INDEX NO:- ----------

UNIVERSITI SAINS MALAYSIA

Second Semester Examination
2010/2011 Academic Session

April/May 2011

KOT 121 – Organic Chemistry I
[Kimia Organik I]

Duration: 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of FORTY 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 any **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.

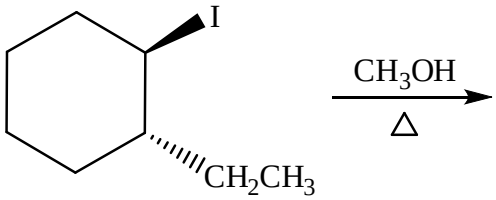
In the event of any discrepancies, the English version shall be used.

SECTION B (60 MARKS)

Answer THREE questions.
Only the first THREE questions answered in the answer book will be marked.
You must start each question on a new page.

This section contains FOUR questions.

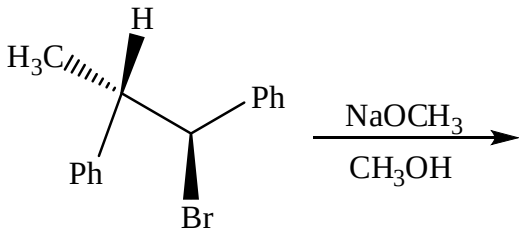
1 (a) Give the major organic product of the reaction below. Draw a detailed, stepwise mechanism which accounts for its formation.



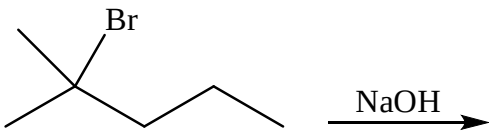
(6 marks)

(b) Draw the structure(s) of the major organic product(s) in the following reactions:

(i)



(ii)



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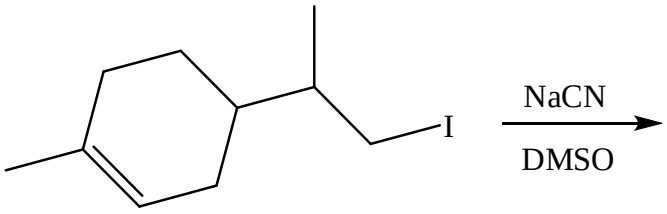


(6 marks)

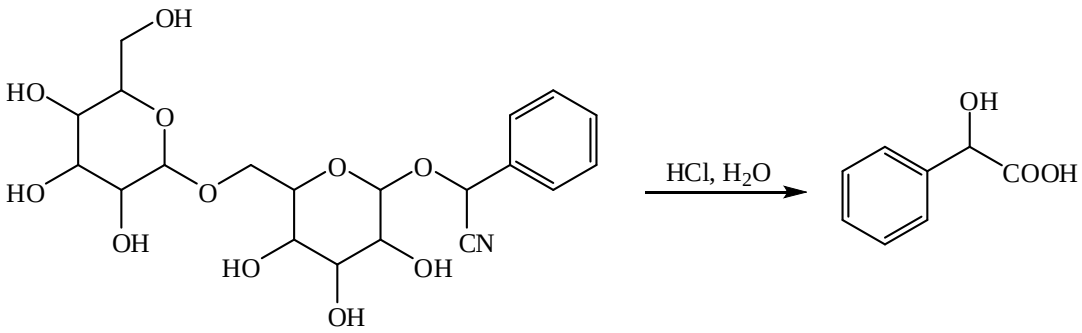
(c) Provide **TWO** circumstances under which solvolysis of a chiral alkyl halide would not result in the generation of a racemate.

(4 marks)

(d) Do all primary iodides react with N_3^- at the same rate via the S_N2 mechanism? Explain your answer using suitable examples.

