

INDEX NO:- .....

---

UNIVERSITI SAINS MALAYSIA

Second Semester Examination  
2009/2010 Academic Session

April/May 2010

**KOT 121 – Organic Chemistry I**  
*[Kimia Organik I]*

Duration: 3 hours  
*[Masa : 3 jam]*

---

Please check that this examination paper consists of FORTY-ONE 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.

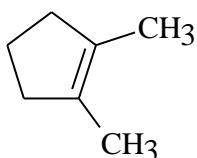
In the event of any discrepancies, the English version shall be used.

**SECTION B** (60 MARKS)**Answer THREE questions.**

Only the first THREE questions answered in the answer book will be marked.

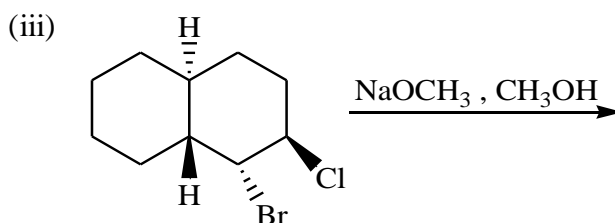
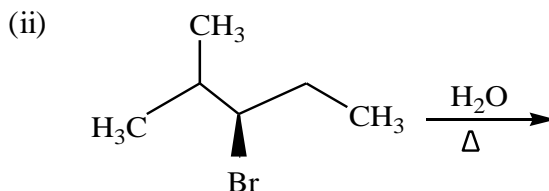
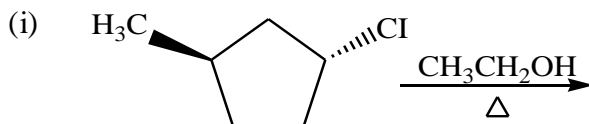
You must start each question on a new page.

1. (a) When 1-bromo-2, 2-dimethylcyclopentane is heated in ethanol, one of the products which results is shown below. Provide a detailed, stepwise mechanism for the production of this compound. Give the name of the mechanism by which it is produced.



(7 marks)

- (b) Give the major organic product(s) for each of the reactions below.

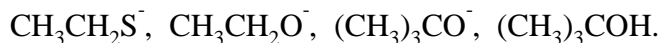


(8 marks)

- (c) Explain why 3-bromo-but-1-ene undergoes solvolysis much more rapidly than 2-bromobutane.

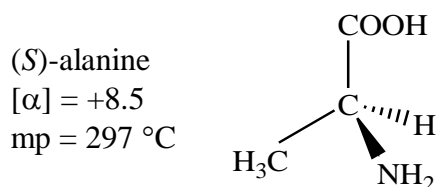
(3 marks)

- (d) Arrange the following species in order of *increasing* nucleophilicity:



(2 marks)

2. (a) The amino acid (*S*)-alanine has the physical characteristics listed with the structure below.



- (i) What is the melting point of (*R*)-alanine?
- (ii) How does the melting point of a racemic mixture of (*R*)- and (*S*)-alanine compare to the melting point of (*S*)-alanine?
- (iii) What is the specific rotation of (*R*)-alanine, recorded under the same condition as the reported rotation of (*S*)-alanine?
- (iv) What is the optical rotation of a racemic mixture of (*R*)-alanine and (*S*)-alanine?
- (v) Label each of the following as optically active or inactive:  
 A solution of pure (*S*)-alanine, an equal mixture of (*R*)- and (*S*)-alanine, a solution that contains 75 % (*S*)- and 25 % (*R*)-alanine.

(8 marks)

- (b) The equilibrium constant for the conversion of the axial to the equatorial conformation of methoxycyclohexane is 2.7.

