THE OPEN UNIVERSITY OF SRI LANKA

B Sc Degree/ Stand Alone courses in Science

LEVEL 5 - ASSIGNMENT TEST I 2015/2016

CMU 3233– POLYMER CHEMISTRY

DURATION : One Hour

DATE : 15th May 2016 TIME : 09.00 a.m -10.00 a.m

This Assignment test paper consists of two parts, A and B. Part A consists of 10 MCQ and part B consists of two structured type questions. You need to hand over only part B with the MCQ answer sheet.

- Answer all questions
- Choose the most correct answer to each question and mark a cross" X" over the answer on the given answer sheet.
- Use a PEN (not a pencil) in answering.
- Any answer with more than one cross will not be counted.
- 1/6th marks will be deducted for each incorrect answer
- The use of a non – programmable electronic calculator is permitted.
- Logarithm tables will be provided.
- Mobile phones are not allowed.

Avogadro constant , (L)	$= 6.022\times10^{23}$ mol^{-1}
Plank constant, (h)	$= 6.63 \times 10^{-34}$ Js
Velocity of light, (c)	$= 3 \times 10^{8}$ ms^{-1}
Standard atmospheric pressure,(π)	$= 10^{5}$ Pa(Nm^{-2})
Gas Constant (R)	= 8.314 J mol^{-1} K^{-1}
Faraday constant (F)	= 96,500 C mol^{-1}
Log_e (x)	= 2.303 Log_{10} (x)

PART A – Answer all questions. (30 marks)

01. What is the functionality of $HO\text{-}CH_2\text{-}CH_2\text{-}CH_2\text{-}COOH$?

1) 0 2) 1 3) 2 4) 3 5) 4

02. What statement is **incorrect?**
1) Monomers contain two or more functional groups.
2) Olefins and acetylenes can act as monomers.
3) Phenol has only two reactive sites
4) Polymers take longer time for dissolution.
5) Polymers do not have saturated points.

03. What type of initiator/s can be used to polymerize styrene?
1) Anionic. 2) Cationic. 3) Free radical. 4) Anionic and cationic
5) All types of initiators.

04. Syndiotactic polymers can be represented as
1) ~~ d d d d d d d ~~ 2) ~~ l l l l l l l ~~ 3) ~~ d l d l d l d l ~~
4) ~~ l d l d l d l d ~~ 5) ~~ d d d d d l l l d ~~

05. What statement is **not true** about Ziegler – Natta catalyst?
1) It is mainly used to produce stereo regular polymers.
2) It consists of two components.
3) Catalyst part consists of halides of group 4-7 elements.
4) Co – catalysts part consists of organometallic compounds.
5) It catalyses olefins and dienes only via monometallic mechanism.

06. What statement is **not** true about solution polycondensation?
1) Monomers are dissolved in a suitable inert solvent and condensed.
2) The solvent serves as an entrapping agent for the by-products formed.
3) Removal of by-product is not easy.
4) Low molar mass polymer is formed.
5) Easy to control the temperature

07. Consider following statements regarding bulk polymerization?
(a). The monomer is in the liquid state.
(b) Chain transfer agent is added to control the molar mass.
(c) Auto acceleration takes place.

The correct statement/s is/are
1. (a) only. 2. (b) only. 3. (c) only. 4. (a) and (c) only 5. all of above.

08. Above T_g, the polymer is in the
(a) rubbery state (b) visco-elastic state (c) Glassy state (d) solid state
(e) visco-fluid state

The correct statement/s is/are
1) (a) and (b) only. 2) (b) and (c) only. 3) (c) only.
4) (a), (b) and (c) only 5) (b), (d) and (e) only.

09. T_m can be measured using
1) IR Spectroscopy 2) NMR spectroscopy 3) Thermal analysis
4) X-Ray diffraction 5) All of above.

10. For unsymmetrical polymers, the correlation between T_g and T_m can be represented as

1) $T_g = \frac{1}{2}T_m$ 2) $T_m = \frac{1}{2}T_g$ 3) $T_g = \frac{2}{3}T_m$ 4) $2T_m = \frac{2}{3}T_g$ 5) $T_g = \frac{1}{3}T_m$

PART B – Answer all questions only in the space provided. Attached sheets will not be graded. (70 marks)

01. (a)i. What is meant by a functionality of a monomer?

(03 marks)

ii. Can any molecule act as a monomer? Explain.

