
UNIVERSITI SAINS MALAYSIA

First Semester Examination
2011/2012 Academic Session

January 2012

EKC 107 – Organic Chemistry
[Kimia Organik]

Duration : 3 hours
[Masa : 3 jam]

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

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

Instruction: Answer **ALL** (4) questions.

Arahan: Jawab **SEMUA** (4) soalan.]

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.]

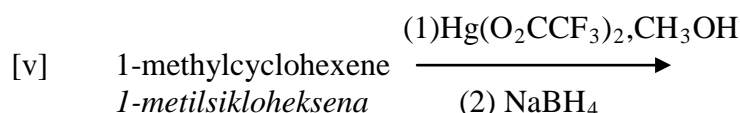
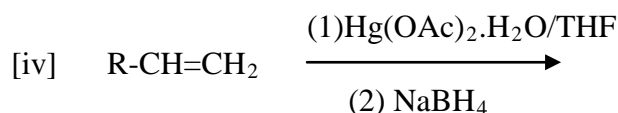
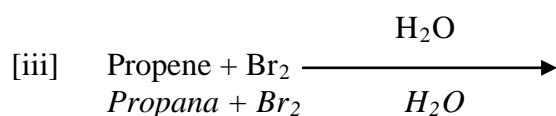
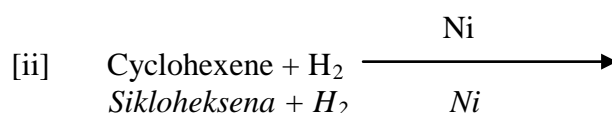
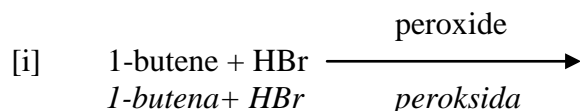
Answer ALL questions.
Jawab SEMUA soalan.

1. [a] Write the structural formula for each of the following compounds:
Tuliskan formula struktur bagi setiap sebatian berikut:
- [i] Isopropyl alcohol
Isopropil alkohol
 - [ii] Neopentyl chloride
Neopentil klorida
 - [iii] 4-isopropyloctane
4-isopropiloktana
 - [iv] 3-methyl-1-butene
3-metil-1-butena
 - [v] 1-bromo-1-methyl-cyclohexane
1-bromo-1-metil-sikloheksana [5 marks/markah]
- [b] Explain why water has higher boiling point compared to the following:
Terangkan kenapa air mempunyai titik didih yang tinggi berbanding dengan yang berikut:
- [i] CH_3OH (65°C)
 - [ii] NH_3 (-33°C)
 - [iii] HF (20°C) [6 marks/markah]
- [c] Explain why the following reactions occur. Give example for each of the reactions.
Terangkan mengapa tindak balas berikut berlaku. Berikan contoh bagi setiap tindak balas.
- [i] Esters do not react with halide ions or with carboxylate ions but with water to form carboxylic acids and alcohols.
Ester tidak bertindak balas dengan ion halida atau dengan ion karboksilat tetapi dengan air ia membentuk asid karboksilik dan alkohol.
 - [ii] Hydrolysis and the alcoholysis of an ester are very slow reactions.
Hidrolisis dan alkoholisis ester adalah tindak balas yang lambat.
 - [iii] The reaction of an ester with an amine is not as slow as the reaction of an ester with water or an alcohol.
Tindak balas ester dengan amina tidaklah selambat tindak balas ester dengan air atau alkohol. [9 marks/markah]

- [d] Briefly explain the difference between oxymercuration and alkoxymercuration. Show example.

Terangkan dengan ringkas perbezaan di antara oksimerkurasi dan alkoksimerkurasi. Tunjukkan contoh-contohnya. [5 marks/markah]

2. [a] Give the products for each of the following reactions:
Berikan produk bagi setiap tindak balas berikut:



[5 marks/markah]

- [b] Compare and contrast between catalytic and thermal cracking. Give examples for both of the processes.

Banding dan bezakan di antara pemecahan pemangkin dan pemecahan termal. Berikan contoh bagi kedua-dua proses. [10 marks/markah]

- [c] [i] Briefly explain the Markovnikov's rule?
Terangkan aturan Markovnikov's.

- [ii] Hydroboration-oxidation is an anti-Markovnikov's addition reaction. Why?

Hidrobokasi-oksidasi adalah tindak balas penambahan anti-Markovnikov's. Kenapa? [6 marks/markah]

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

Mengapa alkohol yang mempunyai berat molekul rendah lebih larut di dalam air berbanding dengan berat molekul yang lebih tinggi. [4 marks/markah]

3. [a] Draw structures corresponding to the given names.

