EASTERN UNIVERSITY, SRI LANKA

FIRST YEAR EXAMINATION IN SCIENCE

SECOND SEMESTER 2010-2011 (June/July 2013)

CH 103 STEREOCHEMISTRY AND KINETIC MOLECULAR THEORY

(Proper and 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

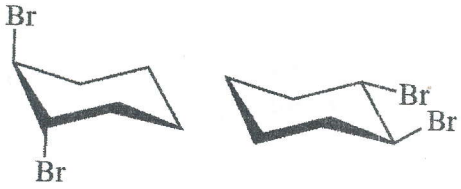
1. a) i) Draw the Fischer projection formulas for the following stereoisomers and point out their R, S specifications, optical activity (where present), and meso compounds.

1. 1, 2, 3, 4-tetrahydroxybutane
2. 1-chloro-2, 3-dibromobutane

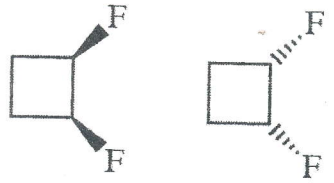
(30 marks)

ii) Identify whether the following pairs are enantiomers, diastereomers, conformers or the identical.

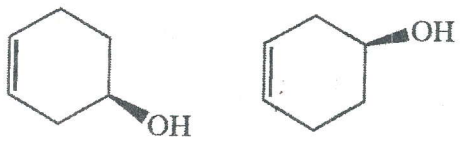
a.



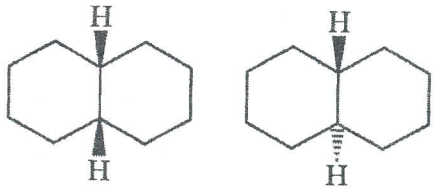
b.



c.

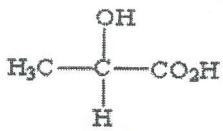


d.



(20 marks)

b) Explain the reaction when the optical active molecule A is treated with NaOH.



Molecule A

(20 marks)

Contd...

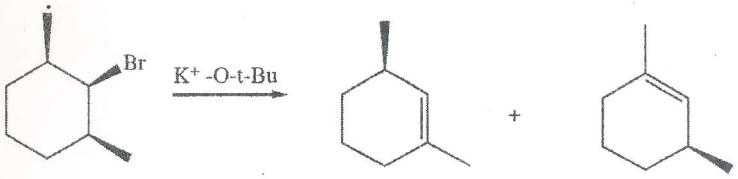
c) The optical rotation of 1g/ml of compound in a 10 cm tube is +19.40. Determine the observed rotation of the sample

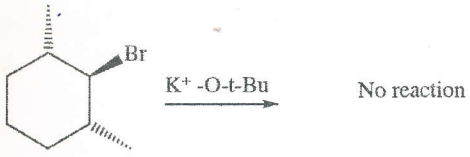
(i) when a 6 cm sample tube is used.

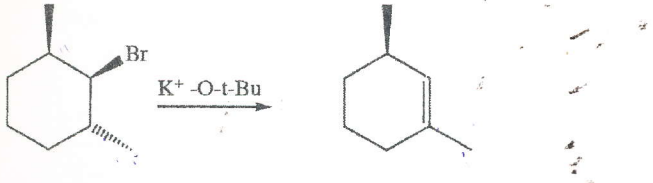
(ii) when the concentration of the solution is diluted to one fourth of its original solution(sample tube is still 10 cm).

(30 marks)

2. a) The E_2 elimination reactions of different configuration of 2,6-dimethylbromocyclohexane with potassium tert-butoxide(K^+ $^-$O-t-Bu) is given below. Explain how these reactions are possible

i. 

ii. 

iii. 

(40 marks)

b) 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.

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

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.

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

(60 marks)