THE OPEN UNIVERSITY OF SRI LANKA

B Sc Degree/ Stand Alone courses in Science

LEVEL 5 - ASSIGNMENT TEST II 2015/2016

CMU3233– POLYMER CHEMISTRY

DURATION : One Hour

DATE : 02nd October 2016 TIME : 13.00 p.m. to 14.00 p.m.

This Assignment test paper consists of two parts, part 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.

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)	$= 2.303\ \text{Log}_{10}$ (x)

PART A – Answer all questions. (30 marks)

(1). Polydispersity factor can be expressed using number average molar mass, $\bar{M}_n$ and weight average molar mass, $\bar{M}_W$ as

1. $\bar{M}_n$ - $\bar{M}_W$ 2. $\bar{M}_W$ / $\bar{M}_n$ 3. $\bar{M}_n$ / $\bar{M}_W$ 4. $\bar{M}_W$ - $\bar{M}_n$ 5. $\bar{M}_W \times \bar{M}_n$

(2). Polydispersity factors of five polymer samples, A, B, C, D and E are 1.1, 1.4, 2.1, 3.2 and 3.5 respectively. Which sample has the narrowest molar mass distribution curve?

1. A 2. B 3. C 4. D 5. E

(3). Which statement is true about swelling of polymers?

1. Can be increased by increasing temperature.
2. Can be decreased by stirring.
3. Can be enhanced by increasing surface areas.
4. Can be enhanced by incorporating polar groups such as CN.
5. Depends on interactions among polymer molecules.

(4). Consider following statements regarding Gel Permeation Chromatography. Which statement is true?

1. This technique can be used to separate polymers into monodispersed samples.
2. Chromatographic column is filled with porous ionic gel beads.
3. The areas of pores are bigger in size than polymer molecules.
4. Need to select a solvent to wash and fill the column different from the polymer dissolved.
5. Larger molecules take longer time to permeate through the column.

(5). Which of the following statements is **not true** about end group analysis?

1. Used to calculate $\bar{M}_n$ of polymer samples.
2. Polymers must contain reactive functional groups at one or both ends of the polymer.
3. Suitable for highly branched polymers.
4. Difficult to find a suitable solvent to dissolve polymers.
5. Time consuming.

(6). Oxidative degradation results in

(a) hardening of polymers
(b) discolouration of polymers
(c) surface changes of polymers

The correct statement/s is/are

1. (a) only 2. (b) only 3. (c) only
4. (a) and (c) only 5. all of above.

(7). Consider following statements regarding cure reactions.

(a) Highly branched polymers undergo these reactions.
(b) Flexible polymers with low molecular mass are formed.
(c) Results in a three dimensional network structure.

The correct statement/s is/are

1.(a) only 2. (b) only 3. (c) only
4. (a) and (c) only 5. all of above.

(8). Which statement is true about poly (vinyl) chloride?

1. Can be manufactured by suspension polymerization of vinyl chloride monomer.
2. Can be manufactured by emulsion polymerization of vinyl chloride monomer.
3. One of the cheapest plastic.
4. Hard material.
5. All of above.

(9). Which statement is **not true** about field latex?

1. It is a colloid. 2. Iso-electric point lies between 4.5-5.0.
3. It undergoes auto coagulation. 4. Acetic acid is used as a common preservative.
5. It contains 69% of water.

(10). Additive/s used in plastic formulation is/are

1. Fillers. 2. Colourants. 3. Plasticizers.
4. Anti-degradants. 5. All of above.

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B.Sc DEGREE/STAND ALONE COURSE IN SCIENCE - LEVEL 5
ASSIGNMENT TEST II – 2015/2016
CMU3233 – POLYMER CHEMISTRY

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

Registration No.

		Marks
Unanswered		
Correct Answers		
Wrong Answers		
Total		

PART A

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												

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 intrinsic viscosity?

(05 marks)

ii. How do we experimentally measure it? Explain the experimental procedure.

(10 marks)

(b) i. Polystyrene sample consists of three fractions with the molar ratio 0f 3:2:1. If the molar masses of three fractions are 15, 000 g/mol, 20,000 g/mol, and 35,000 g/mol respectively, calculate the Number average molar mass, $\bar{M}_n$ of the sample.

(15 marks)

ii. Calculate the number average degree of polymerization of above polystyrene sample.

(10 marks)

02. (a) i. What are foaming agents?

(05 marks)

ii. Explain how rigid forms are formed?

(05 marks)

iiii. What do you mean by virgin polymers?

(05 marks)

(b) i. "Polyethylene is more resistant to oxidation than polypropylene". Justify the statement.

