



Second Semester Examination
Academic Session 2020/2021

July 2021

KOE423 – Selected Topics in Organic Chemistry

Duration: 2 hours

Please check that this examination paper consists of **SEVEN (7)** pages of printed material before you begin the examination.

Section A: Answer **ALL THREE (3)** questions.

Section B: Answer any **ONE (1)** question.

Answer each question on a new page.

You may answer the question either in Bahasa Malaysia or in English.

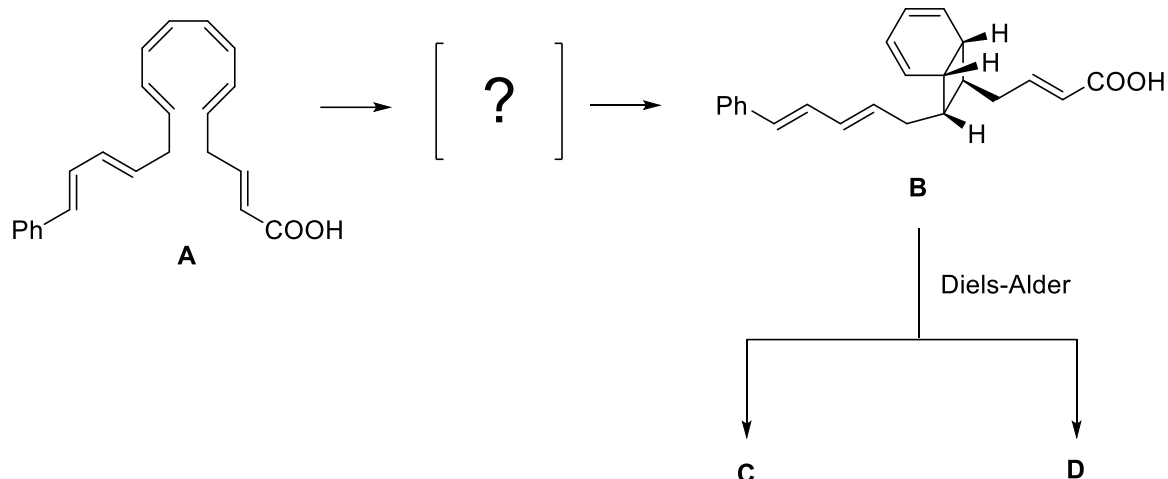
In the event of any discrepancies, the English version shall be used.

If a candidate answers more than five questions, only the answers to the first five questions in the answer sheet will be graded.

SECTION A: Answer ALL THREE (3) questions.

1. (a) Distinguish the difference between biosynthesis of endiandric acids and kingianins (3 marks)

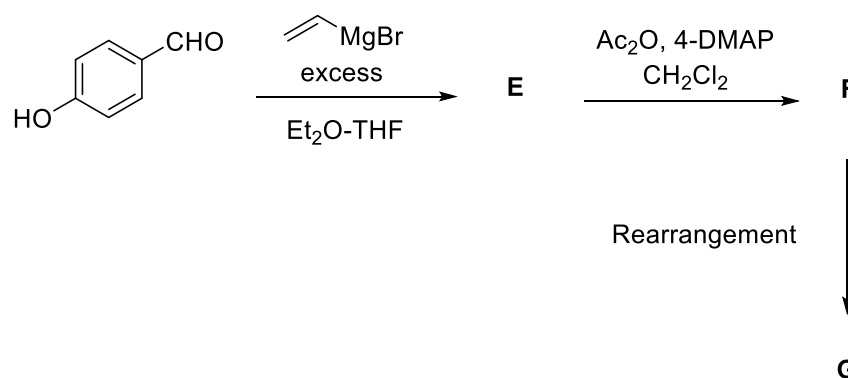
- (b) The following transformations involve pericyclic reactions in total synthesis of polyketides.



- i. Show the mechanisms and intermediate compounds of this transformation (transformation from **A** to **B**).
- ii. If **B** proceeds with Diels-Alder reaction, give the structures of **C** and **D**.
- iii. Explain your answer in (ii).