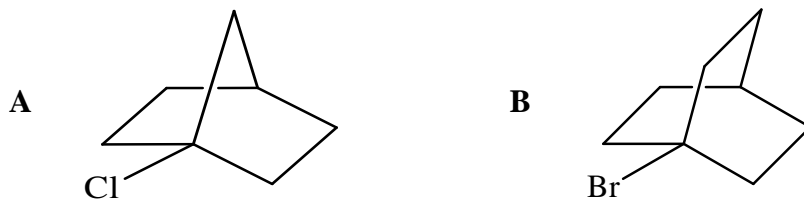
- (i) Given these data, draw the conformation of both structures.
- (ii) Which conformation is present in the larger amount at equilibrium?
- (iii) Is  $\Delta G^\circ$  for this process positive or negative?

(4 marks)

- (c) Explain why the alkyl halide  $\text{CH}_3\text{CH}_2\text{OCH}_2\text{Cl}$  reacts rapidly with  $\text{CH}_3\text{CH}_2\text{OH}$  under  $\text{S}_\text{N}1$  condition to afford  $\text{CH}_3\text{CH}_2\text{OCH}_2\text{OCH}_2\text{CH}_3$ .

(4 marks)

- (d) Explain why the following alkyl halides **A** and **B** do not undergo nucleophilic substitution by either an  $S_N1$  or  $S_N2$  mechanism.

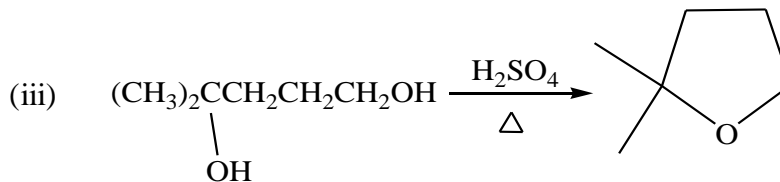
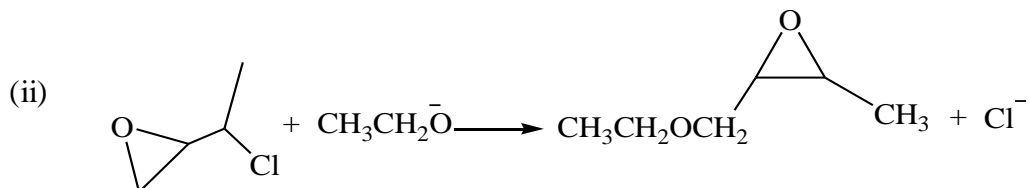
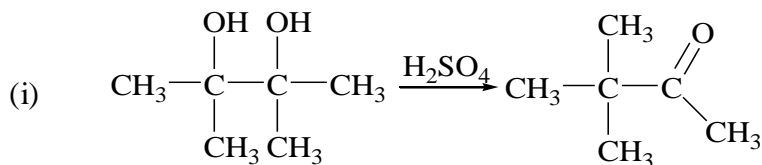


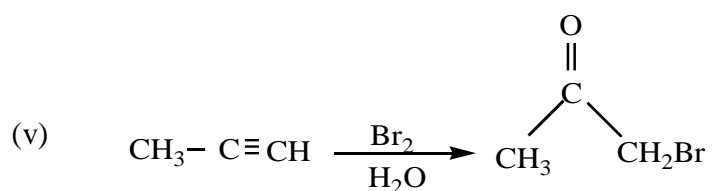
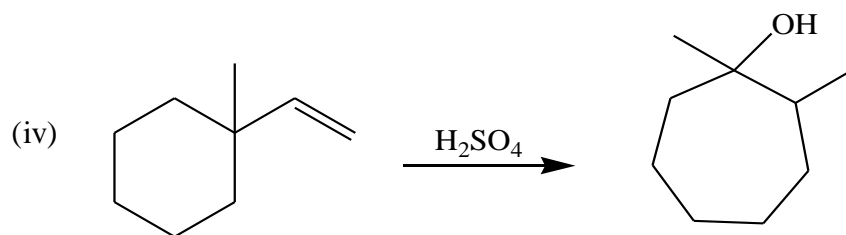
(4 marks)

3. (a) Give the IUPAC name of all alcohols having five carbon atoms and classify them into either  $1^\circ$ ,  $2^\circ$  or  $3^\circ$  alcohol.

