UNIVERSITI SAINS MALAYSIA

Final Examination
2015/2016 Academic Session

May/June 2016

JIK 224 – Organic Chemistry I
[Kimia Organik I]

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.

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.*

Setiap jawapan mesti dijawab di dalam buku jawapan yang disediakan.

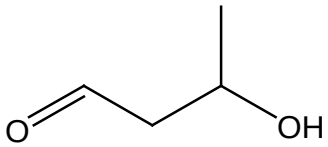
Setiap soalan bernilai 20 markah dan markah subsoalan diperlihatkan di penghujung subsoalan itu.

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

1. (a) Name the following compounds according to the IUPAC system.

Namakan sebatian-sebatian berikut mengikut system IUPAC.

(i)



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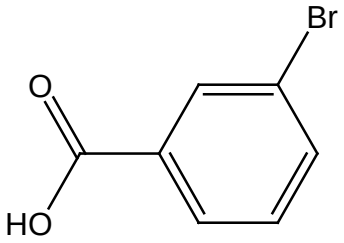

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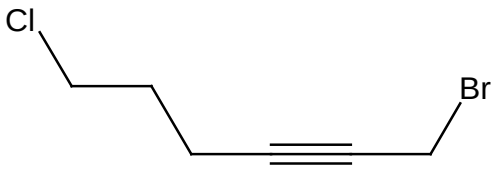

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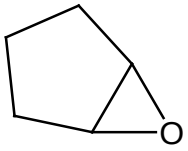

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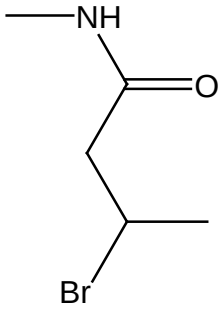


(10 marks/*markah*)

(b) Draw compounds that meet the following descriptions:

(i) Three acid chlorides having the formula C_6H_9ClO

(ii) Three amides having the formula $C_7H_{11}NO$

Lukiskan sebatian-sebatian yang memenuhi kriteria yang berikut:

(i) Tiga asid klorida yang mempunyai formula C_6H_9ClO

(ii) Tiga amida yang mempunyai formula $C_7H_{11}NO$

(10 marks/*markah*)

2. (a) Define each of the following terms:

(i) Aromatic compound

(ii) Antiaromatic compound

(iii) Nonaromatic compound

Takrifkan setiap istilah berikut:

(i) Sebatian aromatik

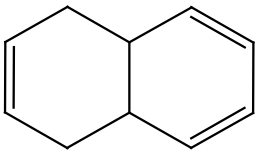
(ii) Sebatian antiaromatik

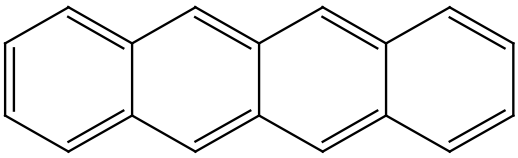
(iii) Sebatian bukan aromatik

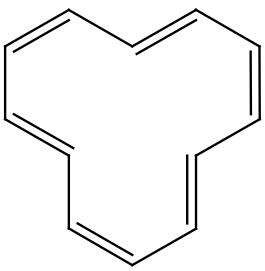
(6 marks/*markah*)

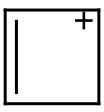
(b) Which compounds are aromatic? Give explanations for any compound that is not aromatic.

Sebatian manakah adalah aromatik? Berikan penjelasan bagi sebatian yang bukan aromatik.