(10 marks)

- (c) From the following reactions,

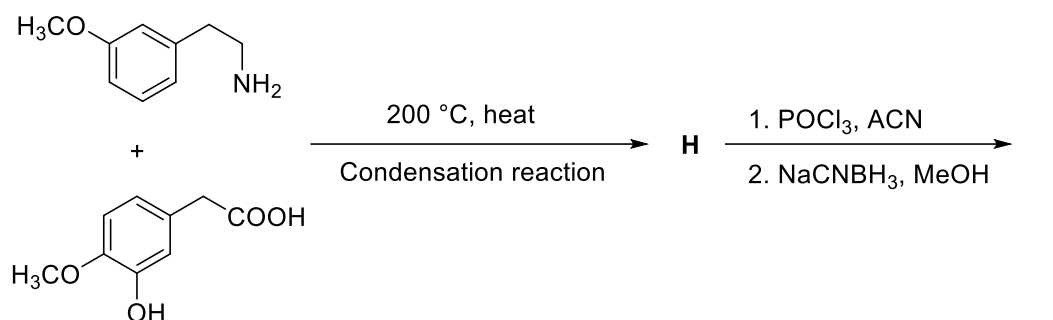


- i. Give structures for products **E**, **F** and **G**.
- ii. Explain the use of excess Grignard reagent for the transformation from 4-hydroxybenzaldehyde to **E**

- iii. Name the rearrangement involve in the transformation of **F** to **G**.
 iv. Show the rearrangement mechanism in (iii)

(7 marks)

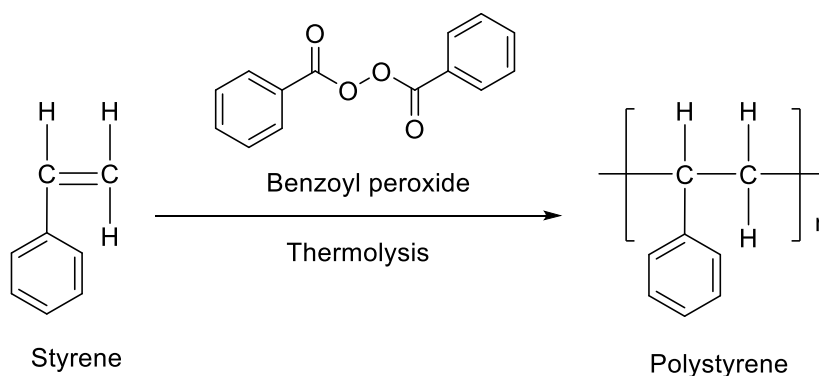
- (d) In the total synthesis of morphine (Rice approach),



- i. draw the structures for products **H** and **I**.
 ii. show the reaction mechanism for the transformation from **H** to **I**.

(5 marks)

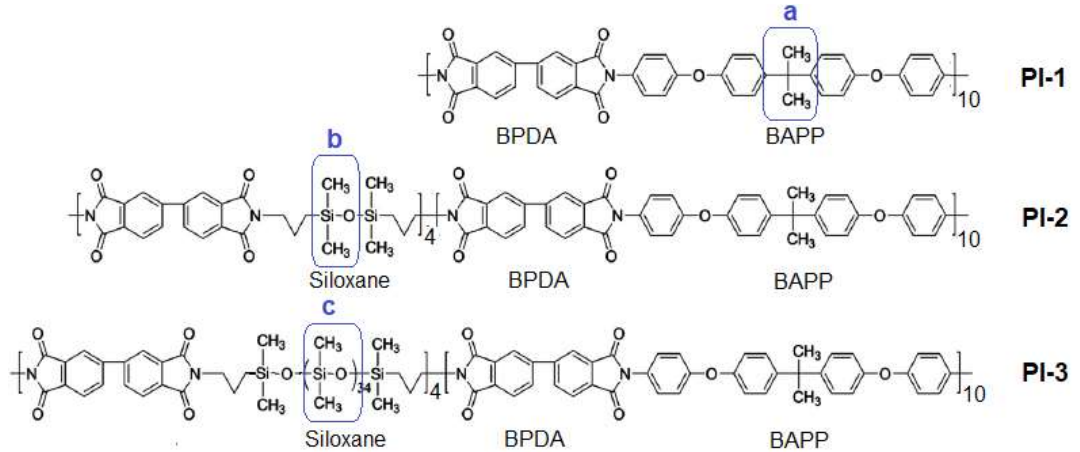
2. (a) Polystyrene foam is a thermoplastic polymer which is widely used to make home and appliance insulation, lightweight protective packaging, food packaging, and automobile parts. The free radical polymerisation of styrene to polystyrenes is an exothermic as shown in figure below. In the case of solution polymerisation, styrene is dissolved in ethylbenzenes to control temperature.



- i. Illustrate the initiation and propagation mechanism of this process using benzoyl peroxide as an initiator. Benzoyl peroxide thermally decomposes to form benzoyl radicals.
 ii. Elaborate the procedure to separate polystyrene from ethylbenzene and benzoyl peroxide.

(10 marks)

- (b) Polyimide (PI) backbone derived from 3,3',4,4'-biphenyltetracarboxylic dianhydride (BPDA) and 4-(4-{1-[4-(4-aminophenoxy)phenyl]-1-methylethyl}phenoxy) aniline (BAPP) can be altered through copolymerisation with siloxane units, as shown below. Subtle variations in this backbone will affect the thermal, mechanical and electrical properties of the polyimide produced.



