UNIVERSITI SAINS MALAYSIA

Final Examination
2016/2017 Academic Session

May/June 2017

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

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

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

Answer **FIVE** questions. You may answer **either** in Bahasa Malaysia or in English, but not a mix of both languages.

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 **SEMBILAN** muka surat yang bercetak sebelum anda memulakan peperiksaan ini.*

*Jawab **LIMA** soalan. Anda dibenarkan menjawab soalan **sama ada** dalam Bahasa Malaysia atau Bahasa Inggeris, tetapi campuran antara kedua-dua bahasa ini tidak dibenarkan.*

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

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

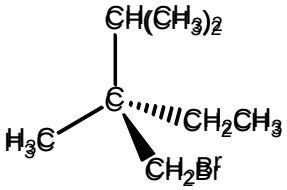
*Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi Bahasa Inggeris hendaklah diguna pakai.*

…2/-

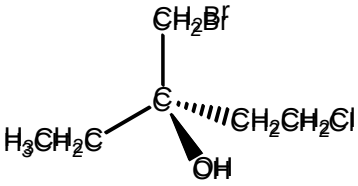
1. (a) Indicate whether each of the following structures has the *R* or the *S* configuration.

*Nyatakan sama ada setiap struktur berikut mempunyai konfigurasi R atau S.*

(i)

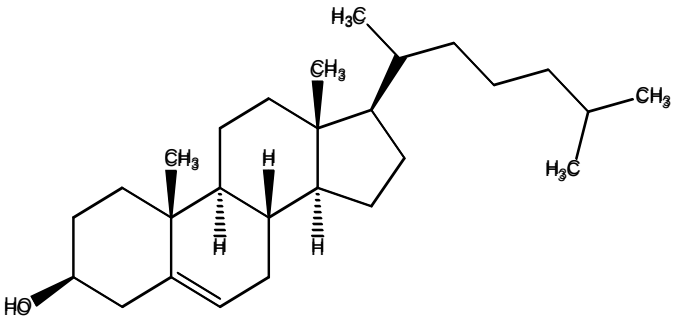


(ii)



(4 marks/*markah*)

(b)



Cholesterol

(i) How many asymmetric carbons does cholesterol have?

*Berapakah karbon asimetrik yang terdapat pada kolesterol?*

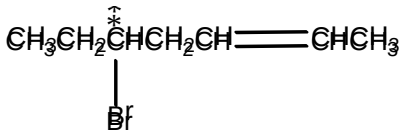
(ii) What is the maximum number of stereoisomers that cholesterol can have?

*Berapakah bilangan maksimum stereoisomer yang boleh wujud bagi kolesterol?*

(4 marks/*markah*)

(c) The following compound has only one asymmetric carbon. Why does it have four stereoisomers? Explain your answer (draw the stereoisomers).

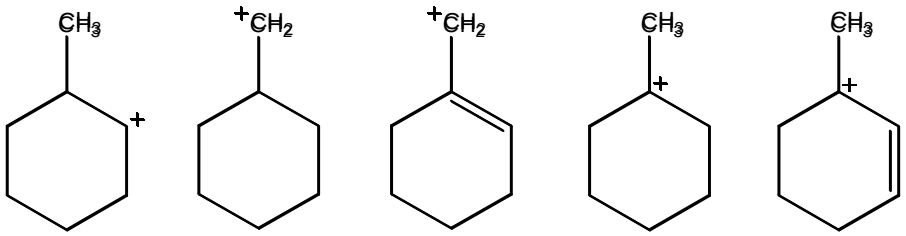
*Sebatian berikut hanya mempunyai satu karbon asimetrik. Mengapakah ia mempunyai empat stereoisomer? Terangkan jawapan anda (lukiskan stereoisomer tersebut).*



(12 marks/*markah*)

2. (a) List the following carbocations in decreasing order of their stability.

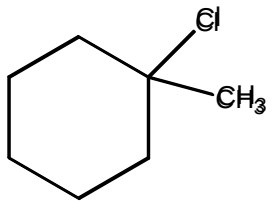
*Senaraikan karbokation berikut dalam susunan kestabilan menurun.*

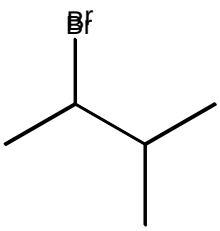


(2 marks/*markah*)

(b) Give the structure of the solvolysis product(s) when each of the following compound is heated in ethanol.