(5 marks)

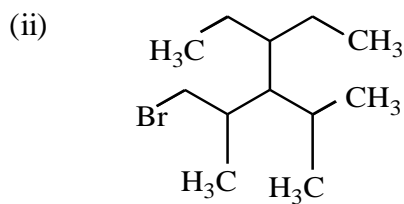
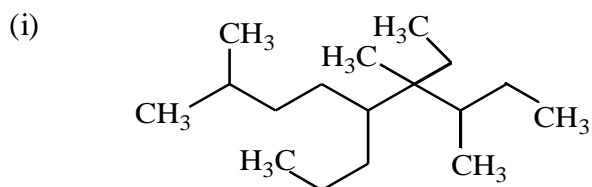
- (b) Draw a stepwise mechanism for each of the following reactions:





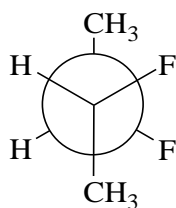
(15 marks)

4. (a) Provide IUPAC names for the following compounds:



(4 marks)

(b) Transform the Newman projection shown below to a Fisher projection.



(4 marks)

20/-

- (c) For a reaction with  $\Delta H^\circ = 10$  kcal, decide which of the following statements is (are) true. Correct any false statement.
- (i) The reaction is exothermic.
  - (ii)  $\Delta G^\circ$  for the reaction is positive.
  - (iii)  $K_{eq}$  is greater than 1.
  - (iv) The bonds in the starting materials are stronger than the bonds in the products.
  - (v) The product is favored at equilibrium.

(6 marks)

- (d) Write briefly, by providing the appropriate examples or equations, on the following topics:
- (i) Keto-enol tautomers
  - (ii) Williamson ether synthesis
  - (iii) Acidity of terminal alkynes

(6 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.

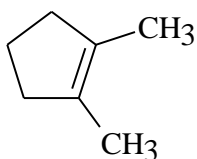
Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.

**BAHAGIAN B (60 MARKAH)****Jawab sebarang TIGA soalan.**

Hanya TIGA jawapan yang pertama akan diperiksa.

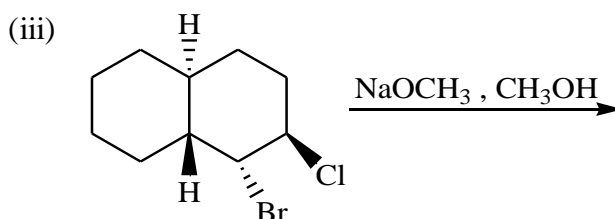
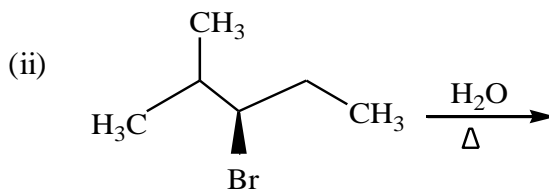
Jawab tipa-tipa soalan pada muka surat yang baru

1. (a) Apabila 1-bromo-2,2-dimetilsikllopentana dipanaskan dalam etanol, pembentukan salah satu hasil daripada tindak balas tersebut telah ditunjukkan di bawah. Cadangkan suatu mekanisme dengan langkah-langkah terperinci bagi pembentukan hasil tersebut. Namakan mekanisme ini.



(7 markah)

- (b) Berikan hasil organik utama bagi setiap tindak balas di bawah



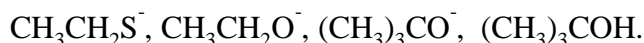
(8 markah)



- (c) Terangkan mengapa 3-bromo-but-1-ena mengalami solvolisis pada kadar yang lebih cepat berbanding kadar solvolisis bagi 2-bromobutana.

