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UNIVERSITI SAINS MALAYSIA

Final Examination  
2015/2016 Academic Session

May/June 2016

**JIK 322 – Organic Chemistry II**  
*[Kimia Organik II]*

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

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Please ensure that this examination paper contains **SEVEN** printed pages before you begin the examination.

Answer **FIVE** questions. You may answer **either** in Bahasa Malaysia or in English.

All answers must be written in the answer booklet provided.

Each question is worth 20 marks and the mark for each sub question is given at the end of that question.

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

*Sila pastikan bahawa kertas peperiksaan ini mengandungi **TUJUH** muka surat yang bercetak sebelum anda memulakan peperiksaan ini.*

*Jawab **LIMA** soalan. Anda dibenarkan menjawab soalan **sama ada** dalam Bahasa Malaysia atau Bahasa Inggeris.*

*Setiap jawapan mesti dijawab di dalam buku jawapan yang disediakan.*

*Setiap soalan bernilai 20 markah dan markah subsoalan diperlihatkan di penghujung subsoalan itu.*

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

1. (a) Can a molecule be chiral if it contains no asymmetric carbon?

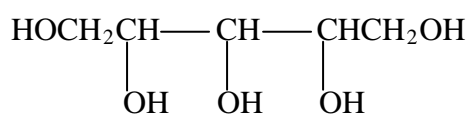
Explain.

*Dapatkan suatu molekul menjadi kiral jika ia tidak mengandungi karbon asimetrik? Jelaskan.*

(6 marks/markah)

- (b) (i) Draw all possible stereoisomers for the following compound.

*Lukiskan semua stereoisomer yang mungkin bagi sebatian berikut.*



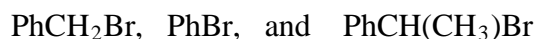
- (ii) Which isomer(s) is(are) optically active and which is(are) optically inactive? Give the reason.

*Isomer-isomer yang manakah aktif optik dan yang manakah tidak aktif optik? Beri alasan.*

(14 marks/markah)

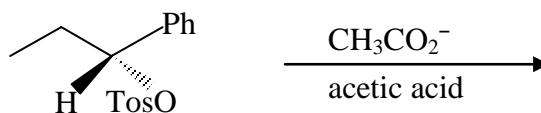
2. (a) By giving your reason, arrange the following bromides in order of their increasing reactivity as substrates in  $S_N2$  reactions.

*Susun substrat bromida-bromida berikut mengikut kereaktifan yang meningkat dalam tindak balas  $S_N2$ . Berikan alasan bagi jawapan anda.*



(10 marks/markah)

- (b) (i) Draw the 3-D structure (perspective drawing) of **three (3)** major organic products of the reaction below.
- (ii) Provide the stepwise mechanism for the formation for each product.
- (iii) Assign *R* or *S* configuration to each chirality center.
- (iv) Name this type of reaction mechanism.
- (i) *Lukiskan struktur bagi tiga (3) hasil sebatian organik utama pada tindak balas di bawah dalam bentuk 3-D (perspektif).*
- (ii) *Berikan langkah-langkah mekanisme pembentukan bagi setiap hasil.*
- (iii) *Tandakan konfigurasi R atau S bagi setiap pusat kiral pada hasil tindak balas.*
- (iv) *Namakan jenis mekanisme tindak balas ini.*

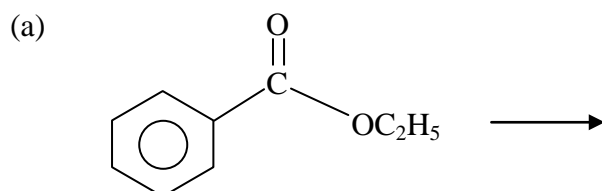


(Tos = Tosylate)

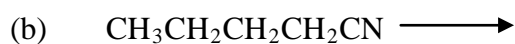
(10 marks/markah)