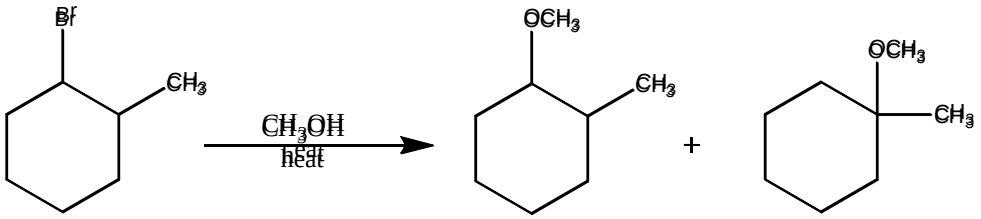
*Berikan struktur hasil/hasil-hasil solvolisis apabila setiap sebatian berikut dipanaskan dalam etanol.*

(i) 

(ii) 

(6 marks/*markah*)

(c) When 1-bromo-2-methylcyclohexane undergoes solvolysis in methanol, two major products are formed. Give the mechanism to account for these products.
*Apabila 1-bromo-2-metilsikloheksana mengalami solvolisis dalam metanol, dua hasil utama terbentuk. Berikan mekanisme bagi menjelaskan pembentukan hasil-hasil tersebut.*




(12 marks/*markah*)

3. (a) Give the structure of the major product(s) for the following reactions, including the correct stereochemistry where appropriate.

(i) (*R*)-butan-2-ol + TsCl in pyridine
(ii) cyclooctanol + $CrO_3/H_2SO_4$
(iii) cyclopentanol + $H_2SO_4$/heat
(iv) 4-cyclopentylhexan-1-ol + DMP reagent

DMP = Dess-Martin Periodinane

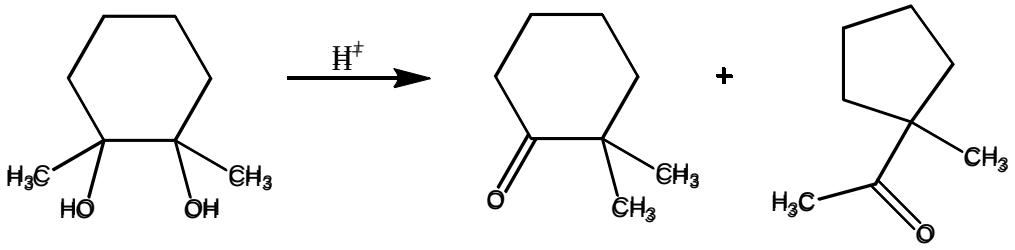
*Berikan struktur hasil/hasil-hasil utama tindak balas berikut, termasuk stereokimia yang tepat mengikut kesesuaian.*

*(i) (R)-butan-2-ol + TsCl dalam piridina*
*(ii) siklooktanol + $CrO_3/H_2SO_4$*
*(iii) siklopentanol + $H_2SO_4$/haba*
*(iv) 4-siklopentilheksan-1-ol + reagen DMP*

*DMP = Dess-Martin Periodinane*

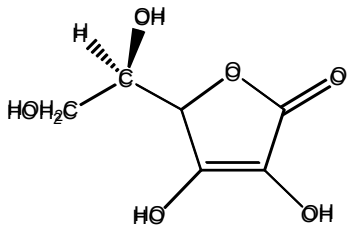
(8 marks/*markah*)

(b) Propose a mechanism for the following reaction.
*Cadangkan suatu mekanisme untuk tindak balas berikut.*




(12 marks/*markah*)

4. (a) Given the structure of ascorbic acid (vitamin C):
*Diberikan struktur asid askorbik (vitamin C):*



