Eastern University, Sri Lanka

External Degree

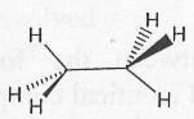
First year Second semester Examination in Science - 2004/2005

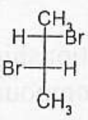
January/ March 2011

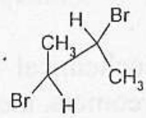
EXTCH 103 Stereochemistry and Kinetic Molecular Theory of Gases

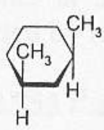
Answer all questions — Time allowed: One Hour

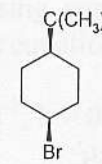
1. (a) Structures of some organic compounds are given below. Answer the questions based on the structures given


I


II


III


IV


V

i) Define the term "structure" of organic compound using ethane (I) as an example

05 marks

ii) Convert the structures II, III and IV into their respective Newmann projection formulae

20 marks

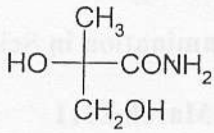
iii) Draw the two chair conformation of the structure V and comments on their stability

15 marks

iv) Draw all the Newman projection formulae for the conformers that are obtained by subsequent 60^{o} rotation about the middle 2C-3C bond of the structure II and construct the potential energy Vs torsional angle diagram for them.

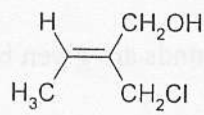
20 marks

(b) Assign the stereogenic centres as R or S in the following compound. Give reasons for your answer



10 marks

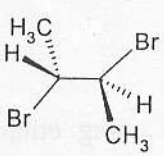
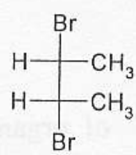
(c) Assign the configuration as E/Z of the carbon-carbon double bond in the following alkene



10 marks

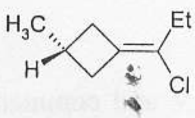
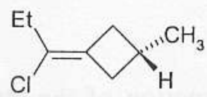
(d) Identify the stereochemical relationships between the following pairs as enantiomers, diastereomers, meso compound and identical compound

i)

 and 

10 marks

ii)

 and 

10 marks

2. (a) i) Write down the postulates of kinetic molecular theory of gases 20 marks

ii) Give the kinetic gas equation and explain all the terms involved in it

10 marks

iii) Derive the expression to show that that the kinetic energy of one mole of gas E is

$$E = \frac{3RT}{2}$$

15 marks

(b) How does the real gas deviate from the ideal behaviour? 15 marks

(c) i) Write down the van der Waals equation of state and explain all the terms involved

15 marks

ii) Calculate the pressure exerted by 1.00 mole of methane (CH_4) in 250 ml container at 300K using van der Waals equation. What pressure will be predicted by ideal gas equation?

($a = 2.253\ l^2.\text{atm.mol}^{-2}$; $b = 0.0428\ l.\text{mol}^{-1}$; $R = 0.0821\ l.\text{atm.mol}^{-1}.\text{K}$)

25 marks

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