- Rank the polyimides in order of increasing glass transition temperature with briefly explanation.
- Rank the polyimides in order of decreasing dielectric constant with briefly explanation.
- Rank the methyl proton (H_a , H_b and H_c) in order of increasing chemical shifts with briefly explanation.

(9 marks)

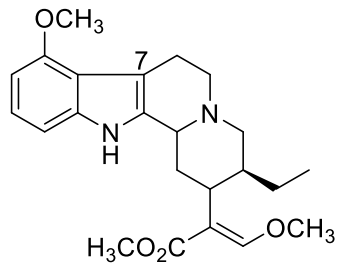
- (c) Explain the effects of the feed ratio on the various properties of phenol formaldehyde materials.

(6 marks)

3. (a)
- Define bioisosteric replacement.
 - State two of any parameters affected by bioisosteric replacements.
 - List out the importance of bioisosteric replacements.
 - Substitution of hydrogen with fluorine is a common monovalent isosteric replacement. Explain the effect of other halogen (Br and I) in bioisosteric replacement.

(10 marks)

- (b) Mitragynine is the main alkaloid present in *Mitragyna speciosa* leaves with opioid agonistic activity.

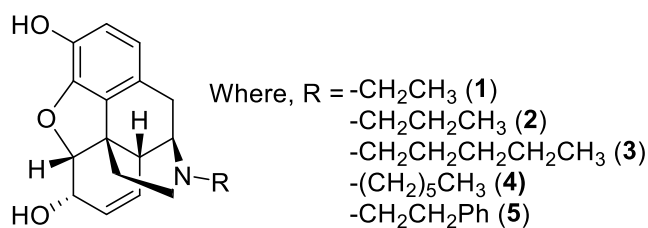


Mitragynine

- i. Predict the product and the effect when Mitragynine undergoes
- Hydrolysis
 - Demethylation
 - Acetylation
 - Inversion of configuration
- ii. Explain what will happen to opioid agonistic activity if a hydroxyl group was introduced at position C7.

(10 marks)

- (c) The alkyl chain length, branching, and ring size can have a profound effect on the potency and pharmacologic activity of a drug. Discuss the effect of each alkyl substituents on the pharmacological activities of morphine (R=CH₃) and its derivatives.



Morphine (R= CH₃)

(5 marks)

SECTION B: Answer any **ONE (1)** questions.

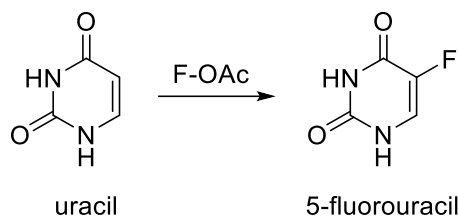
4. (a) In the synthesis of kingianins,
- Discuss the problem and challenges in total synthesis of kingianins.
 - Compare among the Moses, Parker, and Sherbun the synthesis strategies in total synthesis of kingianins.

(10 marks)

- (b) Describe in detail why the production of low dielectric constant materials in modern optoelectronic devices is vital.

(5 marks)

- (c) A classic example of hydrogen replacement by fluorine is the development of the antineoplastic agent 5-fluorouracil from uracil. Show the mechanism of fluorination from uracil to 5-fluorouracil.



uracil

5-fluorouracil

(5 marks)

- (d) Explain the role of natural product as an antiviral agent. Describe the advantages and disadvantages of natural products in alternative medicine.

(3 marks)

- (e) Explain how NMR spectroscopy can be used to investigate structure-activity relationships of drugs.

(2 marks)

5. (a) Give a brief explanation for each of the following terms

- Black's cascade
- Stilbenoid
- Indolostilbene

(6 marks)

- (b) State the importance of chemical structure modifications in drug discovery.

(2 marks)

- (c) Polyimides are produced by polycondensation between dianhydrides and diamines, as well as between dianhydrides and diisocyanates. Compare the advantages of these synthesis routes.

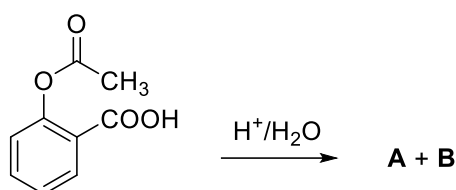
(6 marks)

- (d) The introducing of pores in a polyimide matrix lower its dielectric constant.

- i. Explains the process to introduces pores.
- ii. Discuss how the pores will lower the dielectric constant.

(6 marks)

- (e) Aspirin is widely used as analgesic.



Aspirin

- i. Give the products of **A** and **B** from the above transformation reaction.
- ii. By using the reverse phase (C-18) HPLC method, compare the retention time between aspirin and its hydrolysed products.
- iii. Explain your answer in (ii)

(5 marks)