(05 marks)

ii. What do you mean by mechanical degradation? State its importance.

(05 marks)

iii. What changes can be observed after mechanical degradation?

(05 marks)

Registration Number:.....

Name:.....

Address:.....

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B Sc Degree/ Stand Alone courses in Science
Level 5 - POLYMER CHEMISTRY (CMU3233)
ASSIGNMENT TEST II 2015/2016 (Answer Guide)

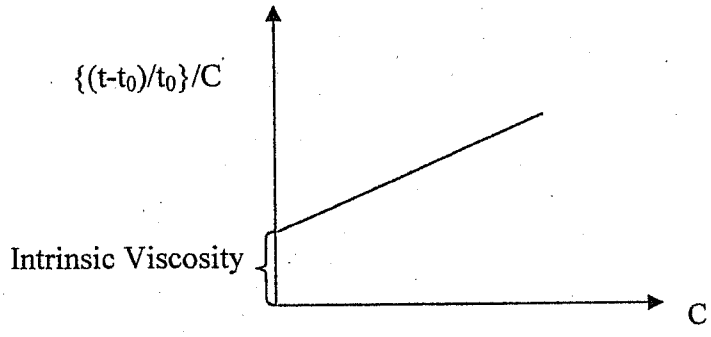
PART A –

(01) 2, **(02)** 1, **(03)** 3, **(04)** 1, **(05)** 3, **(06)** 5, **(07)** 3, **(08)** 5, **(09)** 4, **(10)** 5.

PART B –

01. (a) i. It is the viscosity of a polymer at zero or very low concentration.
ii. By Viscometry Using a viscometer – Draw and label

Dissolve polymer to prepare a dilute solution using a suitable solvent. Sample is sucked in to the tube until the meniscus of the solution is above the graduation. Sample is allowed to flow under gravity through standardized bore. The time taken for the meniscus to pass between two graduations is recorded. Wash out polymer solution by the solvent and repeat with different concentrations. Record the time for each concentration and measure the time taken for pure solvent.



(b) i. $n_1 : n_2 : n_3 = 3 : 2 : 1$ $n_1/n_2 = 3/2$, $n_2/n_3 = 2/1$ $n_1 = 3n_2/2$ $n_3 = n_2/2$

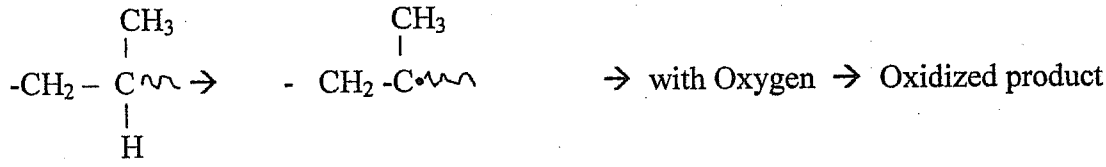
$$\bar{M}_n = \frac{\frac{3}{2}n_2 M_1 + n_2 M_2 + \frac{n_2}{2} M_3}{\frac{3}{2}n_2 + n_2 + \frac{n_2}{2}} = \frac{\frac{3}{2}M_1 + M_2 + \frac{M_3}{2}}{\frac{3}{2}+1+\frac{1}{2}} = \frac{3M_1 + 2M_2 + M_3}{3+2+1}$$

$$= \frac{(3\times 15{,}000) + (2x20{,}000) + (1x35{,}000)}{6} = \mathbf{20{,}000\ g/mol}$$

ii. $\bar{M}_n = \left[\bar{D}\right]_n . M$, Here 20,000 g/mol $= \left[\bar{D}\right]_n \times 104$ g/mol $\rightarrow$ $\left[\bar{D}\right]_n = \mathbf{192}$

2. (a) i These are the substances used to produce expanded or spongy polymeric materials. They are low boiling solvents or certain chemical compounds.
ii. A polystyrene bead embedded with 5-8% of n-pentane is treated under heat and pressure. Low boiling pentane vapour causes styrene beads to expand to about 40 times of the original size.
iii. Polymers in their pure form as obtained from producing plants after isolation and purification are called virgin polymers.

(b) i. Polypropylene forms free radicals and, they are stabilized by hyperconjugation.



But there is no such formation in polyethylene.

ii. A process of which, a polymer is subjected to a mechanical force such as mastication, agitation, grinding, or extrusion to break molecules to form molecules with lower molar masses. Easy to mix with other ingredients.

iii. Size becomes smaller. Viscosity decreases to make a soft solid.