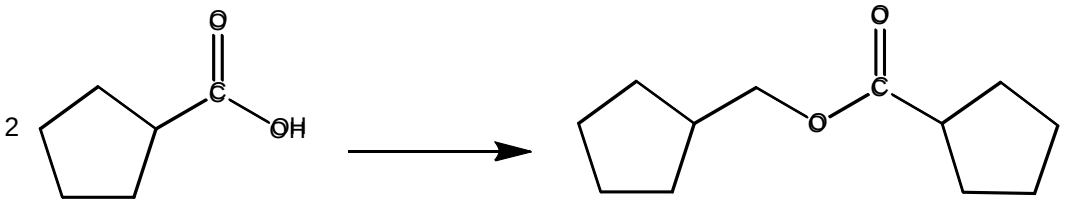

(i) Is ascorbic acid a carboxylic acid?
*Adakah asid askorbik suatu asid karboksilik?*

(ii) Show which proton in ascorbic acid is the most acidic.
*Tunjukkan proton yang paling berasid dalam asid askorbik.*

(4 marks/*markah*)

(b) Show how you would accomplish the following synthesis. You may use any additional reagents and solvents you need.

*Tunjukkan bagaimana sintesis berikut boleh dilakukan. Anda boleh menggunakan sebarang reagen tambahan dan pelarut yang diperlukan.*

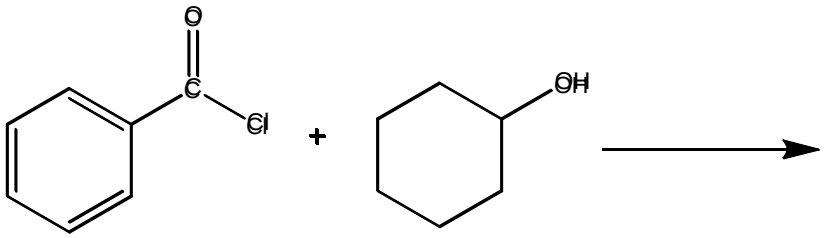


(6 marks/*markah*)

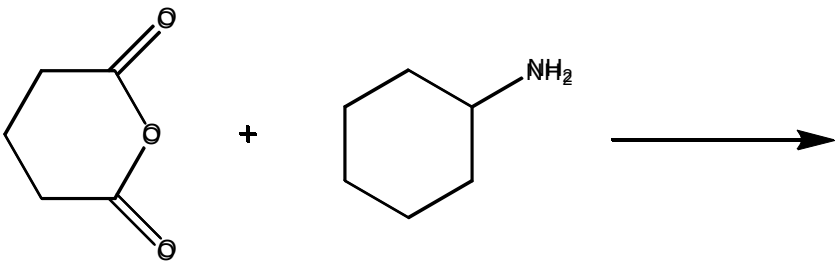
(c) Give the structure of the product(s) for each of the following reactions:

*Berikan struktur hasil/hasil-hasil bagi setiap tindak balas berikut:*

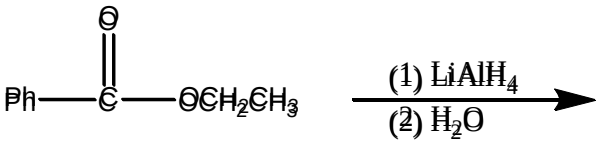
(i)



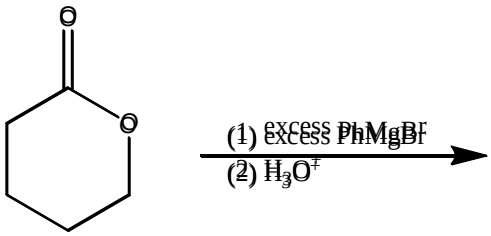
(ii)



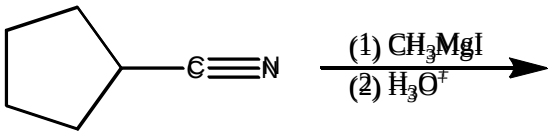
(iii)



(iv)

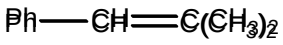



(v)