(4 marks)

2. (a) Amygdalin, a compound isolated from the pits of apricots, and wild cherries, is sometimes called laetrile. Although it has no known therapeutic value, amygdalin has been used as an unsanctioned anticancer drug both within and outside of the USA. One hydrolysis product formed from amygdalin is mandelic acid, used in treating common skin problems caused by photo-aging and acne.



amygdalin acid mandelic

(i) How many stereogenic centers are present in amygdalin?
(ii) What is the maximum number of stereoisomers possible?
(iii) Draw both enantiomers of mandelic acid and label each stereogenic center as *R* or *S*.
(iv) Pure (*R*)-mandelic acid has a specific rotation of -154. if a sample contains 60% of the *R* isomer and 40% of its enantiomer, what is [α] of this solution?
(v) Calculate the *ee* of a solution of mandelic acid having [α] = +50. What is the percentage of each enantiomer present?

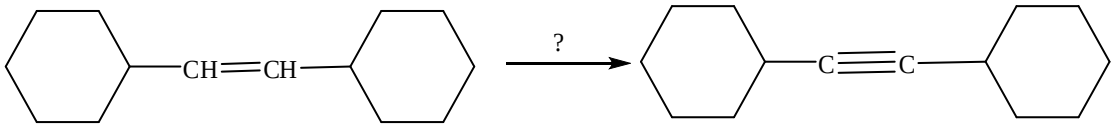
(6 marks)

(b) Draw the products formed when 3-hexyne is treated with each of the following reagents.

(i) HBr (2 equivalents)
(ii) Br_2 (2 equivalents)
(iii) (1) BH_3; (2) H_2O_2, HO^-.

(6 marks)

(c) Show the stepwise reaction and reagents leading to compouns B.

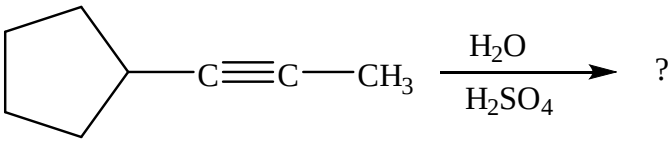


A **B**

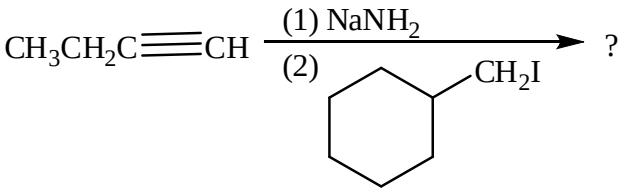
(4 marks)

(d) Draw the organic products formed in each of the following reactions:

(i)

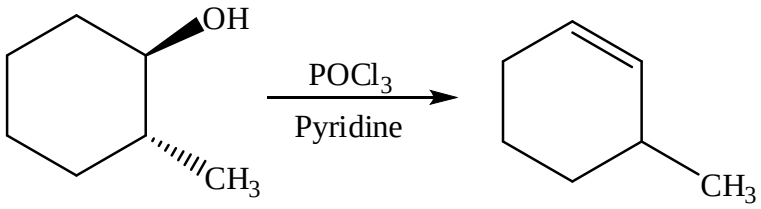


(ii)



(4 marks)

3. (a) Consider the following reaction:

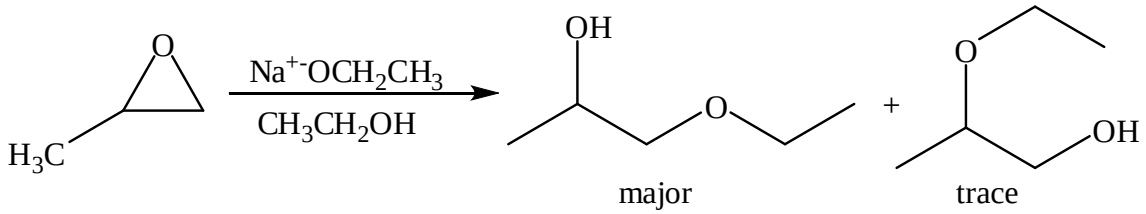


(i) What is the type of mechanism involved in this reaction?

