
UNIVERSITI SAINS MALAYSIA

First Semester Examination
2010/2011 Academic Session

November 2010

EKC 107 – Organic Chemistry
[Kimia Organik]

Duration : 3 hours
[Masa : 3 jam]

Please check that this examination paper consists of TEN pages of printed material before you begin the examination.

[Sila pastikan bahawa kertas peperiksaan ini mengandungi SEPULUH muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]

Instruction: Section A is **COMPULSORY**. Answer any **TWO** (2) questions from Section B and answer any **TWO** (2) questions from Section C.

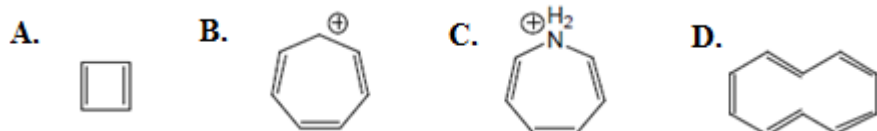
[Arahan: Bahagian A **WAJIB** dijawab. Jawab mana-mana **DUA** (2) soalan daripada Bahagian B dan mana-mana **DUA** (2) soalan daripada Bahagian C.]

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

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

Section A : Answer ALL questions.
 Bahagian A: Jawab SEMUA soalan.

1. [a] Which one of the following compounds is likely to adopt a planar conformation?
 Yang mana satukah antara sebatian-sebatian berikut berkemungkinan memiliki ciri satu satah sama bentuk?



[2 marks/markah]

- [b] Which one of the following statements about benzene is incorrect?
 Yang mana satukah antara kenyataan-kenyataan berikut adalah tidak benar berkaitan benzena?

- A. It undergoes electrophilic substitution reactions rather than electrophilic addition reactions.
 Ia mengalami tindak balas penggantian elektrofilik berbanding tindak balas penambahan elektrofilik.
- B. It is less reactive than hexatriene ($\text{CH}_2=\text{CH}-\text{CH}=\text{CH}-\text{CH}=\text{CH}_2$).
 Ia adalah kurang reaktif berbanding heksatriena ($\text{CH}_2=\text{CH}-\text{CH}=\text{CH}-\text{CH}=\text{CH}_2$).
- C. The carbon-carbon bond lengths are all the same.
 Panjang ikatan karbon- karbon adalah kesemuanya sama.
- D. The carbon-carbon bond lengths are longer than ethane.
 Panjang ikatan karbon- karbon adalah lebih berbanding etana.

[2 marks/markah]

- [c] What is the purpose of the FeBr_3 catalyst in an electrophilic aromatic substitution?
 Apakah kegunaan pemangkin FeBr_3 dalam satu penggantian aromatik elektrofilik?

- A. It serves as a radical initiator.
 Ia berfungsi sebagai satu pemula radikal.
- B. It destabilizes the carbocation intermediate.
 Ia menyahstabil pengkarbonan teralih.
- C. It acts as a Lewis acid to activate Br_2 .
 Ia bertindak sebagai asid Lewis untuk mengaktifkan Br_2 .
- D. None of the above.
 Bukan semua di atas.

[2 marks/markah]

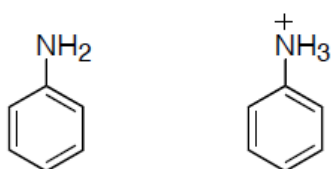
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- [d] What is the approximate magnitude of aromatic stabilization energy achieved by a simple compound like benzene?
Apakah magnitud anggaran bagi tenaga penstabilan aromatik yang dicapai oleh satu sebatian ringkas seperti benzena?

- A. 5 kcal/mol
 5 kkal/mol
- B. 15 kcal/mol
 15 kkal/mol
- C. 25 kcal/mol
 25 kkal/mol
- D. 35 kcal/mol
 35 kkal/mol

[2 marks/markah]

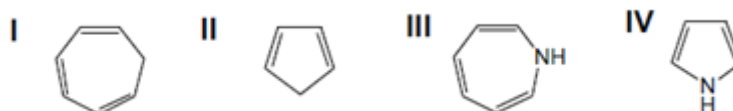
- [e] Which compound is more susceptible to electrophilic aromatic substitution?
Manakah sebatian yang lebih cenderung kepada penggantian aromatik elektrofilik?



