



UNIVERSITY COLLEGE TATI (UC TATI)

FINAL EXAMINATION QUESTION BOOKLET

COURSE CODE : BPE 1164
COURSE : INTRODUCTION TO POLYMERS
SEMESTER/SESSION : 1-2022/23
DURATION : 3 HOURS

Instructions:

1. This booklet contains **5** questions. Answer **ALL** questions.
2. All answers should be written in answer booklet.
3. Write legibly and draw sketches wherever required.
4. If in doubt, raise your hands and ask the invigilator.

DO NOT OPEN THIS BOOKLET UNTIL YOU ARE TOLD TO DO SO

THIS BOOKLET CONTAINS 4 PRINTED PAGES INCLUDING COVER PAGE

QUESTION 1 (20 MARKS)

Polymerization is used in order to obtain variety of long chain polymers.

- a) Polyethylene terephthalate (PETE) is used as containers and known as polyester when used for fabric or fiber applications.

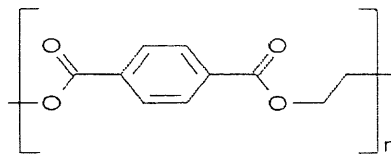


Figure 1: PETE

- i. Indicate the complete equation (structures) in producing PETE by using dehydration reaction. (8 marks)
- ii. State two (2) reasons why PETE material becomes the main choice in packaging. (2 marks)
- b) Free radical reaction is one of addition polymerization. Discover the mechanism on how the polypropylene ($\text{CH}_2=\text{CHCH}_3$) is synthesized from its monomer. Use hydrogen peroxide, HOOH as initiator. (10 marks)

QUESTION 2 (20 MARKS)

Despite the excellent characteristics of the polymers, the environmental aspect becomes the issue due to the disposal problem.

- a) Three treatment methods of waste polymer are incinerating, landfill and recycling. Express all of them in terms of *how the method is implemented, effect of method and example of polymer that can be used in each method.* (9 marks)
- b) Discuss two (2) methods that can be used in reducing waste polymer disposal problem. (6 marks)
- c) Polyvinyl chloride (PVC) is a common material used in our daily application. Discover how PVC becomes a hazard material to us. (5 marks)

QUESTION 3 (20 MARKS)

- a) i. Find the structure of polyethylene (PE). (2 marks)
 ii. Find two (2) applications of PE. (2 marks)
 iii. Outline four (4) types of engineered composites and one (1) application for each. (8 marks)

b) Given:

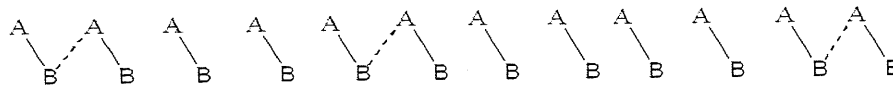
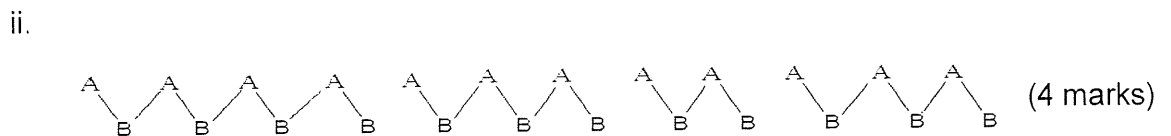
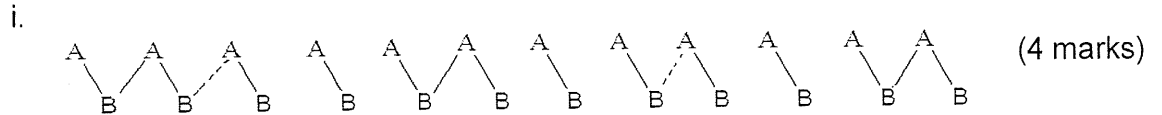


Figure 2: Unreacted polymer

Based on the structure above, interpret the degree of polymerization (DP) for each case below by using Carothers equation.



QUESTION 4 (20 MARKS)

- a) i. Distinguish the terms of *latex*, *natural rubber latex* and *natural rubber*. (6 marks)
 ii. Illustrate the chemical structure of natural rubber and name the structure. (4 marks)
- b) Polymerization is a process to produce larger structure of polymers.
 i. List two (2) types of polymerization process. (2 marks)
 ii. Present four (4) differences between two types of polymerizations that have been mentioned in (i). (8 marks)

QUESTION 5 (20 MARKS)

- a) Polypropylene (PP) is one of the most widely used commodity plastics.
- Indicate two (2) stereochemistry structures (tacticity) of PP and name the structures. (6 marks)
 - Find two (2) advantages of PP. (2 marks)
- b) Polyamide is an engineering plastic that has special products such as nylon and kevlar.
- Discuss two (2) specific applications of each products above. (4 marks)
 - Discover two (2) monomers used in making nylon-6,6 and state the name. (8 marks)

-----End of question-----