

INDEX NO:-

UNIVERSITI SAINS MALAYSIA

First Semester Examination
2011/2012 Academic Session

January 2012

KOT 121 – Organic Chemistry I
[Kimia Organik I]

Duration: 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of THIRTY NINE pages of printed materials before you begin the examination.

Instructions:

PART A (40 marks), comprising 40 multiple-choice questions (MCQ), **has to be answered within the first hour of the examination on the OMR forms provided. The completed OMR forms will be collected one hour after the commencement of the examination.**

PART B (60 marks) consists of essay-type questions. Answer only **THREE** (3) questions.

Answer each question on a new page.

You may answer either in Bahasa Malaysia or in English.

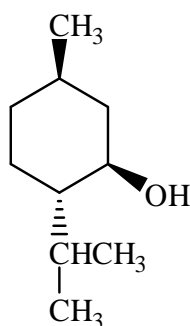
Ensure that your OMR form is complete [with your index number, course code, answers to the questions]. Use only a 2B pencil on your OMR form.

Submit the answer scripts and question paper to the Invigilator before you leave the Examination Hall at the end of the examination.

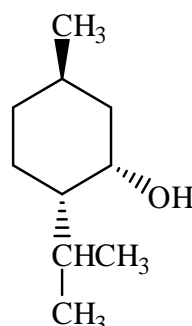
In the event of any discrepancies, the English version shall be used.

SECTION B (60 MARKS)Answer any **THREE** (3) questions

1. (a) Draw both chair conformations for menthol and its stereoisomer, neomenthol. Which groups are axial and which groups are equatorial? Explain which conformation is more stable for each stereoisomer.



Menthol



Neomenthol

(6 marks)

- (b) Draw Newman projections for the anti and gauche conformations about the C—C bond of the following compounds. What other factors, besides steric and torsional strain, influence the stability of these conformations?

(i) 1,2-Dichloroethane

(ii) 1,2-Ethandiol

(8 marks)

- (c) A solution of 0.2 gmol^{-1} of a compound in a 1.0 dm cell rotates plane-polarized light $+13.3^\circ$ at the sodium D line.

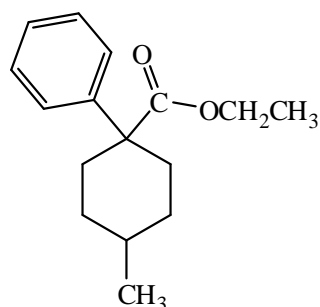
(i) What is the specific rotation of this compound?

(ii) What is the rotation caused by a solution of 0.1 g of this compound in 10 mL of solution?

(iii) Suppose a solution of a compound gave a rotation of $+160^\circ$. How could this rotation be distinguished from one of -200° and from one of $+520^\circ$?

(6 marks)

2. (a) What is the hybridization of each of the carbon and oxygen atoms in the following compounds?



A

B

(2 marks)

- (b) Which H atom in vitamin C (ascorbic acid) is the most acidic. Explain your answer.

(2 marks)

- (c) Draw the two chair conformers for each of the following, and indicate which conformer is more stable:

(i) *trans*-1-Ethyl-2-isopropylcyclohexane

(ii) *trans*-1-Ethyl-2-methylcyclohexane.

(4 marks)

- (d) Propose a mechanism for the following reaction:

(4 marks)

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- (e) Explain why $(\text{CH}_3)_3\text{CO}^-$ is a stronger base than $\text{CH}_3\text{CH}_2\text{O}^-$. (2 marks)
- (f) Draw the products formed when each of the following alkenes is treated with HBr.
- (i)
- (ii)
- (iii)
- (3 marks)
- (g) Give the IUPAC name of all alcohols having four carbon atoms and classify them into either 1° , 2° or 3° alcohol. (3 marks)

3. (a) What is the product **A** and the reagents involve in the following reactions?

(8 marks)

- (b) Reaction of HBr with 1-ethylcyclohexene would produce 1-bromo-1-ethylcyclohexane but not 1-bromo-2-ethylcyclohexane. Explain this statement.

(6 marks)

- (c) Give the products of each of the reaction below:

(i)

(ii)

(iii)

(6 marks)

4. (a) Unsymmetrical ethers can be prepared via the Williamson ether synthesis from alkyl halides by S_N2 reactions using strong nucleophiles. Explain why the unsymmetrical ether below cannot be synthesized via the Williamson ether synthesis.

(3 marks)

- (b) Provide the major organic product of the reaction below and a detailed, stepwise mechanism which accounts for its formation.

(5 marks)

- (c) Draw a stepwise S_N1 or $E1$ mechanism to illustrate how the four products are formed in the following reaction:

(6 marks)

- (d) Draw the steps involved in the dehydration of the following alcohols to the alkenes:

(i)

(ii)

(iii)

(6 marks)

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TERJEMAHAN

Arahan:

BAHAGIAN A (40 markah, mengandungi 40 soalan objektif (MCQ), **perlu dijawab dalam masa 1 jam pertama di dalam borang jawapan OMR yang disediakan. Borang OMR akan dikutip 1 jam selepas peperiksaan bermula.**

BAHAGIAN B (60 markah), mengandungi soalan bertulis. Jawab hanya **TIGA** (3) soalan sahaja. Jawab setiap soalan di muka surat yang baru.