[2 marks/markah]

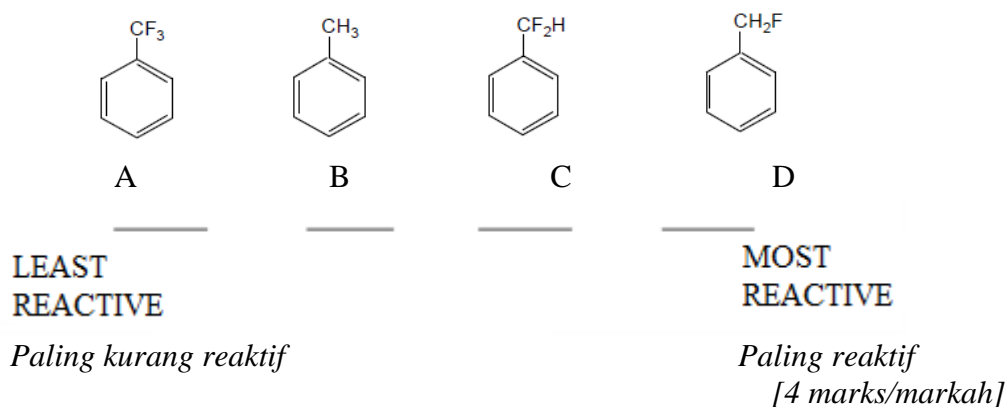
- [f] Fill in the blanks of the following. Of the compounds
Isikan tempat-tempat kosong bagi yang berikut. Daripada sebatian-sebatian

- [i] I and II, _____ is the stronger acid
I dan II, _____ adalah asid lebih kuat.
- [ii] III and IV, _____ is the stronger base.
III dan IV, _____ adalah bes lebih kuat.



[3 marks/markah]

- [g] Rank the following in order of reactivity in electrophilic aromatic substitution
Susun mengikut tertib kereaktifan dalam penggantian aromatik elektrofilik

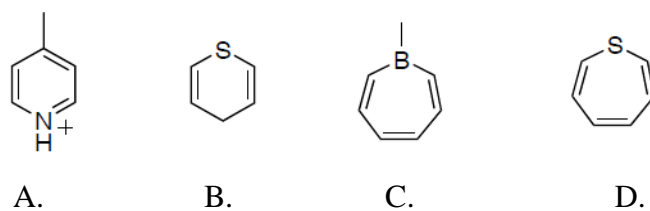


- [h] Which molecule is more stable? Explain why.
Manakah molekul yang lebih stabil? Terangkan kenapa?



[4 marks/markah]

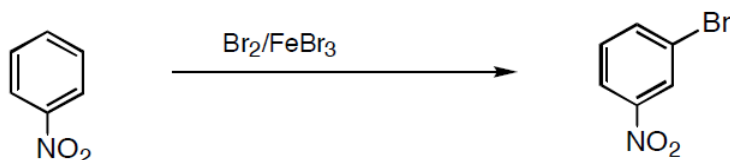
- [i] Which of the following heterocycles are aromatic?
Manakah daripada heterokitar yang berikut adalah aromatik?



[4 marks/markah]

- [j] Write the complete stepwise mechanism for the following reaction. Show all electron flow with arrows and include all intermediate structures. Mechanism must account for formation of meta-substituted product.

Tuliskan mekanisma berlangkah yang lengkap untuk tindak balas berikut. Tunjukkan kesemua aliran elektron menggunakan anak panah dan sertakan kesemua struktur-struktur peralihan. Mekanisma mestilah mengambil kira pembentukan hasil meta-gantian.



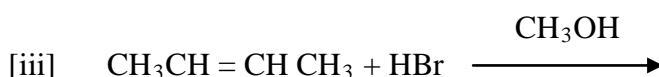
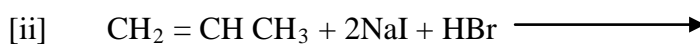
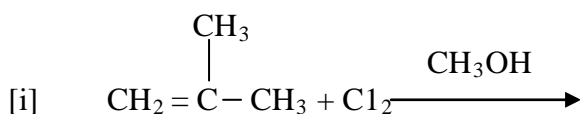
[5 marks/markah]

Section B: Answer any TWO questions.

Bahagian B: Jawab mana-mana DUA soalan.

2. [a] There are two nucleophiles in each of the following reactions. For each reaction, explain why there is a greater concentration of one nucleophile than the other. What will be the major product of each reaction?

Terdapat dua nukleofil dalam setiap tindak balas berikut. Bagi setiap tindak balas, terangkan kenapa terdapat kepekatan yang tinggi bagi satu nukleofil berbanding dengan yang lain. Apakah produk utama bagi setiap tindak balas?