(ii) Why is 3-methylcyclohexene the major product of this reaction instead of 1-methycyclohexene?

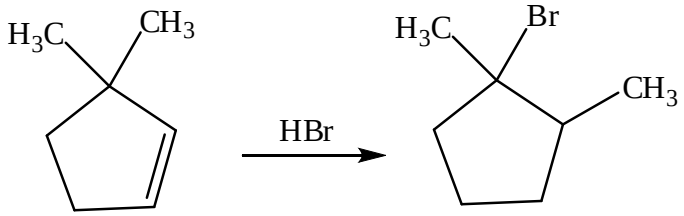
(6 marks)

(b) When 1,2-epoxypropane is treated with sodium ethoxide in ethanol 1-ethoxy-2-propanol is the major product while only a trace amount of 2-ethoxy-1-propanol is produced. Explain these results based on the reaction mechanism.



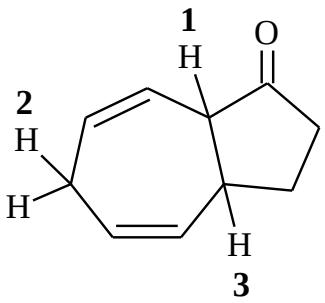
(7 marks)

(c) Write the complete stepwise mechanism for the following reaction. Show all intermediate structures and all electron flow with arrows.



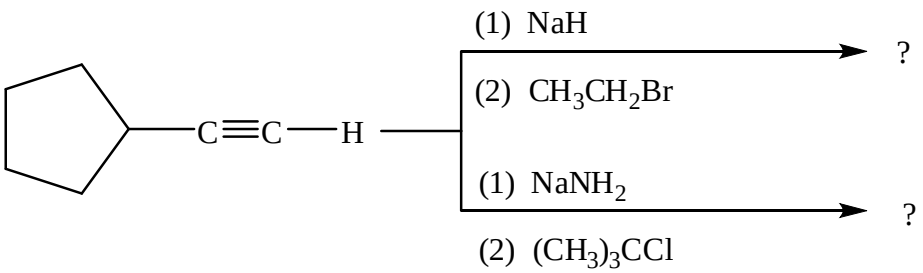
(7 marks)

4. (a) Rank the following protons in order of increasing acidity. Explain your answer.



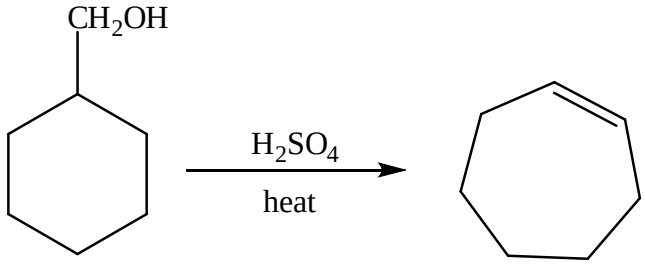
(4 marks)

(b) Draw the organic products formed in the following reaction:



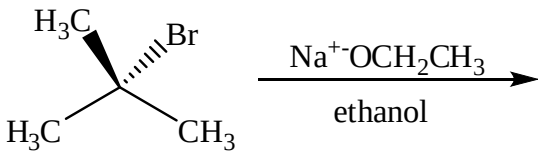
(6 marks)

(c) Show a detailed, step-by-step mechanism for the following reaction:



(6 marks)

(d) Draw the structure of the major product for the following reaction:



(4 marks)

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 **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.

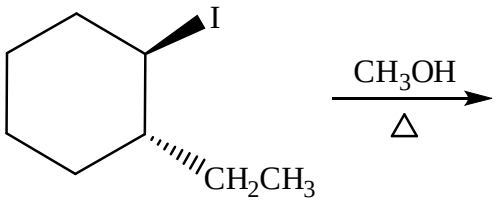
Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.

<u>BAHAGIAN B</u> (60 MARKAH)

Jawab sebarang TIGA soalan.
Hanya TIGA jawapan yang pertama akan diperiksa.
<u>Jawab tiap-tiap soalan pada muka surat yang baru.</u>

Bahagian ini mengandungi EMPAT soalan.

