

LAMPIRAN D3



PENYEMAKAN KERTAS SOALAN PEPERIKSAAN
Proof-reading of Examination Question Paper

Untuk Kegunaan Seksyen Peperiksaan dan Pengijazahan	
Nombor Sampul	
Tarikh Peperiksaan	
Sesi Peperiksaan	PAGI / PETANG

Gunakan satu proforma untuk satu kertas soalan peperiksaan.
Use separate proforma for each Question Paper

Kepada : Ketua Penolong Pendaftar
 Seksyen Peperiksaan dan Pengijazahan

SAYA/KAMI TELAH MENYEMAK SALINAN-SALINAN KERTAS SOALAN PEPERIKSAAN BERTAIP YANG DISEBUTKAN DI BAWAH INI :

I/We have checked the typed copies of the Examination Paper stated below :

Kod Kursus : EBP 201 Tajuk Kursus : Sintesis Polimer Dan Kejuruteraan Tindak Balas
Course Code Course Title polymer synthesis And Reaction Engineering

Jangka Masa Peperiksaan : 3 Jam Bilangan Muka Surat Bertaip : 10 Muka Surat Bilangan Soalan Yang Perlu Dijawab : 5 Soalan
Duration of Examination Hours Number of typed pages Pages Number of questions required to be answered Questions

Soalan-soalan dijawab atas : <i>Questions to be answered in :</i> Sila (✓) Please (✓)	BUKU JAWAPAN <i>Answer Book</i>	OMR <i>OMR Form</i>	JAWAB DALAM KERTAS SOALAN <i>Answer In Question Paper</i>
	✓		

DENGAN INI DISAHKAN BAHAWA KERTAS SOALAN PEPERIKSAAN INI ADALAH TERATUR, BETUL DAN SEDIA UNTUK DICETAK.
Certified that this question paper is in order, correct and ready for printing.

Nama Pemeriksa : KU MARBUA Tandatangan : [Signature] Tarikh : 20/10/2016
Name of Examiner(s) Signature Date
 Huruf Besar
In Block Capitals

Tandatangan dan Cop Rasmi [Signature] PROFESOR DR. ZUHAILAWATI HUSSAIN : 11/11/16
Signature and Official Stamp Date
 DEKAN/PENGARAH
 P. Peng. Kej. Bahan & Sumber Mineral
 Kampus Kejuruteraan
 Universiti Sains Malaysia

NOTA : Pemeriksa-pemeriksa yang menyediakan kertas soalan peperiksaan adalah bertanggungjawab atas ketepatan isi kandungan kertas soalan peperiksaan berkenaan.
NOTE : Accuracy of the contents of the question paper is the responsibility of the Examiner(s) who set the question paper.

UNIVERSITI SAINS MALAYSIA

First Semester Examination
2016/2017 Academic Session

December 2016 / January 2017

EBP 201/3 – Polymer Synthesis and Reaction Engineering [*Sintesis dan Kejuruteraan Tindakbalas Polimer*]

Duration : 3 hours
[Masa : 3 jam]

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

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

This paper consists of SEVEN questions. TWO questions from PART A, THREE questions from PART B and TWO questions from PART C.

[Kertas soalan ini mengandungi TUJUH soalan. DUA soalan dari BAHAGIAN A, TIGA soalan dari BAHAGIAN B dan DUA soalan dari BAHAGIAN C.]

Instruction: Answer FIVE questions. Answer ALL questions from PART A, TWO questions from PART B and ONE question from PART C. If a candidate answers more than five questions only the first five questions answered in the answer script would be examined.

[Arahan: Jawab LIMA soalan. Jawab SEMUA soalan dari BAHAGIAN A, DUA soalan dari BAHAGIAN B dan SATU soalan dari BAHAGIAN C. Jika calon menjawab lebih daripada lima soalan hanya lima soalan pertama mengikut susunan dalam skrip jawapan akan diberi markah.]

The answers to all questions must start on a new page.

[Mulakan jawapan anda untuk semua soalan pada muka surat yang baru.]

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

[Anda dibenarkan menjawab soalan sama ada dalam Bahasa Malaysia atau Bahasa Inggeris.]

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

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

PART A / BAHAGIAN A

1. [a] Table 1 show the value of Q-e scheme for the given monomers during copolymerization process. Identify the type of copolymer that will be formed during copolymerization between styrene and acrylamide as well as styrene and propylene. Explain your answer in terms of Q and e values.

Jadual 1 menunjukkan skema nilai Q-e bagi beberapa monomer untuk proses pengkopolimeran. Tentukan jenis kopolimer yang terhasil bagi pengkopolimeran stirena dan akrilamida serta stirena dan propilena. Jelaskan jawapan anda berdasarkan nilai Q dan e.

Table 1

Jadual 1

Monomer	Q	e
Styrene <i>Stirena</i>	1.00	-0.80
Acrylamide <i>akrilamida</i>	1.18	1.30
Propylene <i>propilena</i>	0.002	-0.78

(50 marks/markah)

- [b] Describe the requirements to design an industrial polymerization reactor.

Jelaskan keperluan bagi rekabentuk reaktor pempolimeran industri.

