



THE OPEN UNIVERSITY OF SRI LANKA  
B.SC DEGREE/STAND ALONE COURSES IN SCIENCES - 2007/2008  
CHU 3238/CHE 5238 - POLYMER CHEMISTRY - LEVEL 5  
ASSIGNMENT TEST - I

DURATION: 1½ Hours

Date: 26<sup>th</sup> November 2007

Time: 3.30 p.m. - 5.00 p.m.

- Answer all questions
- Choose the most correct answer to each question and mark this answer with an 'x' on the answer script.
- Use a PEN (not a pencil) in answering.
- Any question with more than one answer will NOT be counted.
- 1/6<sup>th</sup> marks will be deducted for each incorrect answer.
- The use of a non-programmable electronic calculator is permitted.
- Logarithm tables will be provided.

Gas constant (R)	= 8.314 J <sup>1</sup> mol <sup>-1</sup> K <sup>-1</sup>
Avogadro constant (L)	= 6.023 x 10 <sup>23</sup> mol <sup>-1</sup>
Planks constant (h)	= 6.63 x 10 <sup>-34</sup> Js
Velocity of light (C)	= 3.0 x 10 <sup>8</sup> ms <sup>-1</sup>
Atmospheric pressure (π)	= 10 <sup>5</sup> Pa (Nm <sup>-2</sup> )
Faraday constant (F)	= 96,500 C mol <sup>-1</sup>
Log <sub>e</sub> (X)	= 2.303 log <sub>10</sub> (X)

## Part A

### Answer all questions

- 1) Polymer based industries in Sri Lanka are  
a) Fiber                      b) Paint                      c) Rubber                      d) Plastic                      e) Adhesives  
The correct statements are  
(1) a c d                      (2) b c d                      (3) a b e                      (4) c d e                      (5) all
- 2) Which of the following molecules can act as monomers?  
a)  $\text{CH}_3\text{CH}=\text{CH}_2$                       b)  $\text{CH}_3\text{COOH}$                       c)  $\text{HO}-\text{CH}_2-\text{COOH}$   
d)  $\text{H}_2\text{N}-\text{CH}_2\text{CH}_2-\text{COOH}$                       e)  $\text{CH}_3\text{CH}_2\text{OH}$   
The correct molecules are  
(1) a c d                      (2) a b c                      (3) b c d                      (4) c d e                      (5) b d e
- 3) If the molar mass of polystyrene is  $10,402 \text{ gmol}^{-1}$ , number of repeat units in this polystyrene is  
(1) 200                      (2) 100                      (3) 2000                      (4) 1000                      (5) 300
- 4) Ziegler-Natta catalyst is  
(1) Ti / Al                      (2) Al /  $\text{TiCl}_3$                       (3)  $\text{Al}(\text{CH}_3)_3$  /  $\text{TiCl}_3$   
(4) HCl /  $\text{AlCl}_3$                       (5) None of the above
- 5) The one which cant be polymerized is  
(1)  $\text{CH}_2=\text{CHCN}$                       (2)  $\text{CH}\equiv\text{CH}$                       (3)  $\text{CH}_2=\text{CH}_2$   
(4)  $\text{CH}_3-\text{CH}=\text{CH}_2$                       (5)  $\text{HO}-\text{CH}_2\text{CH}_2-\text{OH}$
- 6) Both styrene and polystyrene have  
(1) same melting point  
(2) same boiling point  
(3) same solubility  
(4) same density  
(5) different properties from each other
- 7) Acrylonitrile undergoes  
(1) cationic polymerization only  
(2) free radical polymerization only  
(3) anionic polymerization only  
(4) free radical and anionic polymerization  
(5) free radical and cationic polymerization
- 8) Termination in free radical polymerization can take place by  
a) combination                      b) disproportionation                      c) chain transfer                      d) inhibitors  
The correct statements are  
(1) a b c                      (2) a c d                      (3) b c d                      (4) a b d                      (5) all of above

9) Radicals formed in the free radical polymerization can be stabilized by

- (1) resonance
- (2) UV light
- (3) hyperconjugation
- (4) resonance and hyperconjugation
- (5) none of the above

10) Living polymers are produced by

- (1) Ziegler Natta catalyst
- (2) anionic polymerization
- (3) cationic polymerization
- (4) free radical polymerization
- (5) polycondensation



11) When acrylonitrile is reacted with polystyrene, the copolymer produced is

- (1) graft
- (2) block
- (3) random
- (4) alternative
- (5) none of the above

12) Very broad molar mass distribution results in which polymerization technique?

