Eastern University Sri Lanka

First Year Second Semester Examination in Science

2015/2016 (May/June-2018)

CH103 Stereochemistry and Kinetic Molecular Theory of Gases

(Proper)

Answer all questions

Time: One Hour

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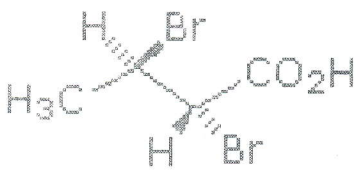
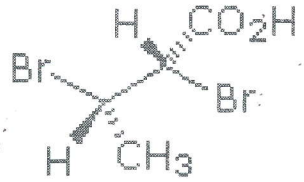
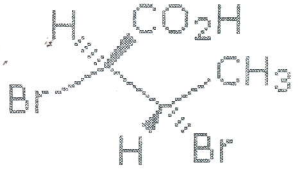
1. (a) Consider the following pair of structures **I**, **J** and **K**.



I



J



K

(i) *Define* the configuration of all the stereogenic centres of **I**, **J** and **K** as R/S

(12 marks)

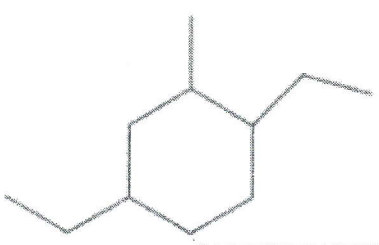
(ii) *Identify* the stereochemical relationship between the pairs of (**I** and **J**), (**J** and **K**) and (**I** and **K**).

(06 marks)

(iii) *Draw* Newmann and Fischer representations of **I**, **J** and **K**.

(12 marks)

(b)



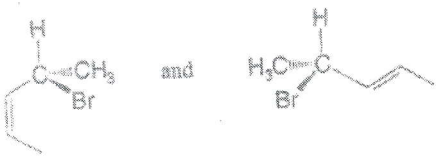
(i) *Draw* all the possible chair conformations for all stereo isomers of the above compound (1,2,4 trisubstituted cyclohexane).

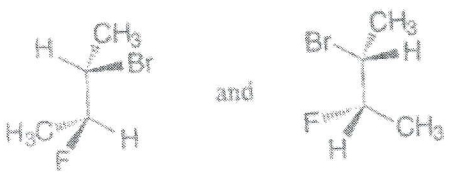
(15 marks)

(ii) Give reasons *indicate* the most stable conformation of the above possible chair forms (Your answer should include the various destabilising interactions that contribute to the total strain of each conformation).

(15 marks)

(c) i) *Identify* whether the following pairs are enantiomers, diastereomers or identical compounds.

1. 

2. 

3. 

(15 marks)

ii) A solution prepared by mixing R and S enantiomers was found to have an observed specific rotation of -90^0, where the pure solution rotates at -135^0.

$$\text{optical purity} = \frac{\text{observed specific rotation}}{\text{specific rotation of the pure enantiomer}}$$

i) Calculate the percentage optical purity of the solution.

ii) Determine the percentages of S and R enantiomers in the mixture.

(25 marks)

2. (a) (i) *What* are the assumptions made in the derivation of kinetic gas equation?

(10 marks)

(ii) *Explain* why the pressure of a gas increases as the temperature increases.

(10 marks)

(iii) *Explain* what would happen to the new pressure of a gas when the number of moles of the gas and the volume of the container is tripled.

(10 marks)

(b) You are in-charge of the manufacture of cylinders of compressed gas at a company. Your company would like to offer a 4.00 L cylinder containing 500 g of chlorine in the new catalog. The cylinders you have on hand have a rupture (breaking) pressure of 40 atm.

i) *Calculate* the pressure in a cylinder at 25°C.using ideal gas law.

ii) *Calculate* the pressure in a cylinder at 25°C using van der Waals equation.

iii) *Determine* whether this cylinder likely to be safe against sudden rupture?

(Van der Waals constants a and b of Cl_2 is = 6.260 l^2.atm.mol^{-2} and b = 0.0542 l.mol^{-1} respectively; **R** = 0.0821 l.atm.mol^{-1}.K^{-1})

(35 marks)

(c) *Describe* a method to resolve a racemic mixture of 2-chloro-propanoic acid by salt formation with (+) 1-phenylethylamine.

(35 marks)

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