Lakarkan stuktur yang sepadan seperti diberikan.

- [i] 5,5-dimethyl-1,3-cyclohexanedione (dimedone)
5,5-dimetil-1, 3-sikloheksanadion (dimedon)

- [ii] 1-phenyl-2-propanone
1-fenil-2-propanon

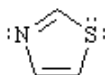
- [iii] *m*-nitrobenzaldehyde
m-nitrobenzaldehyd

- [iv] 2-hydroxyacetophenone
2-hidroksiasetofenon

- [v] Salicylic acid
Asid salisilik

[5 marks/markah]

- [b] Answer the following questions concerning sulfathiazole,
Berikan jawapan kepada soalan berikut mengenai sulfatiazol,



- [i] What is the hybridization of the nitrogen atom in sulfathiazole?
Apakah pengacukan atom nitrogen di dalam sulfatiazol?

- [ii] Assuming that the sulfur atom is sp^2 -hybridized, how many π -electrons are there in the sulfathiazole ring?

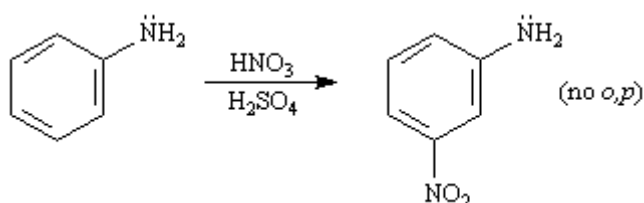
Andaikan atom sulfur adalah kacukan- sp^2 , berapakah elektron-elektron π yang berada di gelang sulfatiazol?

- [iii] What type of reactivity do you predict for sulfathiazole?
Apakah jenis tindak balas yang diramalkan untuk sulfatiazol?

[5 marks/markah]

- [c] The -NH_2 group is listed in our textbook as the strongest *o,p*-directing activator in electrophilic aromatic substitution reactions. However, when aniline is subjected to standard nitration conditions poor yield of *m*-nitroaniline is obtained.

Kumpulan -NH_2 yang disenaraikan di dalam buku teks sebagai o, p-pengaktif terus yang paling kuat di dalam tindak balas penggantian aromatik elektrofilik. Walau bagaimanapun, apabila anilin disubjekkan kepada keadaan penitratan piawai hasil m-nitroanilina yang rendah diperolehi.



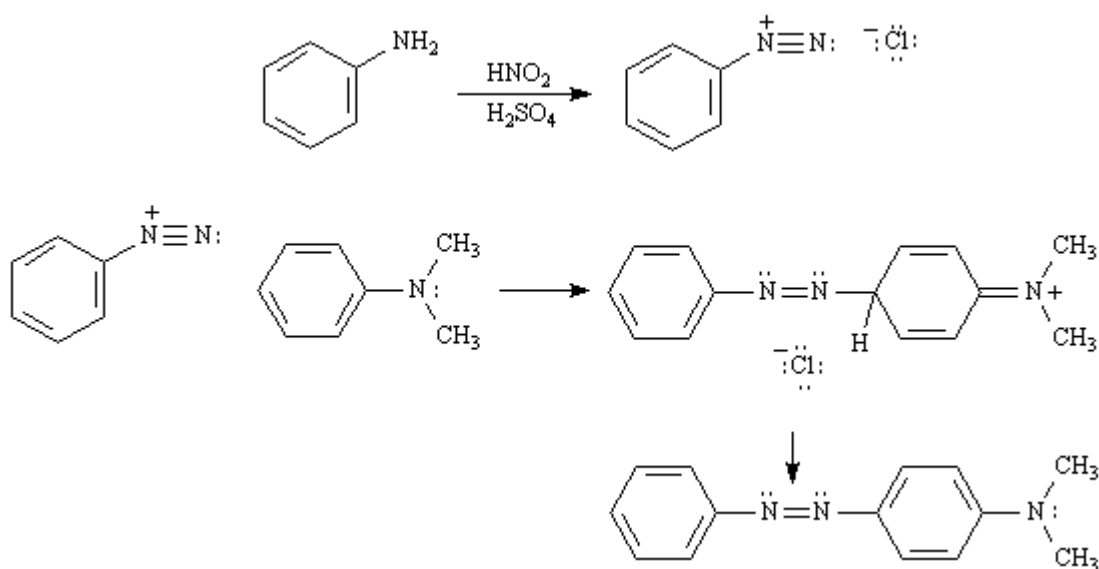
Clearly, the reaction conditions are influencing the directing effect of the -NH_2 group. Explain why this occurs.

Secara jelas, keadaan tindak balas mempengaruhi kesan terus kumpulan -NH_2 . Jelaskan mengapakah ini berlaku?