- (1) solution
- (2) suspension
- (3) bulk
- (4) emulsion
- (5) none of the above

13) Heat dissipation is difficult in which polymerization technique?

- (1) solution
- (2) suspension
- (3) emulsion
- (4) bulk
- (5) all

14) Ziegler Natta polymerization can be explained by

- (a) free radical polymerization
- (b) ionic polymerization
- (c) bimetallic mechanism
- (d) monometallic mechanism

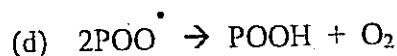
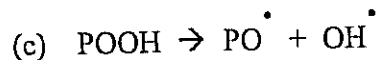
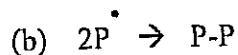
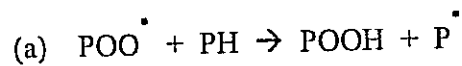
The correct statements are

- (1) a and b only
- (2) c and d only
- (3) b and c only
- (4) a and d only
- (5) a, c and d only

15) Using low concentration of accelerator and activator relative to sulphur in the vulcanization of rubber favours

- (1) a monosulphide cross linked structure
- (2) low degree of cross links structure
- (3) high degree of cross linking
- (4) a product with a thermal stability
- (5) a product with good physical properties

Consider the following steps of oxidation degradation of polymer P to answer questions from 16 to 18.



16) The initiation step/s is/are

(1) a only

(3) e only

(5) a, c and d only

(2) c only

(4) a and d only

17) The propagation step/s is/are

(1) a only

(3) b and d only

(5) a, d and e only

(2) a and c only

(4) c and d only

18) The termination step/s is/are

(1) a only

(3) a and c only

(5) a, d and e only

(2) b and d only

(4) c and d only

19) Antioxidants are incorporated to polymers to prevent

(1) thermal degradation

(2) photo degradation

(3) mechanical degradation

(4) hydrolytic degradation

(5) oxidative degradation

20) During vulcanization process, the molar mass of rubber

(1) decreases

(2) increases

(3) double that of the original mass

(4) tripple that of original mass

(5) no change



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POLYMER CHEMISTRY – Level 5 -CHU 3238/CHE 5238

ASSIGNMENT TEST I

M.C.Q. ANSWER SHEET: Mark a cross (X) over the most suitable answer.

Name: .....

Reg. No.

FOR EXAMINERS USE	
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
- 11.  1  2  3  4  5
- 12.  1  2  3  4  5
- 13.  1  2  3  4  5
- 14.  1  2  3  4  5
- 15.  1  2  3  4  5
- 16.  1  2  3  4  5
- 17.  1  2  3  4  5
- 18.  1  2  3  4  5
- 19.  1  2  3  4  5
- 20.  1  2  3  4  5

**Part B**

Answer all questions only in the space provided. Attached sheets will not be graded.

1. (a) Write down three basic steps for free radical polymerization of  $\text{H}_2\text{C}=\text{CHBr}$ . (use  $\text{I}_2$  as the initiator)

(b) What do you mean by copolymers?

(c) Briefly explain different types of copolymers.

(d) Write a brief account on suspension polymerization.

2. (a) What are the chemicals essential for rubber vulcanization?

(b) Explain the role of them in the vulcanization process.

(c) Explain the term mastication by using rubber as the polymer. What is the importance of it?



(d) How do you prevent photo degradation? Explain two methods.