(i) 

(ii) 

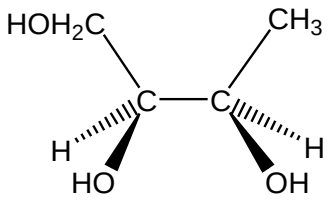
(iii) 

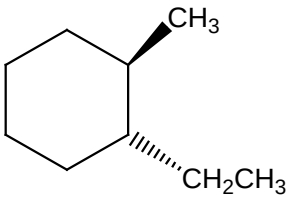
(iv) 

(8 marks/*markah*)

(c) Draw the enantiomer and diastereomer for each of the following compounds:

Lukiskan enantiomer dan diastereomer untuk setiap sebatian berikut:

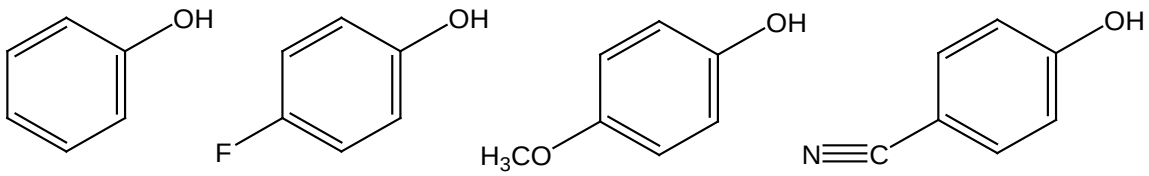
(i) 

(ii) 

(6 marks/*markah*)

3. (a) Rank the following substituted phenols in order of increasing acidity. Explain your answer.

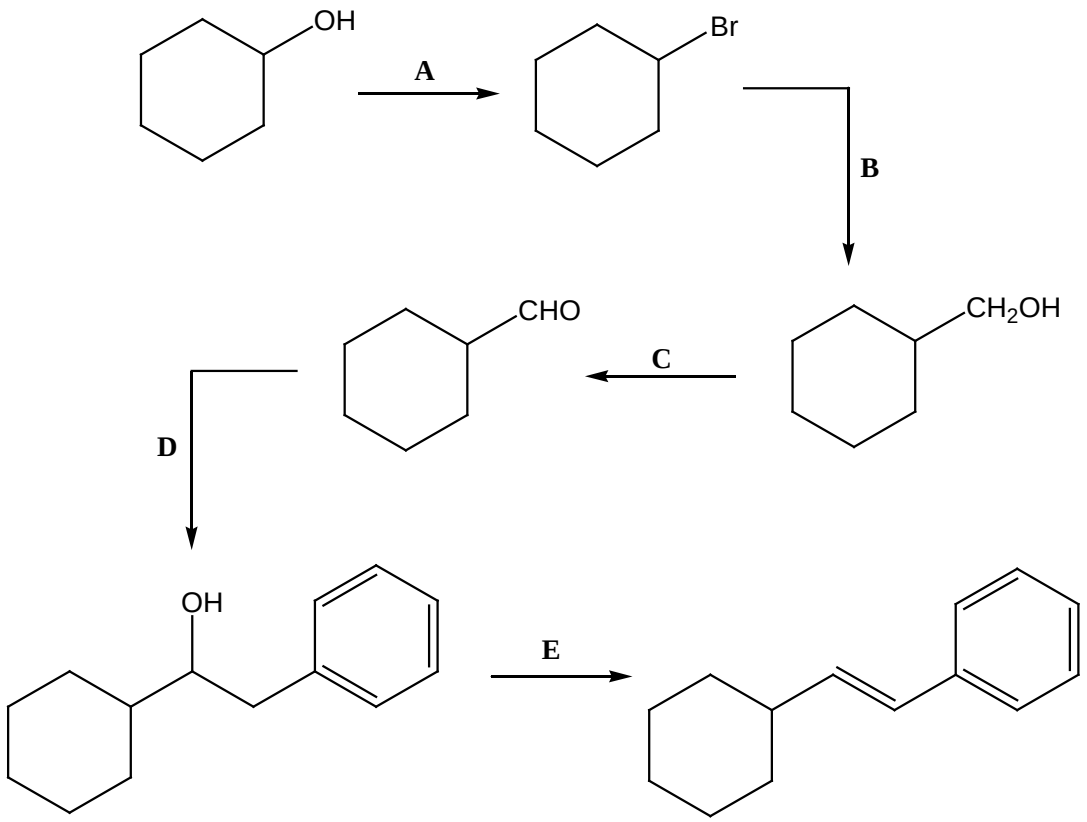
Susunkan fenol tertukarganti berikut dalam susunan keasidan meningkat. Jelaskan jawapan anda.