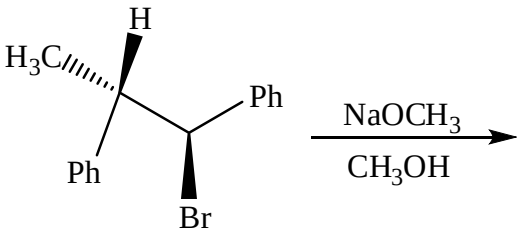
1. (a) Berikan hasil organik utama bagi tindak balas berikut. Lukiskan suatu mekanisme langkah demi langkah dan terperinci bagi pembentukan hasil organik tersebut.



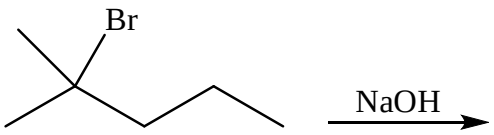
(6 markah)

(b) Lukiskan struktur hasil organik utama bagi tindak balas berikut:

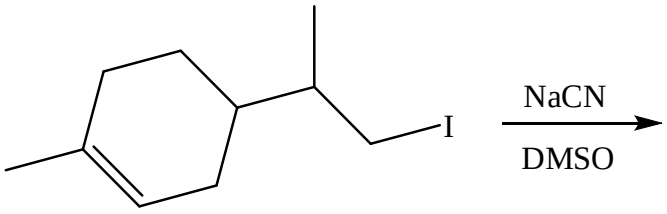
(i)



(ii)



(iii)



(6 markah)

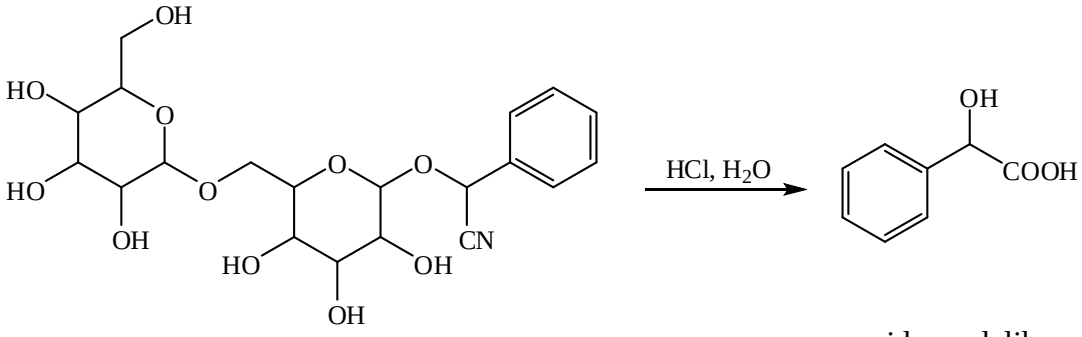
(c) Berikan **DUA** keadaan yang mana solvolisis suatu alkil halida kiral tidak akan menyebabkan penghasilan suatu rasemat.

(4 markah)

(d) Adakah kesemua iodida primer bertindakbalas dengan N_3^- mengikut kadar yang sama menerusi mekanisme S_N2? Terangkan jawapan anda dengan menggunakan contoh yang sesuai.

(4 markah)

2. (a) Amygdalina, suatu sebatian dipencilkan daripada biji aprikot, dan chery liar, kadang kala dikenali sebagai laetril. Walaupun ia tidak mempunyai nilai terapeutik yang diketahui, amygdalina telah digunakan sebagai suatu ubat anti kanser di dalam dan luar AS. Suatu hasil hidrolisis yang terbentuk daripada amygdalina ialah asid mandelik, yang digunakan untuk mengubati masalah kulit yang disebabkan oleh foto-penuaan dan jerawat.



