EASTERN UNIVERSITY, SRI LANKA

FIRST YEAR EXAMINATION IN SCIENCE

SECOND SEMESTER (April/May-2017)

EXTCH 103: STEREOCHEMISTRY AND KINETIC MOLECULAR THEORY
(Repeat)

Answer all questions **Time allowed: ONE Hour**

You may find the following data useful

Avogadro constant (N_A): 6.023×10^{23} mol^{-1}

Electron charge (e): 1.602×10^{-19} C

Faraday constant (F): 9.648×10^{4} $Cmol^{-1}$

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

Planck's constant (h): 6.626×10^{-34} Js

Rest mass of electron (m_e): 9.1×10^{-31} kg

Velocity of light (c): 3×10^{8} 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 specificatio (where present).

a) (R)-2-bromo-1-butanol

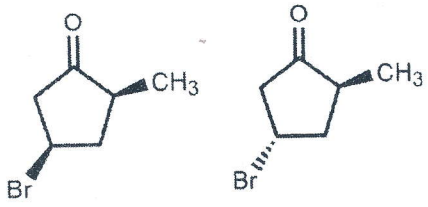
b) (S)-1,2-dichloropentane

c) (2R,3S)-2-chloro-3-pentanol

d) (2R,3S)-2,3-dibromoheptane

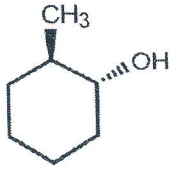
(30 marks)

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



(15 mark

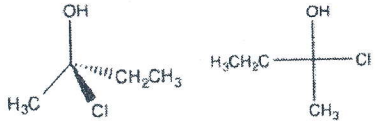
b) i) Give reasons and indicate the most stable conformation of the two possible chair for of the following compound (your answer should include the various destabiliz interactions that contribute to the total strain of each conformation).



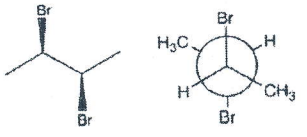
(15 mark

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

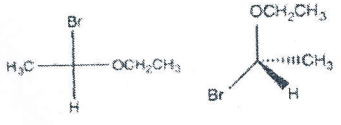
a.



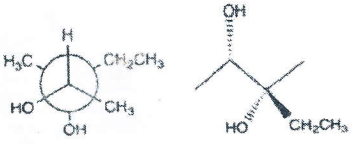
b.



c.



d.



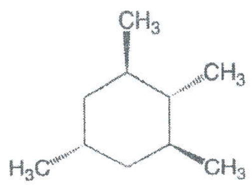
(20 marks)

Contd...

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.

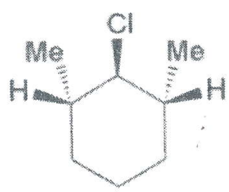
(20 marks)

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.

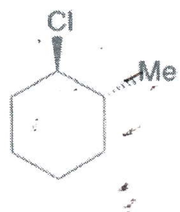


(10 marks)

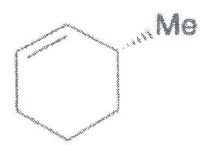
b) Explain why E_2 elimination of **B** gives only the compound **C** whereas the E_2 elimination of **A** does not give any product.



A



B



C

(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,

i. The total change of momentum per second on **one** face of the box due to **one** molecule only.

(15 marks)

ii. The total change of momentum due to impacts of **all** the molecules on **all** faces of the box.

(15 marks)

iii. Show that

$$PV = \frac{1}{3} mN\overline{C^2}$$

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)

iv. Calculate the root mean square velocity of an He molecule at 30 ^{0}C and 76 cm Hg pressure (76 cm Hg = 1 atm = 10^5 Pa; 1 Pa =1 Nm^{-1}; He = 4).

(15 marks)