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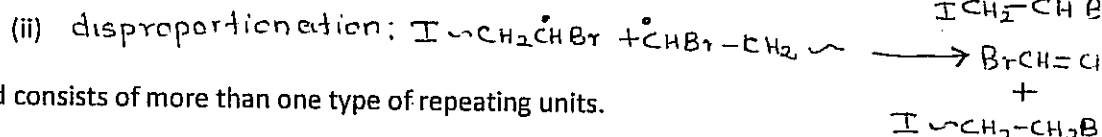
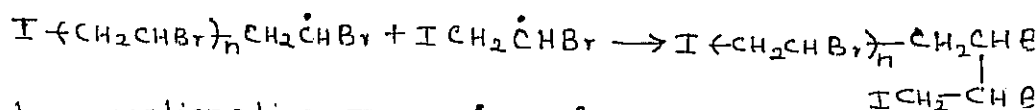
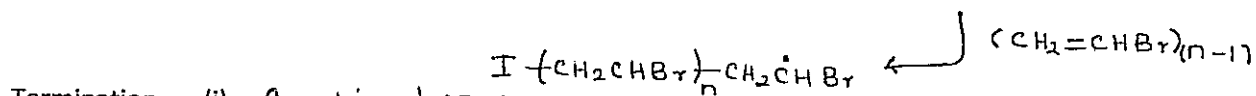
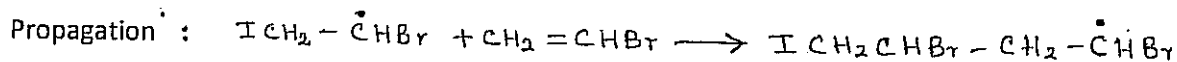
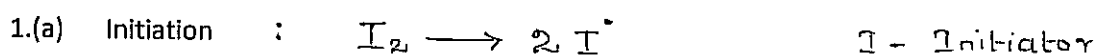
ASSIGNMENT TEST I

PART A

ANSWER SHEET

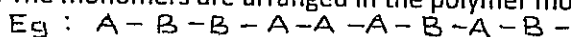
- (1) 5 (2) 1 (3) 2 (4) 3 (5) 2 (6) 5 (7) 4 (8) 5 (9) 4 (10) 2 (11) 1 (12) 3 (13) 4  
 (14) 2 (15) 2 (16) 3 (17) 2 (18) 2 (19) 5 (20) 2

PART B

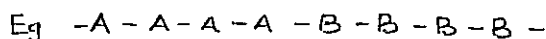


(b) The polymer formed consists of more than one type of repeating units.

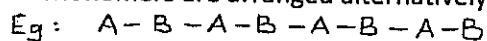
(c)(1) Random copolymer: The monomers are arranged in the polymer molecule in a random way.



(2) Block copolymer: This polymer contain a block of one monomer unit joining to the block of the second monomer unit.



(3) Alternative copolymer: Monomers are arranged alternatively in a regular fashion.



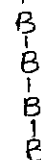
(4) Graft copolymer: Polymerisation is carried out between a monomer and an existing polymer. First, the monomer is polymerized and then joined to the existing polymer chain. Eg: A-A-A-A-A-A

(d) (i) Only water insoluble monomers can be polymerized.

(ii) The monomer is suspended in water in the form of droplets.

(iii) Initiators are water soluble.

(iv) Polymer is produced as a suspension of very small pearls or beads in water.



Disadvantage: Removal of surface active agent is difficult.

- Advantages:**
1. Economical process
  2. Heat dissipation is easy.
  3. Control chain length.
  4. Hundred Percent conversion of monomer.

2. (a) Sulphur, Accelerator, Zinc Oxide,, Stearic acid

(b) Sulphur : for vulcanization

Accelerator : to increase the rate of vulcanization

Zinc oxide/Stearic acid : to activate the vulcanization reaction

(c) When a rubber is subjected to a mechanical force such as mastication, agitation, extrusion which breaks the molecules, lowering molar mass. As a result viscosity decreases. So that the chemicals such as sulphur, accelerators etc are added and properly mixed with rubber.

(d) (1) **Light screeners:** These are surface coating paints which prevent the penetration of UV light into the polymer.

(2) **UV absorbers Or Photo stabilizers :** This is to absorb UV radiation and dissipate the energy thus absorbed to the environment in some harmless form.