(25 marks/markah)

- [c] Define the various process variables in polymer reactors.

Tentukan pembolehubah bagi pelbagai proses di dalam reaktor polimer.

(25 marks/markah)

2. [a] Define kinetic chain length and henceforth provide its mathematical derivation based on monomer and initiator concentration

Berikan definisi panjang rantai kinetik dan seterusnya berikan terbitan matematikanya berdasarkan kepekatan monomer dan pemula.

(25 marks/markah)

- [b] Explain the effect of chain transfer agent on the rate and molecular weight of a chain growth polymerization

Jelaskan kesan agen perpindahan rantai ke atas kadar dan berat molekul terhadap pemolimeran rantai tumbuh.

(35 marks/markah)

- [c] During synthesis of polystyrene, the chain transfer constant for benzene is 0.023 but that of toluene is 0.125. Explain for this difference.

Semasa sintesis polisterina, pemalar perpindahan rantai bagi benzena ialah 0.023 tetapi bagi toluene ialah 0.125. Jelaskan kenapa terdapat perbezaan ini.

(40 marks/markah)

PART B / BAHAGIAN B

3. [a] Give two reasons the importance of controlling the tacticity in polymers during their synthesis

Berikan dua sebab kepentingan dalam mengawal 'taksisiti' polimer semasa sintesis.

(20 marks/markah)

- [b] Discuss the catalytic features in Ziegler-Natta catalyst which is responsible in controlling tacticity during α -alkenes polymerisation. Your answer should include metal component of the catalysts, type of monomers and the role of vacant orbital of the metal atom.

Bincangkan ciri-ciri pemangkinan dalam mangkin Ziegler-Natta yang bertanggung-jawab dalam mengawal sifat taktik semasa pemangkinan α -alkenes. Jawapan perlulah menyentuh tentang komponen logam, jenis monomer serta peranan orbital kosong pada atom logam itu.

(40 marks/markah)

- [c] Discuss the catalytic feature of a metallocene catalyst which is responsible in controlling the tacticity during α -alkenes polymerization. Your answer should include the chirality, rigidity and stereo-structure at the catalytic site.

Bincangkan ciri-ciri pemangkinan dalam mangkin metalosin yang bertanggung-jawab mengawal sifat taktik semasa pemolimeran α -alkena. Jawapan perlulah menyentuh sifat kiral, kekakuan dan struktur-stereo pada pusat pemangkinan.

(40 marks/markah)

4. [a] Derive the Carothers equation.

Terbitkan persamaan Carothers.

(20 marks/markah)

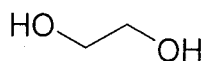
- [b] With regard to the monomer used, describe 2 factors in controlling the degree of polymerization during step growth polymerization.

Merujuk kepada penggunaan monomer, bincangkan 2 faktor dalam menentukan tahap pempolimeran semasa pempolimeran langkah.

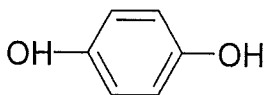
(30 marks/markah)

- [c] Given the following monomers used to produced a crosslink network of polyethylene terephthalate. Calculate average molecular weight M_n at extend of reaction of 30%, 90% and 98%.

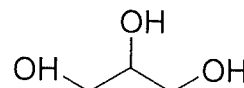
Diberi monomer-monomer berikut untuk menghasilkan rangkaian sambungsilang polietilena tereftalat. Kira purata berat molekul M_n pada tahap pempolimeran 30%, 90%, 98%.



Glycol (1 mole)



terephthalic acid (1 mole)

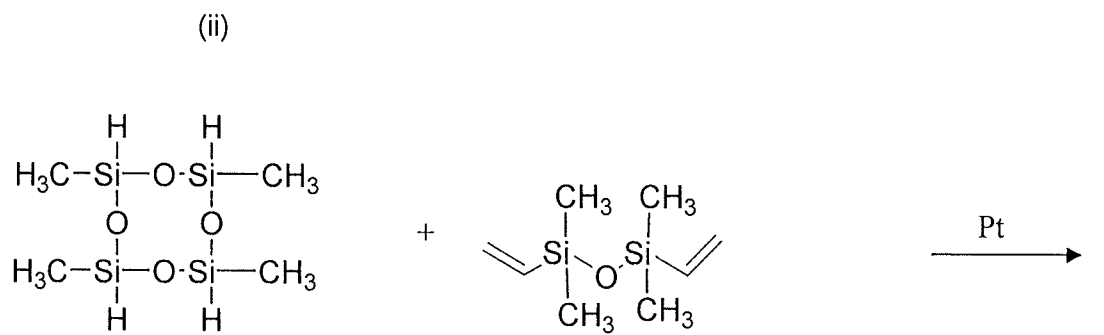
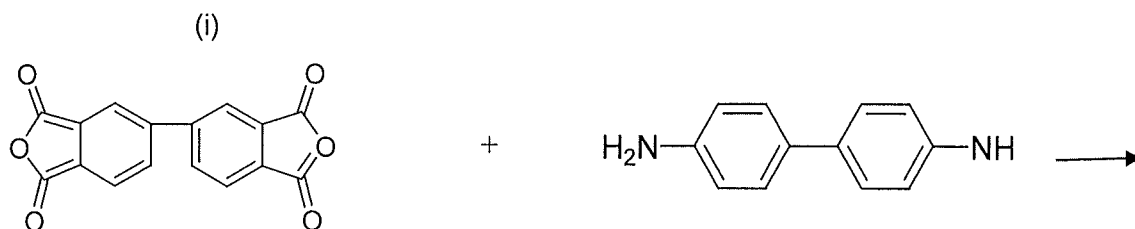