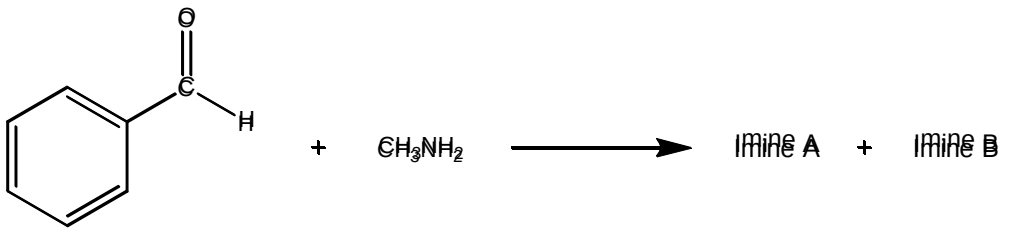

(10 marks/*markah*)

5. (a) Show how Wittig reactions might be used to synthesise the following compound. Start with an alkyl halide and a ketone or an aldehyde.
*Tunjukkan bagaimana tindak balas Wittig boleh digunakan untuk mensintesis sebatian berikut. Mulakan dengan alkil halida dan suatu keton atau aldehid.*




(5 marks/*markah*)

(b) Depending on the reaction conditions, two different imines of formula $C_8H_9N$ might be formed by the reaction of benzaldehyde with methylamine. Explain and give the structures of the two imines.
*Bergantung kepada keadaan tindak balas, dua imina berbeza dengan formula $C_8H_9N$ mungkin terbentuk apabila benzaldehid bertindak balas dengan metilamina. Jelaskan dan berikan struktur kedua-dua imina tersebut.*



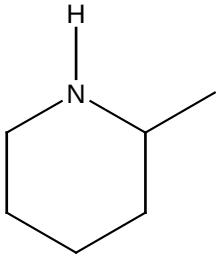

(5 marks/*markah*)

(c) Propose a mechanism for the acid-catalysed reaction of benzaldehyde with methanol to give benzaldehyde dimethyl acetal.
*Cadangkan suatu mekanisme untuk tindak balas bermangkin asid antara benzaldehid dengan metanol untuk memberikan benzaldehid dimetil asetal.*

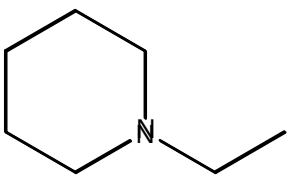
(10 marks/*markah*)

6. (a) Give the structure of the major product(s) formed when the following amines undergo exhaustive methylation, treatment with $Ag_2O$ and heating.
*Berikan struktur hasil/hasil-hasil utama yang terbentuk apabila amina berikut mengalami pemetilan habisan, olahan dengan $Ag_2O$ dan pemanasan.*

(i) 2-methylpiperidine
*2-metilpiperidina*



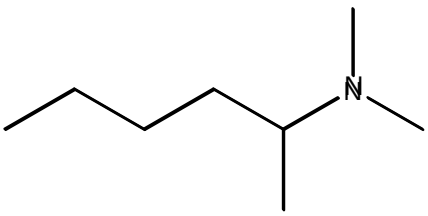

(ii) *N*-ethylpiperidine
*N-etilpiperidina*



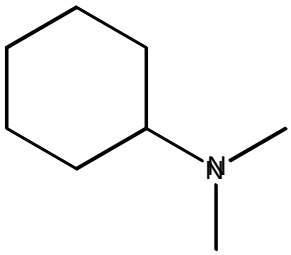

(5 marks/*markah*)

(b) Give the structure of the product(s) formed when the following amines are treated with a peroxyacid and heated.
*Berikan struktur hasil/hasil-hasil yang terbentuk apabila amina berikut diolah dengan asid peroksi dan dipanaskan.*

(i) *N*,*N*-dimethylhexan-2-amine
*N*,*N*-*dimetilheksan*-*2*-*amina*

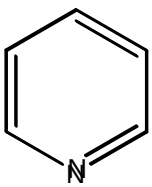


(ii) cyclohexyldimethylamine
*sikloheksildimetilamina*



(5 marks/*markah*)

(c) Propose a mechanism for the sulphonation of pyridine. Explain why the sulphonation occurs at the 3-position.
*Cadangkan suatu mekanisme untuk tindak balas pensulfonan piridina. Jelaskan mengapa pensulfonan tersebut berlaku pada posisi-3.*



Pyridine

(10 marks/*markah*)