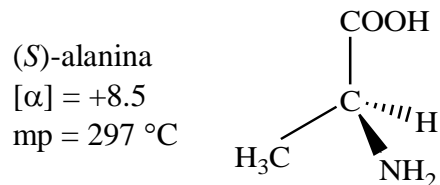
(3 markah)

- (d) Susunkan spesies berikut mengikut kekuatan nukleofil dalam tertib menaik:



(2 markah)

2. (a) Asid amino (*S*)-alanina mempunyai ciri-ciri fizikal dan struktur berikut:



- (i) Apakah takat lebur bagi (*R*)-alanina?
- (ii) Bagaimanakah takat lebur bagi campuran rasem (*R*)- dan (*S*)-alanina dapat dibandingkan dengan takat lebur (*S*)-alanina?
- (iii) Apakah putaran spesifik bagi (*R*)-alanina yang direkod dalam keadaan yang sama bagi putaran (*S*)-alanina?
- (iv) Apakah putaran optikal bagi campuran rasemik (*R*)-alanina dan (*S*)-alanina?
- (v) Labelkan setiap berikut sebagai aktif optis atau tidak:  
 Suatu larutan (*S*)-alanina yang tulen, suatu campuran seimbang bagi (*R*)- dan (*S*)-alanina, suatu larutan yang mengandungi 75 % (*S*)- dan 25 % (*R*)-alanina.

(8 markah)

- (b) Pemalar keseimbangan bagi penukaran metoksisikloheksana daripada konformasi kepada khatulistiwa ialah 2.7.

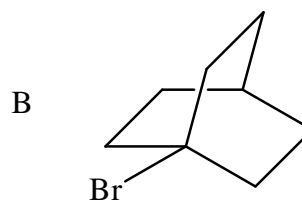
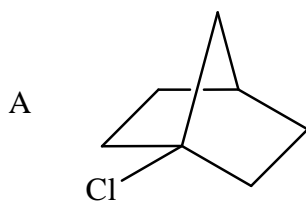
- (i) Diberikan data ini, lukiskan konformasi bagi kedua-dua struktur ini.
- (ii) Konformasi yang manakah wujud dengan lebih banyak dalam keseimbangan?
- (iii) Apakah  $\Delta G^\circ$  bagi proses ini positif atau negatif?

(4 markah)

- (c) Terangkan kenapa alkil halida  $\text{CH}_3\text{CH}_2\text{OCH}_2\text{Cl}$  bertindak balas dengan cepat dengan  $\text{CH}_3\text{CH}_2\text{OH}$  dalam keadaan  $\text{S}_{\text{N}}1$  untuk menghasilkan  $\text{CH}_3\text{CH}_2\text{OCH}_2\text{OCH}_2\text{CH}_3$ .

(4 markah)

- (d) Terangkan kenapa alkil halida **A** dan **B** tidak melalui mekanisme  $\text{S}_{\text{N}}1$  atau  $\text{S}_{\text{N}}2$  dalam penukargantian nukleofilik.