Glycerine (0.3 mole)

(50 marks/markah)

5. [a] Determine the product of polymerization of the following starting monomers:

Tentukan hasil pempolimeran bagi monomer pemula yang berikut:

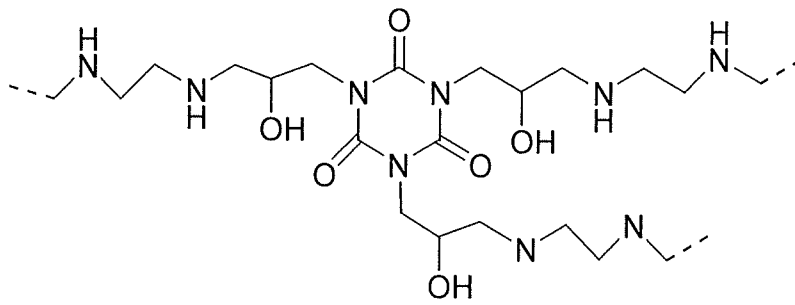


(50 marks/markah)

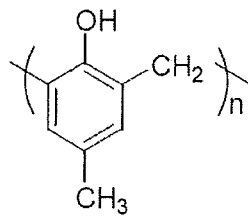
[b] Determine the starting monomers of the following polymeric product:

Tentukan monomer pemula bagi menghasilkan polimer yang berikut:

(i)



(ii)



(50 marks/markah)

PART C / BAHAGIAN C

6. [a] Explain on residence time distribution (RTD) and describe how to determine RTD experimentally.

Jelaskan terhadap pengedaran masa tinggal dan terangkan bagaimana untuk menentukan pengedaran masa tinggal melalui eksperimen.

(20 marks/markah)

- [b] Chemical reactors are vessels designed to contain chemical reactions. Three commonly used reactors are batch reactor, continuous stirred tank reactor and plug flow reactor. Differentiate these reactors in term of principles of working and advantages.

Reaktor-reaktor kimia adalah tangki yang direkabentuk mengandungi tindakbalas kimia. Tiga reaktor yang biasa digunakan ialah 'batch reactor', 'continuous stirred tank reactor' dan 'plug flow reactor'. Bezakan reaktor-reaktor ini berdasarkan kepada prinsip kerja dan kelebihan.

(60 marks/markah)

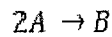
- [c] Reactors are designed based on different mode of operation such as batch or continuous process. Sketch a diagram of these process.

Reaktor-reaktor direkabentuk berdasarkan kepada mod operasi yang berbeza seperti kumpulan ataupun berterusan. Lakarkan gambarajah proses-proses ini.

(20 marks/markah)

7. The following elementary, gas phase reaction takes place in a Plug Flow Reactor (PFR).

Berikut adalah reaksi fasa gas yang berlaku di dalam "Plug Flow Reactor".



The reactor is fed with a mixture of a reactant A and inert diluent I at feed rates N_{Af} and N_{If} at total molar concentration c_f . The feed conditions and rate constant are

Campuran reaktan A dan pencair lengai I dimasukkan ke dalam reaktor pada kadar masuk N_{Af} dan N_{If} pada jumlah molar kepekatan c_f . Kondisi masuk dan kadar berterusan ialah

$$c_f = 0.2 \text{ mol/L}$$

$$N_{Af} = 2.0 \text{ mol/min}$$

$$\frac{N_{If}}{N_{Af}} = 3$$

$$k = 20 \text{ L/mol.min}$$

The pressure and temperature are constant in the PFR, and the gas may be assumed to behave as an ideal mixture.

Tekanan dan suhu adalah malar di dalam PFR dan gas dianggap adalah campuran ideal.

- [a] Write a balance for the steady state molar flow of A, N_A .

Tulis keseimbangan bagi aliran molar keadaan mantap A, N_A

(40 marks/markah)

- [b] What reactor size is required to achieve 85% percent conversion?

Apakah saiz reaktor yang diperlukan bagi mencapai 85% tukaran?

(30 marks/markah)

- [c] Determine what happen to this reactor if

- (i) The rate constant is double
- (ii) The feed flows are double but the feed concentration is constant
- (iii) The feed concentration is double but the feed flows is constant

Tentukan apakah yang terjadi kepada reaktor jika

- (i) *kadar malar menjadi dua kali ganda*
- (ii) *Aliran masuk adalah dua kali ganda tetapi kepekatan masuk adalah malar*
- (iii) *Kepekatan masuk adalah dua kali ganda tetapi aliran masuk adalah malar*

(30 marks/markah)