(10 marks/*markah*)

(b) Identify the reagents **A**–**E** in the following scheme:

*Kenalpasti reagen-reagen **A**-**E** di dalam skema berikut:*



(10 marks/*markah*)

4. (a) When pent-2-yne reacts with mercuric sulphate in dilute sulphuric acid, the product is a mixture of two ketones. Draw the structures of these products, and give its mechanisms.

Apabila pent-2-una bertindak balas dengan merkurik sulfat dalam asid sulfurik cair, hasilnya adalah campuran dua sebatian keton. Lukiskan struktur-struktur hasil ini, dan berikan mekanisme tindak balas.

(10 marks/*markah*)

(b) Show how each of the following compounds could be prepared using given starting material, reaction condition and any reagents needed. More than one step may be required.

(i) Hexanal ⟶ octan-3-ol

(ii) Bromobenzene ⟶ 1-phenylpropene

(iii) 2-Methylcyclopentanol ⟶ 2-methylcyclopentyl acetate

Tunjukkan bagaimana setiap sebatian berikut dapat disediakan dengan menggunakan bahan mula yang diberikan, keadaan tindak balas dan sebarang reagen yang diperlukan. Lebih daripada satu langkah mungkin diperlukan.

(i) Hexanal ⟶ octan-3-ol

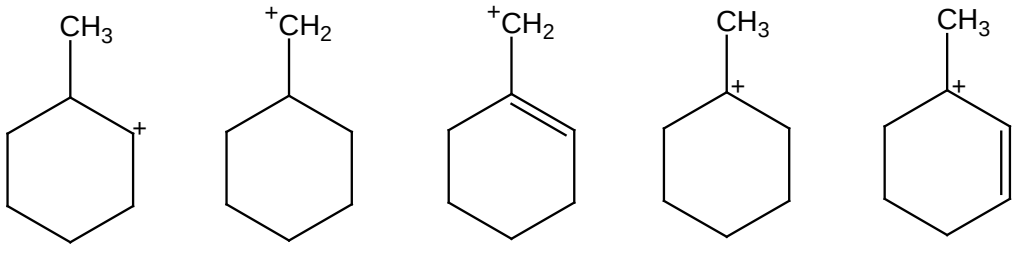
(ii) Bromobenzena ⟶ 1-fenilpropena

(iii) 2-Metilsiklopentanol ⟶ 2-metilsiklopentil asetat

(10 marks/*markah*)

5. (a) List the following carbocations in decreasing order of their stability. Two of the carbocations are prone to rearrangement. Show how they might rearrange to more stable carbocations.

Senaraikan karbokation berikut dalam susunan kestabilan menurun. Dua daripada karbokation tersebut terdedah kepada penyusunan semula. Tunjukkan bagaimana ia mengalami penyusunan semula untuk menghasilkan karbokation yang lebih stabil.



(6 marks/*markah*)

(b) The boiling point of 2-butanone (80 °C) is significantly higher than the boiling point of diethyl ether (35 °C), even though both compounds exhibit dipole–dipole interactions and have comparable molecular weights. Offer an explanation.

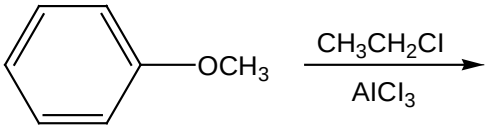
Takat didih 2-butanon (80 °C) adalah lebih tinggi daripada takat didih dietil eter (35 °C), walaupun kedua-dua sebatian mempunyai interaksi dwikutub-dwikutub dan mempunyai berat molekul yang sama. Berikan penjelasan.