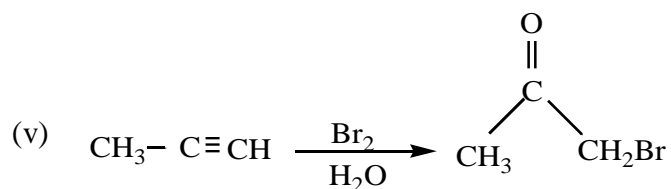
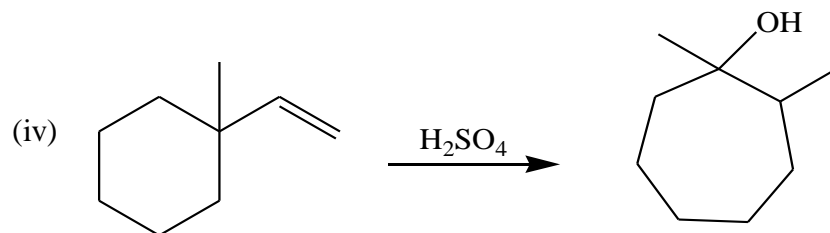
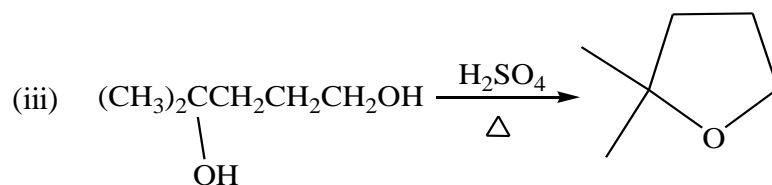
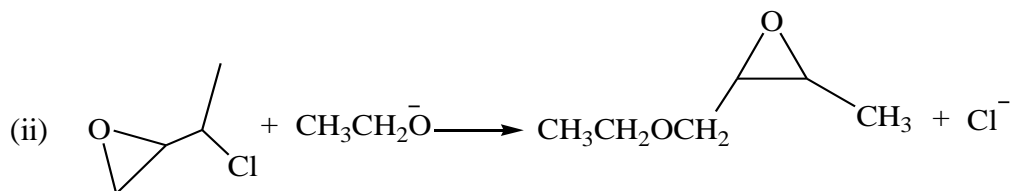
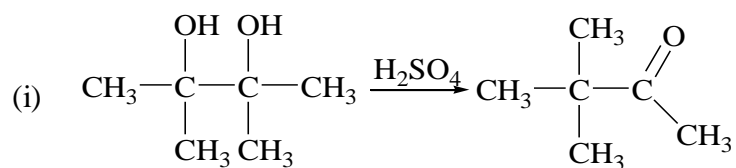


(4 markah)

3. (a) Berikan nama IUPAC bagi semua alkohol yang mengandung lima atom karbon dan kelaskan sama ada ia alkohol  $1^\circ$ ,  $2^\circ$  atau  $3^\circ$ .

(5 markah)

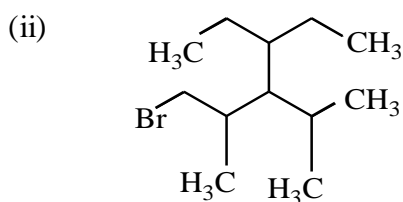
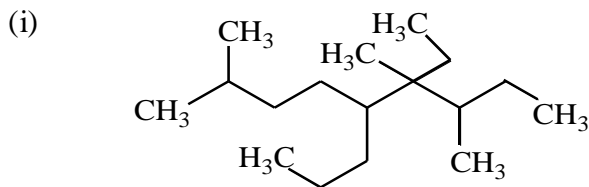
- (b) Lukiskan suatu mekanisme langkah demi langkah bagi setiap tindak balas yang berikut:



(15 markah)

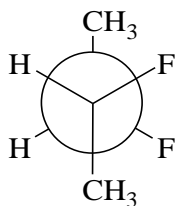
- 40 -

4. (a) Berikan nama IUPAC bagi setiap sebatian berikut:



(4 markah)

(b) Transformasikan unjuran Newman yang ditunjukkan di bawah ke unjuran Fisher.



(4 markah)

(c) Bagi suatu tindak balas dengan  $\Delta H^\circ = 10 \text{ kcal}$ , tentukan yang manakah pernyataan berikut adalah benar. Betulkan pernyataan yang salah.

- (i) Tindak balas ini adalah eksotermik.
- (ii)  $\Delta G^\circ$  bagi tindak balas ini adalah positif.
- (iii)  $K_{eq}$  lebih besar daripada 1.
- (iv) Ikatan dalam bahan tindak balas lebih kuat berbanding ikatan dalam hasil tindak balas.
- (v) Hasil tindak balas diutamakan pada keseimbangan.

(6 markah)

- 41 -

(d) Huraikan secara ringkas, dengan memberikan contoh dan persamaan yang sesuai, bagi topik-topik yang berikut:

- (i) Tautomer keto-enol
- (ii) Sintesis eter Williamson
- (iii) Keasidan alkuna penghujung

(6 markah)

- oooOooo -