amygdalin asid mandelik

(i) Berapakah pusat stereogenik yang hadir dalam amygdalin?
(ii) Apakah bilangan stereoisomer maksimum yang mungkin?
(iii) Lukiskan kedua-kedua enantiomer bagi asid mandelik dan labelkan setiap pusat stereogenik sebagai *R* atau *S*.
(iv) Asid (*R*)-mandelik yang tulen mempunyai putaran spesifik -154. Sekiranya suatu sampel mengandungi 60% isomer *R* dan 40% enantiomernya, apakah $[\alpha]$ bagi larutan tersebut?
(v) Kirakan *ee* bagi suatu larutan asid mandelik yang mempunyai $[\alpha] = +50$. Apakah peratus setiap enantiomer yang hadir?

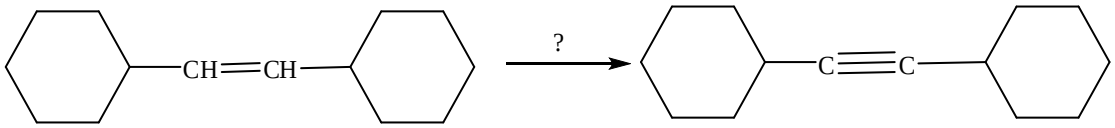
(6 markah)

(b) Lukiskan hasil yang terbentuk apabila 3-heksena diolah dengan setiap reagen yang berikut:

(i) HBr (2 ekuivalen)
(ii) Br_2 (2 ekuivalen)
(iii) (1) BH_3; (2) H_2O_2, HO^-.

(6 markah)

(c) Tukarkan sebatian A kepada sebatian B dengan menggunakan kaedah langkah demi langkah.

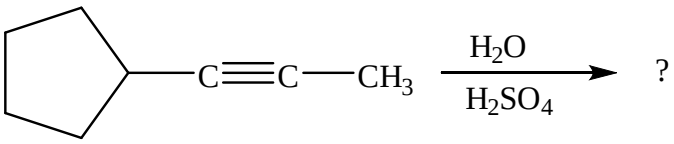


A **B**

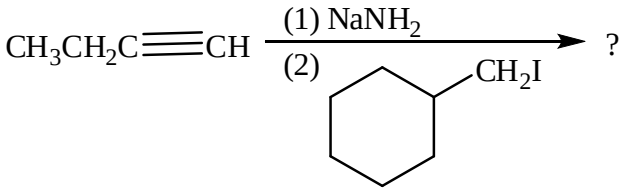
(4 markah)

(d) Lukiskan hasil organik yang terbentuk dalam setiap tindak balas berikut:

(i)

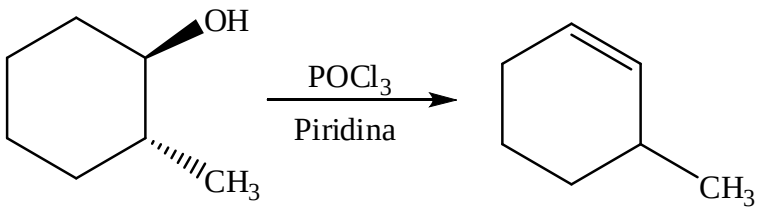


(ii)



(4 markah)

3. (a) Pertimbangkan tindak balas yang berikut:

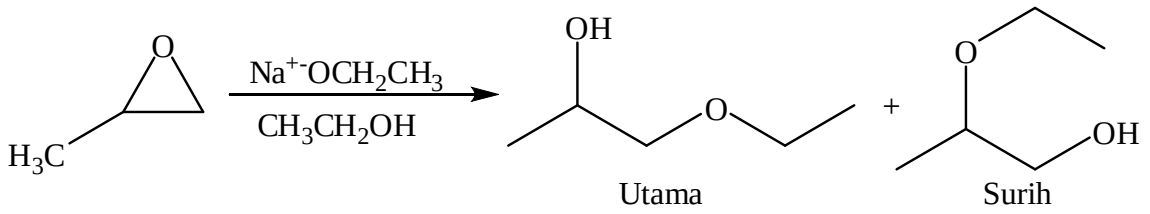


(i) Apakah jenis mekanisme yang terslibat dalam tindak balas ini?

