



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

DEPARTMENT OF PHYSICAL SCIENCES

THIRD YEAR FIRST SEMESTER EXAMINATION FOR

BACHELOR OF EDUCATION (SPECIAL EDUCATION)

BACHELOR OF EDUCATION (SCIENCE)

**SCH 303: STEREOCHEMISTRY, CONFORMATIONAL STUDIES AND
REACTION MECHANISMS**

DATE: 22/7/2019

TIME: 2:00 – 4:00 PM

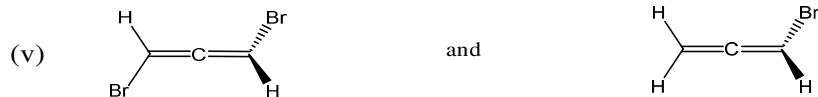
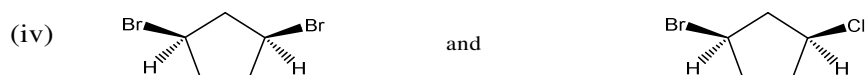
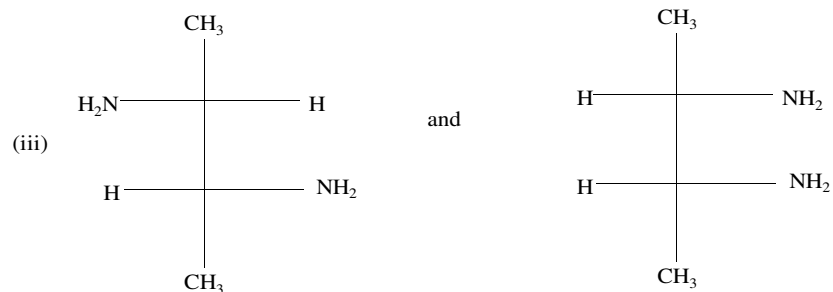
INSTRUCTIONS:

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

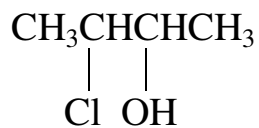
SECTION A: (COMPULSORY)

QUESTION ONE (30 MARKS)

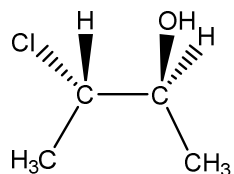
- (a) Define the following terms and provide examples in each case
- i) Constitutional isomers (2 marks)
 - ii) Stereoisomers (2 marks)
- (b) Provide three other names for a stereogenic centre (3 marks)
- (c) In each of the following pairs of compounds one is chiral and the other is achiral. Identify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



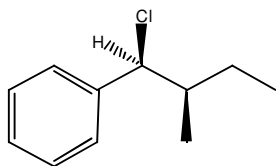
- d) i) Determine the number of asymmetric centres the molecule below has (2 marks)



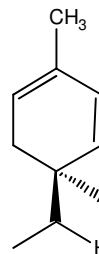
- ii) How many stereoisomers do you expect for this compound? (2 marks)
- di) Starting with the stereoisomer shown below, draw all the other stereoisomers indicating the absolute (R, S) configuration before the name 2-chloro-3-hydroxy butane (3 marks)



- 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)

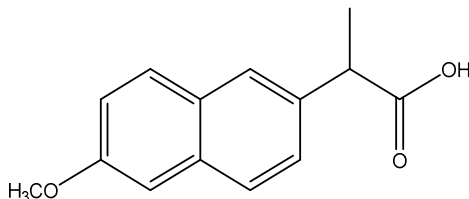


(ii)

SECTION B: ANSWER ANY OTHER TWO QUESTIONS

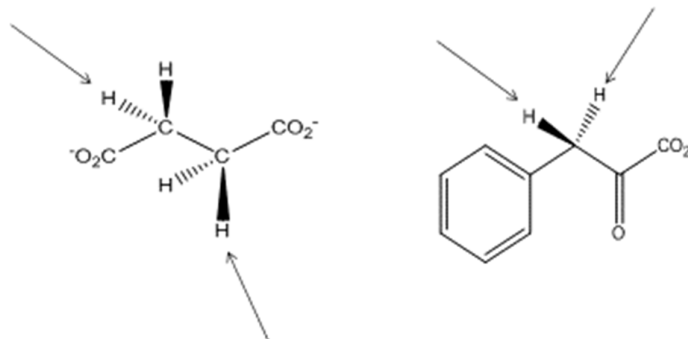
QUESTION TWO (20 MARKS)

- Explain chiral molecules are said to be optically active. (3 marks)
- 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 a 50 kg batch of Naproxen produced at a pharmaceutical industry. She dissolved 2.6 g of product in 10 mL of chloroform and measured an optical rotation of $+15.2^\circ$ in a 10 cm (1 dm) polarimeter.
 - Draw the R-enantiomer of Naproxen (2 marks)
 - Calculate the optical purity of the sample and determine whether it meets the standards for it to be marketed? (4 marks)
 - Determine the mass of the 50 kg batch that is actually (+)(R)-enantiomer (3 marks)



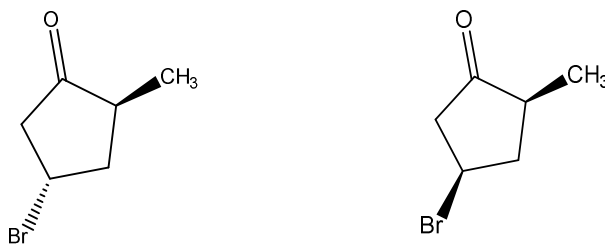
- Describe two ways in which one can distinguish two enantiomers (4 marks)

- d) Identify the highlighted hydrogens in the molecules shown below as either *pro-R* or *pro-S* (4 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)

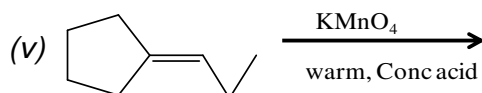
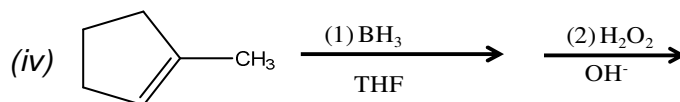
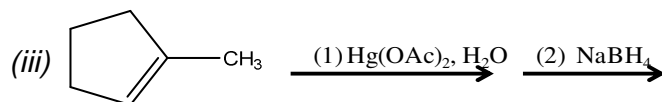
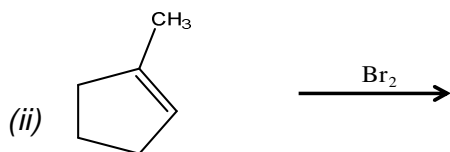


QUESTION FOUR (20 MARKS)

- a) Explain the following terms: (i) Torsional strain
(ii) Steric Strain
(iii) 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 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)