[9 marks/markah]

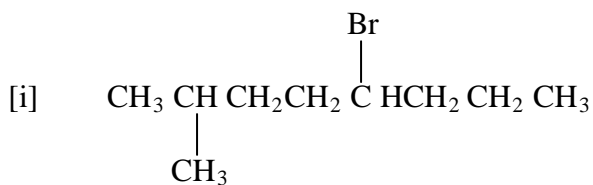
- [b] What product would be obtained from hydroboration-oxidation of the following alkenes? Show the reactions involved.

Apakah produk yang akan diperoleh dari hidroborasi-oksidasi bagi alkena-alkena berikut? Tunjukkan tindak balas-tindak balas yang terlibat.

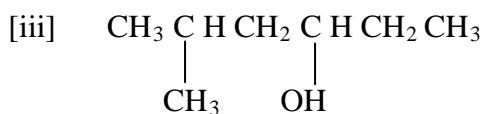
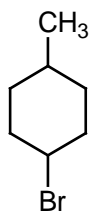
- [i] 2-methyl-2-butene.
2-metil-2-butena.
- [ii] 1-methylcyclohexene.
1-metilsikloheksena.

[4 marks/markah]

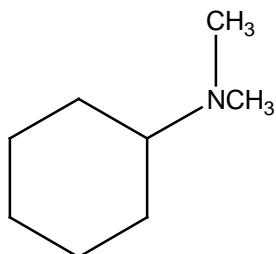
- [c] Give the systematic name for each of the following compounds.
Berikan nama sistematik bagi setiap sebatian berikut.



[ii]



[iv]



[4 marks/markah]

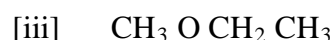
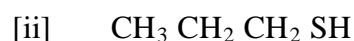
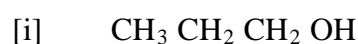
- [d] How many ethers have molecular formula $C_5H_{12}O$? Give the structural formula and systematic name for each. What are their common names?

Berapakah bilangan eter yang mempunyai formula molekul $C_5H_{12}O$? Berikan formula struktur, nama sistematik dan nama biasa bagi setiap satu.

[8 marks/markah]

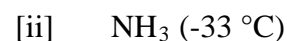
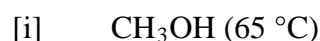
3. [a] Which of the following compounds will form hydrogen bonds between its molecules, and will form hydrogen bonds with a solvent such as ethanol? Explain.

Manakah daripada sebatian-sebatian berikut yang boleh membentuk ikatan hidrogen antara molekulnya, dan akan membentuk ikatan hidrogen dengan pelarut seperti etanol. Terangkan.



[6 marks/markah]

- [b] Explain the reasons why water has higher boiling point than
Kenapakah air mempunyai takat didih yang tinggi daripada



[8 marks/markah]

- [c] Why are alcohols of lower molecular weight more water soluble than those of higher molecular weight?

Kenapakah alkohol yang rendah berat molekulnya lebih larut dalam air berbanding daripada yang tinggi berat molekulnya?

[3 marks/markah]

- [d] Show the mechanism for the formation of carbon tetrachloride (CCl_4), from the reaction of methane (CH_4) with $Cl_2 + hv$.

Tunjukkan mekanisma pembentukan karbon tetraklorida (CCl_4) daripada tindak balas metana dengan $Cl_2 + hv$.

[8 marks/markah]

4. [a] Polymerization is a process of linking together repeating units of small molecules, monomer to form a large molecules, polymer. Draw a short segment of the polymer formed from cationic polymerization of 3,3-dimethyloxacyclobutane, (Figure Q.3.[a]). Show electron flows with arrows writing the complete step-wise mechanism.

Pempolimeran adalah proses yang menghubungkan urutan unit-unit molekul, monomer bagi membentuk molekul yang besar, polimer. Lakarkan segmen polimer pendek yang terbentuk daripada pempolimeran kation untuk 3,3-dimetiloksasiklobutana (Rajah S.3.[a]). Tunjukkan aliran elektron dengan anak panah bagi mekanisma berlangkah yang lengkap.