(04 marks)

iii. What are the differences among mono-functional molecules, bi-functional and tri-functional monomers? Give examples to each.

(09 marks)

(b) i. What is meant by "Autoacceleration" ? Explain.

(04 marks)

ii. What are the differences between suspension and emulsion polymerization techniques?

(08 marks)

(c) i. What are the constituents of Zeiglar-Natta catalyst?

(05 marks)

ii. Why is Zeiglar-Natta catalyst important?

(03 marks)

02. (a) i. What is the difference between homo polymers and copolymers?

(04 marks)

ii. Write down the types of copolymers and explain their structural differences..

(12 marks)

(b) i. List down **five** factors that affect the crystallinity of polymers?

(10 marks)

ii. How does the crystallinity change the physical properties of polymers? Explain.

(08 marks)

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B.Sc DEGREE/STAND ALONE COURSE IN SCIENCE - LEVEL 5
Assignment Test I – 2015/2016
CMU 3233 - POLYMER CHEMISTRY

MCQ ANSWER SHEET: Mark a cross (x) over the most suitable answer.

Registration No. | | |

		Marks
Unanswered		
Correct Answers		
Wrong Answers		
Total		

1.	1	2	3	4	5	2.	1	2	3	4	5	3.	1	2	3	4	5
4.	1	2	3	4	5	5.	1	2	3	4	5	6.	1	2	3	4	5
7.	1	2	3	4	5	8.	1	2	3	4	5	9.	1	2	3	4	5
10.	1	2	3	4	5												

Registration Number:.....

Name:.....

Address:.....

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THE OPEN UNIVERSITY OF SRI LANKA

B Sc Degree/ Stand Alone courses in Science

CMU 3233– POLYMER CHEMISTRY

ANSWER GUIDE: CAT I (2015/2016)

PART A: (MCQ)

1. 3	**2. 3**	**3. 5**	**4. 3 or 4**	**5. 5**
6. 3	**7. 5**	**8. 1**	**9. 5**	**10. 3**

PART B:

01. (a) i. Number of functional groups present in the monomer.

ii. No. To act as a monomer, molecules should have two or more reactive sites.

iii. Mono-functional molecules – Molecules having one reactive site.

Cannot act as a monomer. Example: CH_3COOH

Bi-functional monomers – Molecules having two reactive sites.

Can act as monomers. Example: $HO\text{-}CH_2\text{-}COOH$

Tri-functional monomers – Molecules having three reactive sites.

Can act as monomer. Example: Phenol

(b) i. Autoacceleration – With the increase of viscosity, the diffusability of the growing polymer chain is restricted and chain collision becomes difficult. As a result, active sites accumulate and the rate of polymerisation increases enormously.

ii.

Suspension Polymerisation	Emulsion Polymerisation
Requires longer duration for very high conversions.	Requires shorter duration for very high conversions.
Monomer is suspended in water in the form of tiny droplets.	Monomer is dispersed in water as an uniform emulsion.
Surface active agents are used.	Emulsifying agents are used.
Polymer is produced as a suspension of very small pearls or beads.	Polymer produced is dispersed uniformly in the aqueous phase, that is forming a latex.
Polymer can be isolated by filtration.	Polymer can be isolated form the latex by destabilizing latex, spray drying or freezing.

(c) i. Catalyst – Halides of gp 4-7 elements

Co-catalyst – Organometallic compounds

such as alkyls, aryls and hydrides of gp 1-4 metals

ii. To produce stereo-regular polymers.

To polymerize olefines.

02. (a) i. Homo polymers consist of only one type of repeat unit where as copolymers consist of more than one type of repeat unit.

ii. 1. Random copolymers – Two monomers are arranged in a random manner.

-A-A-A-A-B-B-A-B-B-

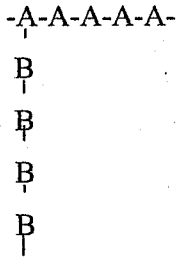
2. Alternative copolymer – Two monomers are added to alternative to each other.

-A-B-A-B-A-B-

3. Block copolymer – Block of one monomer and a block of another monomer are connected.

-A-A-A-A-B-B-B-B-

4. Graft copolymer – Existing polymer react with another monomer.



(b) i. Symmetry of polymers

Intermolecular bonding

Helix structure

Tacticity

Branching and molecular mass

Chain flexibility and steric factor

ii. Crystalline polymers are actually semi crystalline. Therefore, the properties of polymers depend on the percentage crystallinity or degree of cystallinity.