Anda dibenarkan menjawab soalan ini sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.

Pastikan borang OMR diisi dengan lengkap [nombor angka giliran, kod kursus, jawapan]. Gunakan hanya pensil 2B bagi borang OMR.

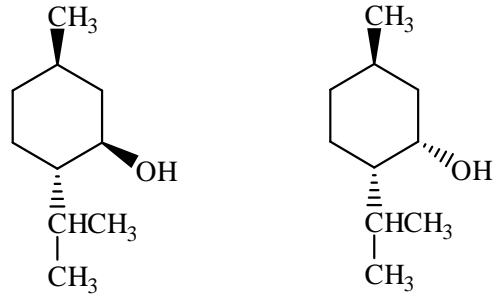
Sila serahkan buku jawapan dan kertas soalan ini kepada pengawas sebelum anda keluar dari dewan peperiksaan.

Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.

BAHAGIAN B (60 MARKAH)

Jawab **TIGA** (3) soalan.

1. (a) Lukis kedua konformasi kerusi untuk mentol dan stereoisomernya, neomentol. Kumpulan mana aksial dan yang manakah ekuatorial?. Jelaskan konformasi mana lebih stabil bagi setiap stereoisomer.



Mentol

Neomentol

(8 markah)

- (b) Lukis projeksi Newman bagi konformasi anti dan gaus berkenaan ikatan C—C sebatian berikut. Apakah factor lain, selain sterik dan *tegangan torsional* menyumbangkan kestabilan konformasi?

- (i) 1,2-Dikloroetana
(ii) 1,2-Etanadiol

(6 markah)

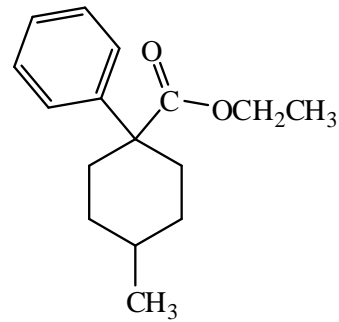
- (c) Larutan 0.2 g mol^{-1} sebatian dalam 1.0 dm sell memutar *cahaya terpolarisasi - bidang* $+13.3^\circ$ pada garis D sodium .

- (i) Apakah putaran spesifik sebatian ini?
(i) Apakah putaran yang menyebabkan larutan 0.1 g sebatian ini dalam larutan 10 mL ?
(ii) Larutan suatu sebatian memberikan putaran $+160^\circ$. Bagaimana putaran ini di kenalpasti dari -200° dan dari $+520^\circ$?

(6 markah)

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2. (a) Apakah penghibridan setiap atom karbon dan oksigen dalam sebatian berikut?



A

B

(2 markah)

- (b) Manakah atom H dalam vitamin C (asid ascorbik) yang paling berasi? Jelaskan jawapan anda.

(2 markah)

- (c) Lukis dua konfomer kerusi setiap berikut, dan tentukan konfomer mana yang lebih stabil:

- (i) *trans*-1-Etil-2-isopropilsikloheksana
 (ii) *trans*-1-Etil-2-metisikloheksana

(4 markah)

- (d) Cadangkan mekanisme setiap tindak balas berikut:

(4 markah)

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- (e) Terangkan mengapa $(\text{CH}_3)_3\text{CO}^-$ adalah bes yang lebih kuat daripada $\text{CH}_3\text{CH}_2\text{O}^-$.

(2 markah)

- (f) Lukiskan hasil yang terbentuk apabila setiap alkena berikut diolah oleh HBr.

(i)

(ii)

(iii)

(3 markah)

- (g) Berikan nama IUPAC bagi semua alkohol yang mengandungi lima atom karbon dan mengelaskannya kepada samada alkohol 1° , 2° atau 3° .

(3 markah)

3. (a) Apakah hasil **A** dan reagen yang terlibat dalam tindak balas berikut?

(8 markah)

- (b) Tindakbalas HBr dengan 1- metilsikloheksena akan menghasilkan 1-bromo-1-metilsikloheksana bukan 1-bromo-2- metilsikloheksana. Terangkan kenyataan ini.

(6 markah)

- (c) Beri hasil tindak balas dibawah:

(i)

(ii)

(iii)

(6 markah)

4. (a) Eter tak-simetri boleh disediakan melalui sintesis eter Williamson daripada halida alkil dan nukleofil yang kuat dengan tindak balas S_N2 . Terangkan mengapa eter tak-simetri yang berikut tidak boleh disediakan melalui sintesis eter Williamson .

(3 markah)

- (b) Berikan hasil organik utama bagi tindakbalas berikut dan suatu mekanisme terperinci yang menerangkan pembentukannya.

(5 markah)

- (c) Lukiskan suatu mekanisme berlangkah S_N1 atau $E1$ untuk menunjukkan pembentukan empat hasil yang terbentuk dalam tindak balas yang berikut:

(6 markah)

- (d) Lukiskan langkah-langkah yang terlibat dalam pengdehidratan alkohol yang berikut kepada alkena:

(i)

(ii)

(iii)

(6 markah)