(4 marks/*markah*)

(c) Draw the structure of the product(s) for each of the following reactions.

Lukiskan struktur sebatian/sebatian-sebatian yang terhasil daripada tindak balas berikut:

(i)



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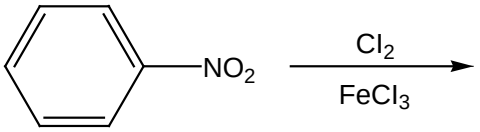

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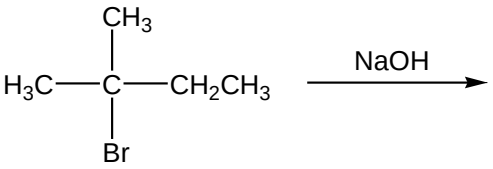

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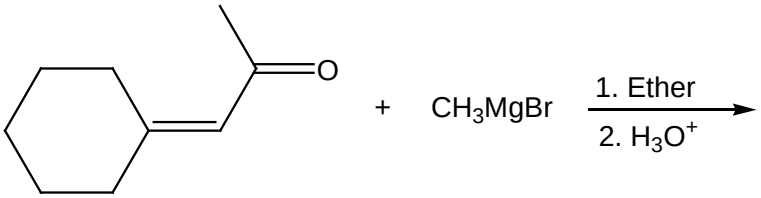
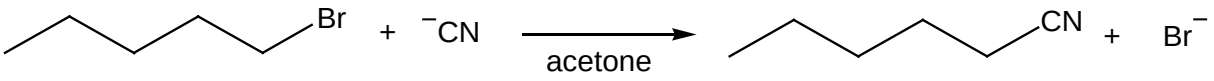


(10 marks/*markah*)

6. (a) Consider the following S_N2 reaction:

Pertimbangkan tindakbalas S_N2 berikut:



(i) Draw a mechanism using curved arrows.

(ii) Draw an energy diagram. Label the axes, the reactants, products, E_a, and $\Delta H°$. Assume that the reaction is exothermic.

(iii) Draw the structure of the transition state.

(iv) What is the rate equation?

(v) What happens to the reaction rate in each of the following instances?

A. The leaving group is changed from Br^- to I^-.

B. The alkyl halide is changed from $CH_3(CH_2)_4Br$ to $CH_3CH_2CH_2CH(Br)CH_3$.

(i) Lukiskan satu mekanisme menggunakan lekuk anak panah.

(ii) Lukiskan gambar rajah tenaga. Labelkan paksi-paksi, reaktan, hasil, E_a, dan $\Delta H°$. Andaikan tindak balas ini adalah eksotermik.

(iii) Lukiskan struktur keadaan peralihan.

(iv) Apakah persamaan kadar?

(v) Apakah yang akan berlaku kepada kadar tindak balas dalam setiap keadaan di bawah ini?

A. Kumpulan peninggal ditukar daripada Br^- kepada I^-.

B. Alkil halida ditukar daripada $CH_3(CH_2)_4Br$ kepada $CH_3CH_2CH_2CH(Br)CH_3$.

(10 marks/*markah*)

(b) Draw the two chair conformations of each compound and label the substituents as axial and equatorial. In each case, determine which conformation is more stable.

(i) *cis*-1-ethyl-2-isopropylcyclohexane

(ii) *trans*-1-ethyl-2-isopropylcyclohexane

Lukiskan dua bentuk konformasi kerusi bagi setiap sebatian dan labelkan kumpulan penukarganti sebagai paksian dan khatulistiwa. Dalam setiap kes, tentukan konformasi yang mana lebih stabil.

(i) cis-1-etil-2-isopropilsikloheksana

(ii) trans-1-etil-2-isopropilsikloheksana

(10 marks/*markah*)

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