(ii) Mengapakah 3-metilsikloheksena adalah hasil utama bagi tindak balas ini dan bukan 1-metilsikloheksena?

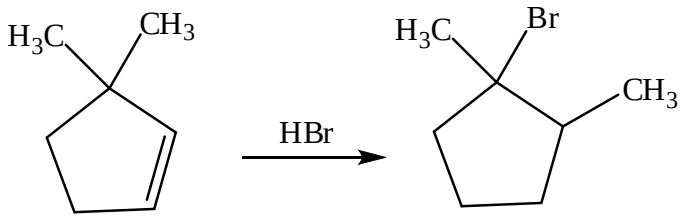
(6 markah)

(b) Apabila 1,2-epoksipropana diolah dengan natrium etoksida dalam etanol 1-etoksi-2-propanol adalah hasil utama manakala hanya sedikit sahaja 2-etoksi-1-propanol dihasilkan. Terangkan keputusan ini berasaskan mekanisme tindak balas.



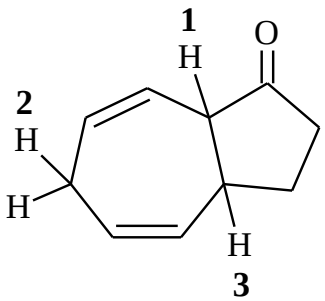
(7 markah)

(c) Tuliskan mekanisme berlangkah yang lengkap bagi tindak balas berikut. Tunjukkan semua struktur perantaraan dan semua aliran elektron dengan anak panah.



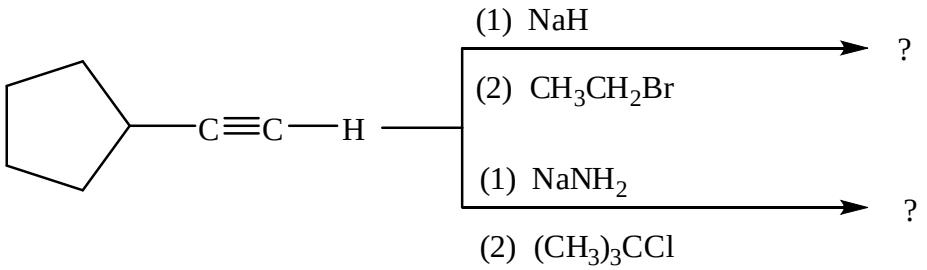
(7 markah)

4 (a) Susunkan keasidan proton berikut mengikut tertib meningkat. Jalaskan jawapan anda.



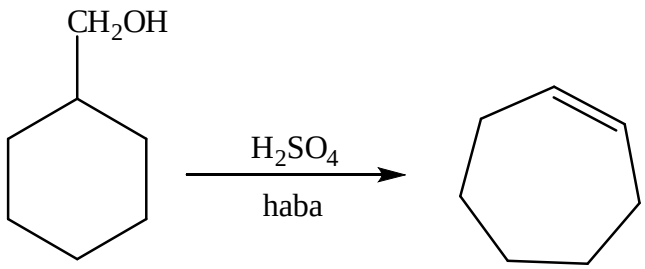
(4 marks)

(b) Lukiskan hasil organik yang terbentuk dalam setiap tindak balas berikut



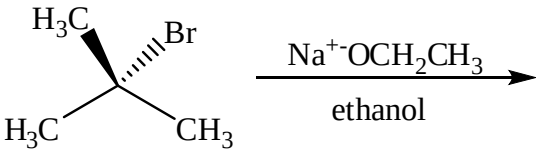
(6 markah)

(c) Tunjukkan secara terperinci mekanisme berlangkah bagi tindak balas berikut:



(6 markah)

(d) Lukiskan struktur hasil utama bagi tindak balas yang berikut:



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