[6 marks/markah]

- [d] Aniline reacts with nitrous acid, HNO_2 , to yield a stable diazonium salt. This diazonium salt undergoes electrophilic aromatic substitution on activated aromatic rings to yield brightly colored azo compounds that are widely used as dyes. The intermediate structures for the mechanism of this reaction are given below. Show all electron flow with arrows for this mechanism on the structures provided.

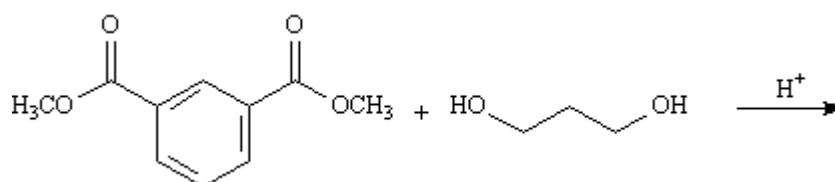
Anilina bertindak balas dengan asid nitrus, HNO_2 untuk menghasilkan garam diazonium yang stabil. Garam diazonium melalui penggantian aromatik elektrofilik dengan mengaktifkan gelang aromatik untuk menghasilkan sebatian azo yang berwarna cerah yang digunakan secara meluas sebagai pencelup. Struktur perantara bagi mekanisma tindak balas diberikan seperti dibawah. Tunjukkan semua aliran elektron dengan anak panah bagi struktur mekanisma yang diberikan.



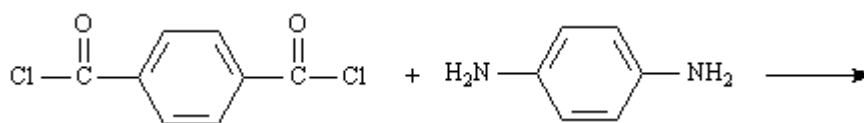
[6 marks/markah]

- [e] Draw the structure of the polymers obtained from the following reactions.
Lakarkan struktur polimer yang diperolehi daripada tindak balas berikut.

[i]



[ii]

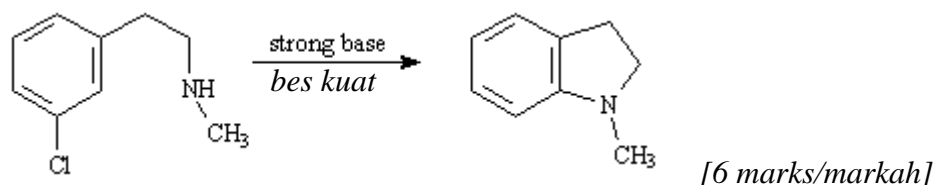


[3 marks/markah]

...7/-

4. [a] The following reaction proceeds by an intramolecular nucleophilic aromatic substitution mechanism. Write the complete stepwise mechanism, showing all intermediate structures and all electron flow with arrows.

Tindak balas berikut diteruskan dengan satu mekanisma penggantian aromatik cita nukleus intramolekul. Tuliskan mekanisma berlangkah yang lengkap menunjukkan kesemua struktur perantara dan kesemua aliran elektron dengan anak panah.



- [b] Propose synthesis of the following compound starting with benzene or toluene. Assume that ortho and para isomers can be separated.

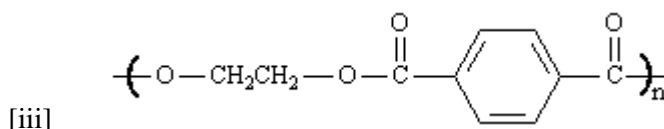
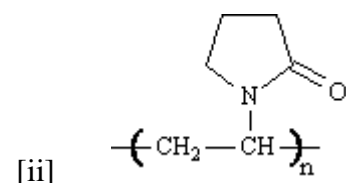
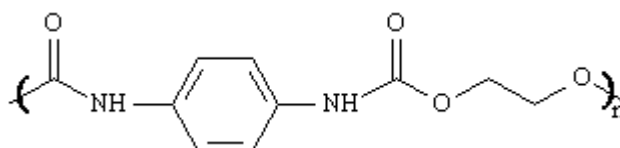
Cadangkan sintesis sebatian berikut yang bermula dengan benzena atau toluena. Anggapkan isomer orto dan para boleh dipisahkan.



- [c] Draw the structure(s) of the monomer(s) used to make each of the following polymers.

Lakarkan struktur monomer yang digunakan untuk membina setiap polimer di bawah.

[i]



- [d] Explain the process of catalytic reforming of naphtha.
Terangkan proses pembentukan semula bermangkin bagi nafta.

[8 marks/markah]