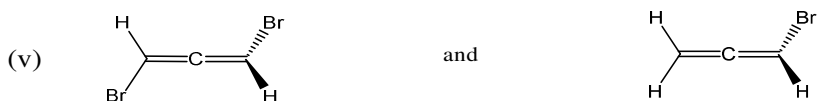
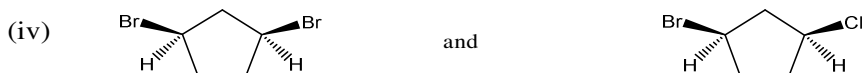
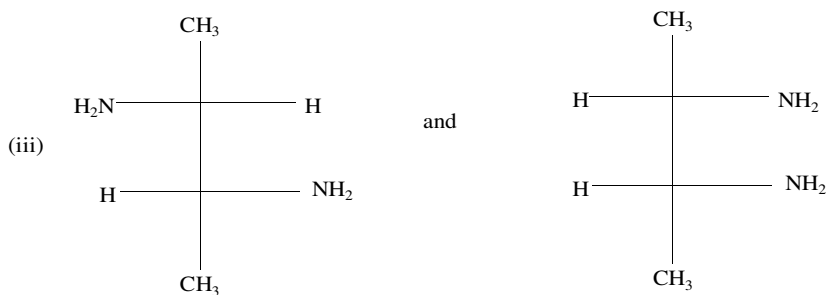
INSTRUCTIONS:

- The paper consists of **two** sections.
- Section **A** is **compulsory** (30 marks).
- Answer any **two** questions from section **B** (each 20 marks).

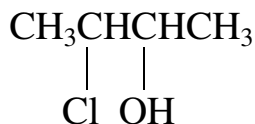
SECTION A

QUESTION ONE (30 MARKS)

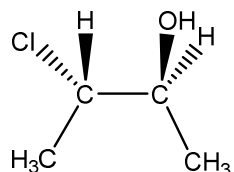
- a) Define the following terms and provide examples in each case;
- i. Constitutional isomers (2 marks)
 - ii. Stereoisomers (2 marks)
- b) Give the other three names for a stereogenic centre (3 marks)
- c) In each of the following pairs of compounds, one is chiral and the other is achiral. Identify each compound as chiral or achiral, as appropriate (10 marks)



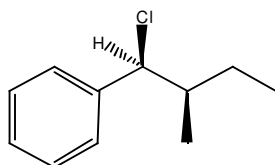
- d) i. How many asymmetric centres are in the following molecule? (2 marks)



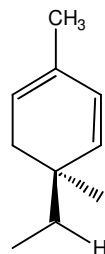
- ii. How many stereoisomers do you expect for this compound? (1 mark)
- iii. Starting with the stereoisomer shown below, draw all the other stereoisomers indicating the absolute (R, S) configuration before the name 2-chloro-3-hydroxy butane (3 marks)



- e) Identify each of the stereogenic centres in the molecules below by placing an asterisk (*) and indicate the absolute (R,S) configuration of each stereogenic centre (6 Marks)



(i)

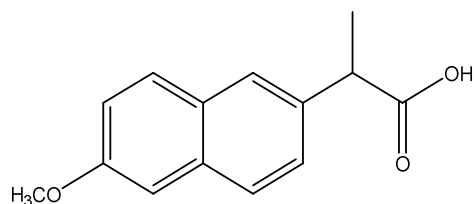


(ii)

SECTION B

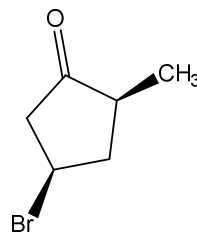
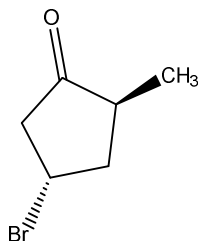
QUESTION TWO (20 MARKS)

- a) Explain why chiral molecules are said to be optically active. (3 marks)
- b) Many chiral drugs must be prescribed as a single enantiomer. Naproxen (shown below) is an anti-inflammatory drug, which is mandated to be sold at greater than 97% enantiomeric excess (e.e.). The specific rotation of the R-enantiomer (in CHCl_3) is $+65.5^\circ$. A quality control chemist samples the latest 50 kg batch of Naproxen produced at a pharmaceutical industry. She dissolves 2.6 g of product in 10 mL of chloroform and measures an optical rotation of $+15.2^\circ$ in a 10 cm (1 dm) polarimeter.
 - i. Draw the R-enantiomer of Naproxen (3 marks)
 - ii. Calculate the optical purity of the sample and determine whether it meets the standards for it to be marketed? (4 marks)
 - iii. Determine the mass of the 50 kg batch that is actually the (+)(R)-enantiomer (3 marks)



QUESTION THREE (20 MARKS)

- a) With illustration, describe three ways in which enantiomers can be separated (15 marks)
- b) Is it theoretically possible to separate the pair of compounds below by distillation? Explain briefly (5 marks)

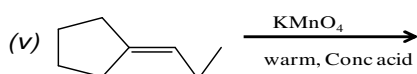
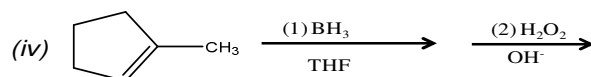
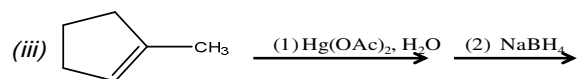
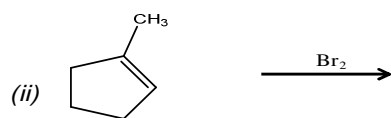


QUESTION FOUR (20 MARKS)

- a) Explain the following terms:
- Torsional strain
 - Steric Strain
 - Angle strain (6 marks)
- b) Draw the four butane conformations and the respective energy diagram representing the potential energy of each conformation versus the dihedral angle (14 marks)

QUESTION FIVE (20 MARKS)

- a) Predict the product for each of the following reactions showing the stereochemistry of the product where appropriate (10 marks)



- b) i A solution containing 0.96 g of 2-bromooctane in 10 mL ether solution gave an observed rotation of -1.8° in a 10 cm cell at 20°C . Calculate the specific rotation of this solution (5 marks)
- ii Draw the two products formed in the witting reaction below, indicating their stereochemistry, the major and minor product (5 marks)