3. Draw the structure of the compound(s) resulting from the complete hydrolysis for the following.

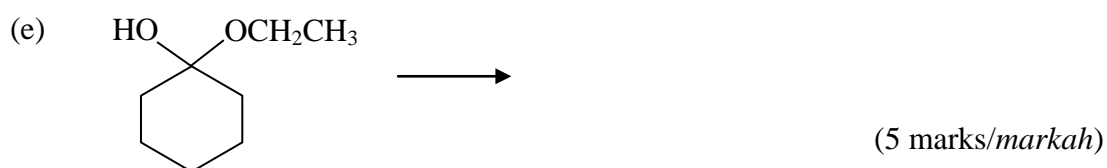
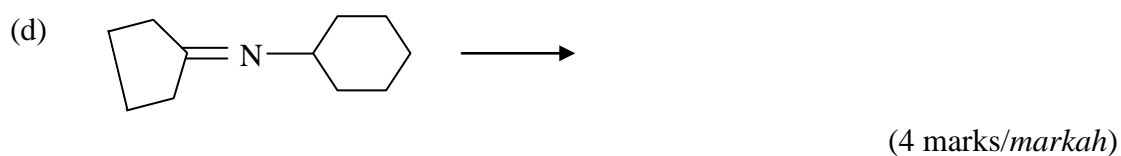
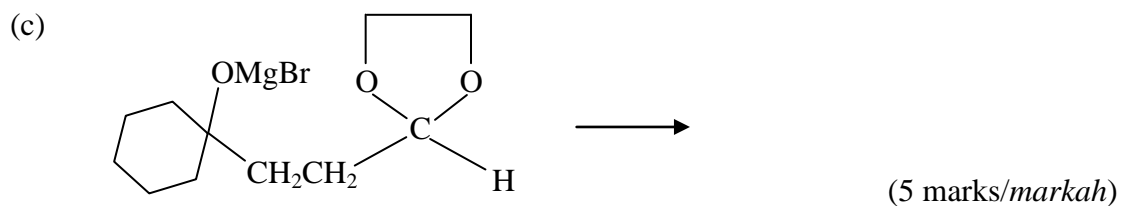
*Lukiskan struktur sebatian/sebatian-sebatian yang terhasil daripada tindak balas hidrolisis lengkap berikut.*



(4 marks/markah)

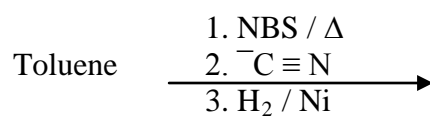


(2 marks/markah)



4. (a) Provide the stepwise, give the product and all intermediate structures for the reaction below.

*Tunjukkan langkah-langkah, berikan struktur hasil serta semua bahan perantara untuk tindak balas di bawah.*

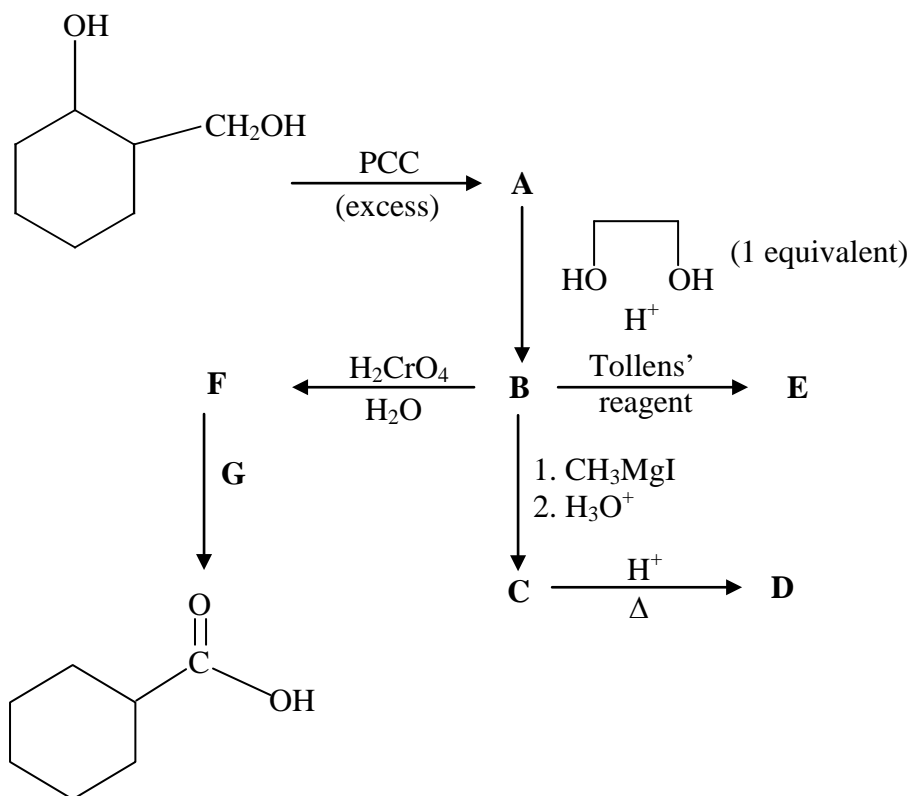


( NBS: N- bromosuccinimide)

(6 marks/markah)

- (b) Draw the structural formula of compounds **A** to **G** in the following reactions scheme.