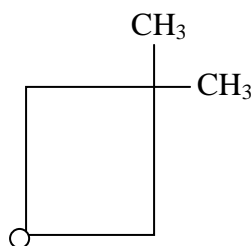
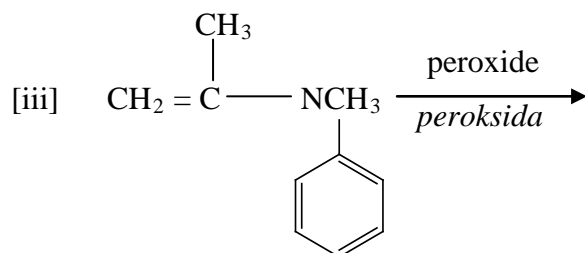
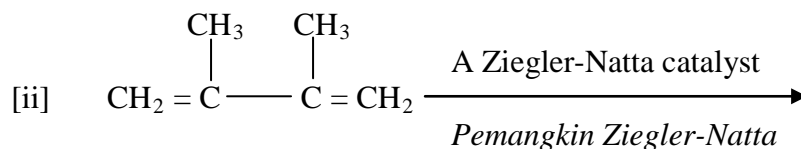
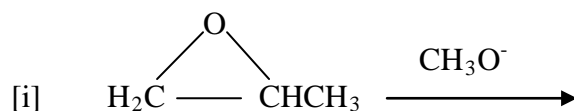


Figure Q.3.[a].
Rajah S.3.[a].

[7 marks/markah]

- [b] Draw short segments of the polymers obtained from the following compounds under the given reaction conditions:

Lukiskan segmen pendek bagi polimer yang didapati daripada sebatian-sebatian berikut berdasarkan keadaan tindak balas yang diberi:



[3 marks/markah]

- [c] [i] Polyethylene can be used for the production of beach chairs and beach balls. Which of these items is made from more highly branched polyethylene?

Polietilena boleh digunakan bagi menghasilkan kerusi dan bola pantai. Antara benda-benda tersebut yang manakah diperbuat daripada polietilena yang lebih banyak cabang?

- [ii] What happens to polyester slacks if aqueous NaOH is spilled on them?
Apa akan terjadi pada seluar poliester apabila larutan akues NaOH tertumpah ke atasnya?

- [iii] If a small amount of glycerol is added to the reaction mixture of toluene-2,6-diisocyanate and ethylene glycol during the synthesis of polyurethane foam, a much stiffer foam is obtained. Explain.

Jika sedikit gliserol ditambahkan ke dalam campuran tindak balas bagi toluena-2,6-diisocyanat dan etilena glikol semasa sintesis busa poliuretana, busa yang lebih kuat didapati. Jelaskan.

[12 marks/markah]

- [d] An oil obtained from coconuts is unusual in that all the molecular formulae of the three fatty acids components are identical. The molecular formula of the oil is $C_{45}H_{86}O_6$. What is the molecular formula of the carboxylate ion obtained when the oils is saponified?

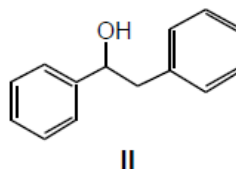
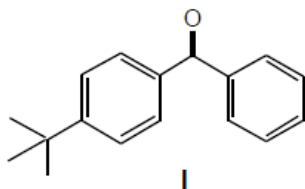
Minyak yang didapati daripada kelapa adalah berbeza kerana formula molekulnya terdapat tiga komponen asid lemak yang sama. Formula molekul bagi minyak ialah $C_{45}H_{86}O_6$. Apakah formula molekul bagi ion karboksilat yang diperolehi apabila minyak disaponifikasikan?

[3 marks/markah]

Section C: Answer any TWO questions.

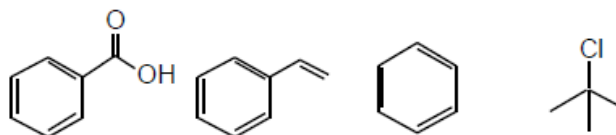
Bahagian C: Jawab mana-mana DUA soalan.

5. Design syntheses of compounds I and II.
Rekabentukkan sintesis-sintesis bagi sebatian I dan II.



You may only use the carbon containing starting materials given below. Pay careful attention the substituent to directing effects in the key reactions that you plan to carry out on the benzene ring.

Anda hanya boleh menggunakan bahan pemula berasaskan karbon seperti di bawah. Pastikan dengan teliti bahan pengganti untuk kesan-kesan terarah dalam tindak balas-tindak balas utama yang anda rancang pada gelang benzena.



[10 marks/markah]

6. Classify polymers depending on their physical behaviour? Explain each of them and give example.

Klasifikasikan polimer-polimer bergantung pada sifat-sifat fizikalnya. Terang dan berikan contoh bagi setiap satu.

[10 marks/markah]

7. Classify the methods that can be carried out for the cracking of oil products? Explain each one of them.

Klasifikasikan kaedah-kaedah yang boleh dijalankan bagi memecahkan hasil-hasil minyak. Terangkan setiap satu daripada kaedah-kaedah tersebut.

[10 marks/markah]