



29 OCT 2015

EASTERN UNIVERSITY, SRI LANKA

FIRST YEAR EXAMINATION IN SCIENCE

SECOND SEMESTER 2012-2013 (August/September-2015)

CH 103: STEREOCHEMISTRY AND KINETIC MOLECULAR THEORY
(Proper)

Answer all questions

Time allowed: ONE Hour

You may find the following data useful

Avogadro constant (N_A): $6.023 \times 10^{23} \text{ mol}^{-1}$

Electron charge (e): $1.602 \times 10^{-19} \text{ C}$

Faraday constant (F): $9.648 \times 10^4 \text{ C mol}^{-1}$

Gas constant (R): $8.314 \text{ JK}^{-1} \text{ mol}^{-1}$

Planck's constant (h): $6.626 \times 10^{-34} \text{ Js}$

Rest mass of electron (m_e): $9.1 \times 10^{-31} \text{ kg}$

Velocity of light (c): $3 \times 10^8 \text{ ms}^{-1}$

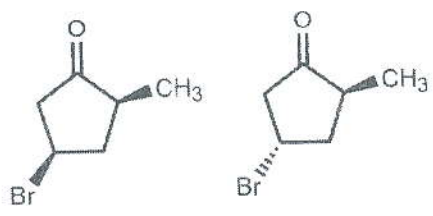
The use of a (non-programmable) calculator is permitted

1. a) i) Draw the structure of the following compounds and interpret their R,S specificity (where present).

- a) (R)-2-bromo-1-butanol
- b) (S)-1,2-dichloropentane
- c) (2R,3S)-2-chloro-3-pentanol
- d) (2R,3S)-2,3-dibromoheptane

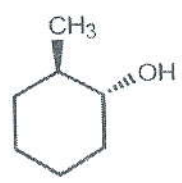
(30 marks)

ii) Is it theoretically possible to separate the pair of compounds below by distillation? Explain briefly.



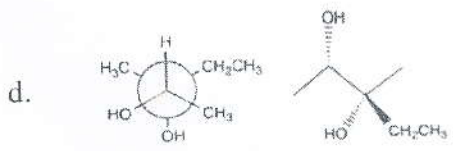
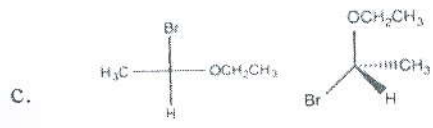
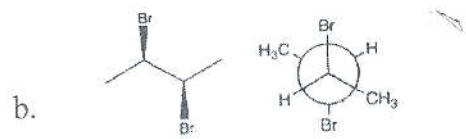
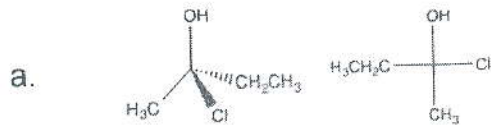
(15 marks)

b) i) Give reasons and indicate the most stable conformation of the two possible chair conformations of the following compound (your answer should include the various destabilizing interactions that contribute to the total strain of each conformation).



(15 marks)

ii) Are the following pairs of compounds enantiomers, diastereomers, or the same compound?



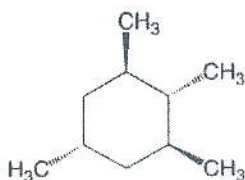
(20 marks)



- c) A solution of 2.0 g of (+)-glyceraldehyde in 10.0 mL of water was placed in a 1 dm polarimeter tube. Using the sodium D line, a rotation of 1.74° was observed at 25°C . Calculate the specific rotation of (+)-glyceraldehyde.

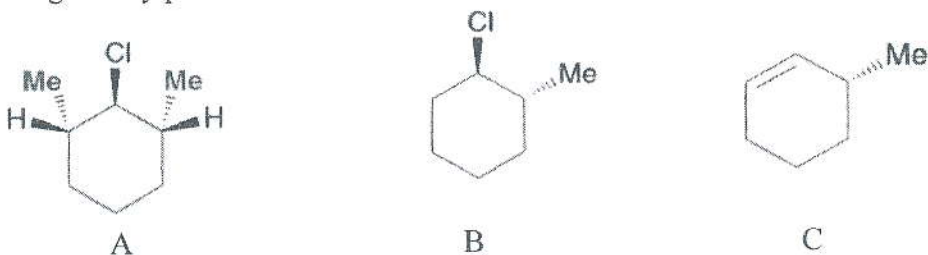
(20 marks)

2. a) Consider the molecule below. What is the maximum number of methyl groups that can be in the equatorial position in the same time? Explain by drawing stable chair conformations of the molecule.



(10 marks)

- b) Explain why E_2 elimination of **B** gives only the compound **C** whereas the E_2 elimination of **A** does not give any product.



(30 marks)

- c) Considering a certain mass of a gas enclosed in a cubic box of length l at a fixed temperature. Derive expressions for,

- The total change of momentum per second on **one** face of the box due to **one** molecule only. (15 marks)
- The total change of momentum due to impacts of **all** the molecules on **all** faces of the box. (15 marks)
- Show that

$$PV = \frac{1}{3} mNC^2$$

Where,

V- volume of the cube

P- pressure of the gas

m- mass of one molecule

N- total number of gas molecules

C- velocity of a molecule.

(15 marks)

- Calculate the root mean square velocity of an He molecule at 30°C and 76 cm Hg pressure (76 cm Hg = 1 atm = 10^5 Pa; 1 Pa = 1 Nm^{-2} ; He = 4).

(15 marks)