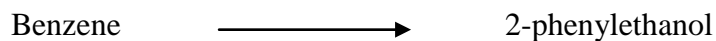
*Lukiskan formula struktur sebatian-sebatian A hingga G pada skema tindak balas berikut.*



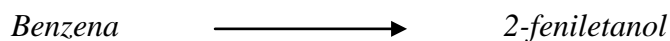
(PCC : pyridine chlorochromate)

(14 marks/markah)

5. (a) Show how you would accomplish the following synthesis using any necessary reagents. Show all intermediate structures.



*Tunjukkan bagaimana anda dapat melakukan sintesis berikut dengan menggunakan sebarang reagen yang diperlukan. Tunjukkan semua struktur bahan perantaraan.*



(10 marks/markah)

- (b) Valine is an essential amino acid with the systematic name 2-amino-3-methylbutanoic acid. It has  $pK_{a_1} = 2.32$  and  $pK_{a_2} = 9.62$ .
- What does essential amino acid mean?
  - Draw a Fischer projection of L-valine, label all chirality center(s) as *R* or *S*.
  - What is the *pI* (isoelectric point) of valine?
  - Draw the structures of predominant form of valine at  $pH = 10$  and  $pH = 1.50$

*Valina adalah asid amino penting dengan nama sistematik 2-amino-3-metilbutanoik. Ia mempunyai  $pK_{a_1} = 2.32$  dan  $pK_{a_2} = 9.62$ .*

- Apakah itu asid amino penting?*
- Lukis projeksi Fischer L-valina, label semua pusat kiral dengan R atau S.*
- Berapakah pI ( titik isoelektrik) valina?*
- Lukis bentuk struktur predomnan valina pada pH = 10 dan pH = 1.50*  
(10 marks/markah)

6. (a) Arrange the following compounds in order of decreasing reactivity electrophilic aromatic substitution. Give your explanation.

Chlorobenzene ; 1-chloro-2,4-dinitrobenzene ; *p*-chloronitrobenzene

*Susun sebatian-sebatian berikut mengikut turutan kereaktifan yang menurun bagi tindak balas penukargantian aromatik elektrofilik. Beri penjelasan bagi jawapan anda.*

*Klorobenzena; 1-kloro-2,4-dinitrobenzena; p-kloronitrobenzena*

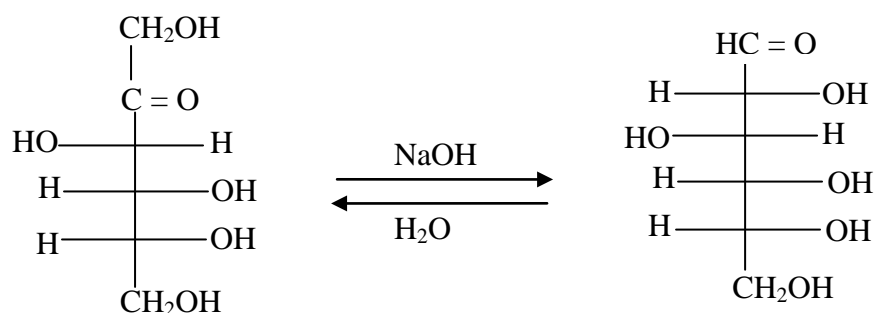
(8 marks/markah)

(b) Fructose reduces Tollens' reagent even though it contains no aldehyde group. This occurs because fructose is readily isomerized to an aldose in basic solution.

- (i) Write the complete stepwise mechanism for the base catalyzed isomerization of fructose to an aldohexose.
- (ii) Show all intermediate structures and all electron flow with arrows.

*Fruktosa menurunkan reagen Tollens' walaupun ia tidak mengandung kumpulan aldehyd. Ini berlaku disebabkan fruktosa mudah membentuk isomer menjadi suatu aldosa dalam larutan bes.*

- (i) *Tuliskan langkah-langkah mekanisme lengkap pengisomeran bermangkinkan bes bagi fruktosa kepada aldohexosa.*
- (ii) *Tunjukkan semua struktur bahan perantaraan serta aliran elektron dengan lekuk anak panah.*



(12 marks/markah)