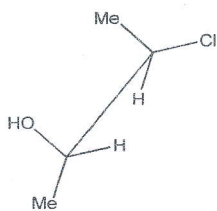Eastern University, Sri Lanka

First Year Second Semester Examination in Science

2017/2018 (April/May 2019)

CH1033 Principles of Chemistry II

(Proper)
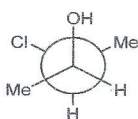
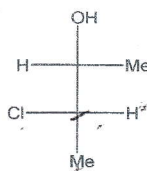Answer all questions   Time: 3 Hours

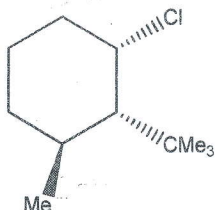1. (a) Consider the following structures **P**, **Q** and **R**.

(i)   *Define* the configuration of all stereogenic centres of **P**, **Q** and **R** as R/S

(12 Marks)

(ii) *Identify* the stereochemical relationship between the pairs of **P** and **Q**, **Q** and **R** & **P** and **R**.

(06 Marks)

(iii) *Draw* Newmann, Fischer and Sawhorse representations of **P**, **Q** and **R** respectively.

(12 Marks)

(b)

(i) *Draw* all the possible chair conformations of the above trisubstituted cyclohexane compound.

(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)

1

(c) i) Sawhorse representations (A-C) of three conformers of an organic molecule are give below. *Rank* these representations A-C in the rder of increasing stability (least to most stable) and briefly *explain* your answer.
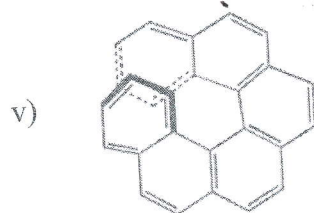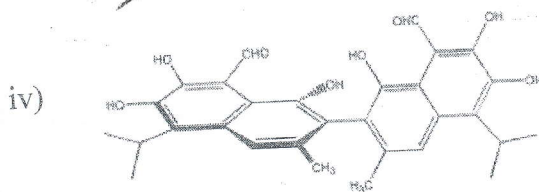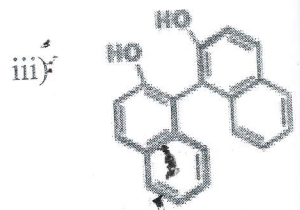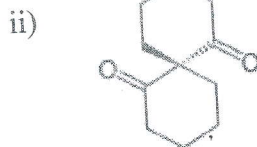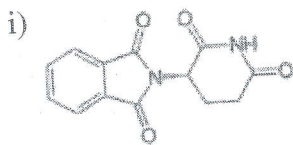

A

B

C
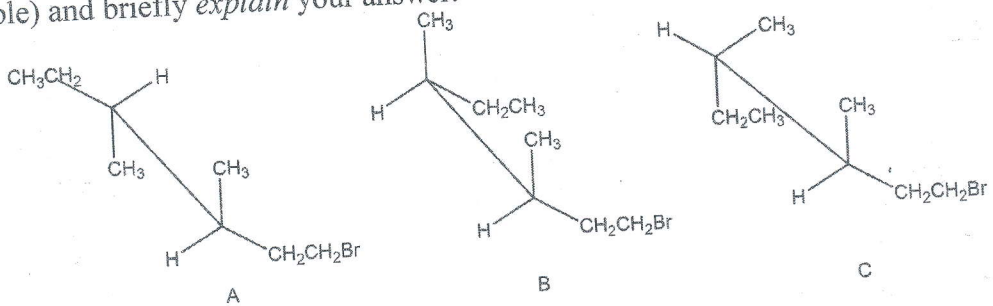
(15 Marks)

ii) What is the percentage of cholesterol and its enantiomer are present in a sample w an observed specific rotation of -22.4°? The specific rotation of pure cholesterol i 32.0°.

(25 Marks

2. (a) *State* whether the following molecules are chiral or achiral.

i)

ii)

iii)

iv)

v)

(30 Marks

(b) *Describe* a method to resolve an enantiomeric mixture of 1-phenylethanol by using 1,2-benzenedicarboxylic anhydride and (-)brucine.
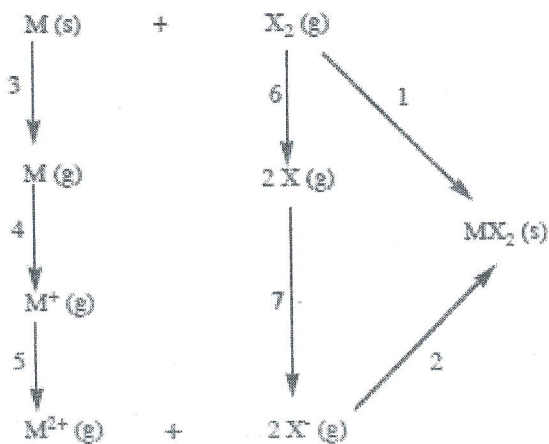
(30 Mark

(c) i) *Explain* the fraction of molecules of a gas with velocity at two different temperatur T_1 and T_2 ($T_2>T_1$) by *drawing* a curve of molecular distribution of velocities?

(20 Mark

ii) *Explain* what would happen to the new pressure of a gas when the number of mole of the gas and the volume of the container is halved.

(20 Mark

c) Consider an ionic compound MX_2 where M is a metal that forms a cation of +2 charge, and X is a nonmetal that forms an anion of −1 charge. A Born-Haber cycle for MX_2 is given below. Each step in this cycle has been assigned a number (1 − 7).

```
   M (s)        +        X₂ (g)
    │3                    │6      ╲1
    ▼                     ▼        ╲
   M (g)                2 X (g)     ╲
    │4                              ▼
    ▼                            MX₂ (s)
   M⁺ (g)                 │7        ▲
    │5                    │        ╱2
    ▼                     ▼      ╱
   M²⁺ (g)       +      2 X⁻ (g)
```

Answer the given questions using the above information.

i) Identify one step (1 - 7) that is endothermic as written.

ii) Which step (1 - 7) corresponds to ΔH°_{sub}?

iii) Which step (1 - 7) corresponds to ΔH°_f?

iv) Use the following energy values to calculate the lattice energy (in $kJmol^{-1}$) for MX_2.
ΔH°_{sub} = 296 $kJmol^{-1}$, ΔH°_f = -421 $kJmol^{-1}$, 1st ionization energy = 378 $kJmol^{-1}$, 2nd ionization energy = 555 $kJmol^{-1}$, bond dissociation enthalpy = 310 $kJmol^{-1}$, electron affinity = -427 $kJmol^{-1}$

(30 Marks)

d) i) *List out* the characteristics of a primary standard solutions.

ii) A 6.50 mL of 0.100 M $H_2C_2O_4$ is required to neutralize 10.0 mL of NaOH solution in a titration. *Calculate* the base concentration.

(30 Marks)

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