



# Technical University of Mombasa

Faculty of Applied and Health Sciences

## DEPARTMENT OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF  
TECHNOLOGY IN APPLIED CHEMISTRY (ANALYTICAL OPTION)  
BTAC 11M

### ACH 4404: POLYMER TECHNOLOGY

SEMESTER EXAMINATION

DECEMBER 2013 SERIES

2 HOURS

Instructions to candidates:

This paper consist of **FIVE** questions

Answer question **ONE** (compulsory) and any other **TWO** questions

#### QUESTION ONE

a) Define the following terms

- (i) Polymerization (2marks)
- (ii) Dimer (2marks)
- (iii) Heterogenity ratio (2marks)
- (iv) Macromolecule (2marks)

b) (i) Name **THREE** structures of macromolecules. (3marks)

(ii) Outline **FOUR** areas where polymers are used in medicine (4marks)

(iii) Explain the differences in structure between plastics and rubber that account for their physical characteristics (4marks)

c) A polymer with 300 molecules had 100 molecules with RMM of 10,000, 100 with

RMM. Of 20,000 and 100 with RMM of 30,000.

- (i) Calculate the number average molar mass **(3marks)**
  - (ii) Calculate the mass average molar mass **(3marks)**
- d) Differentiate between addition and condensation polymerization **(5marks)**

## QUESTION TWO

- a) Starting with  $I_2$  and  $CH_2CHR$  monomer
- (i) Show the initiation process using equations **(4marks)**
  - (ii) Describe the propagation process **(4marks)**
  - (iii) Using chemical reactions show TWO fermentation processes. **(6marks)**
- b) Show how nylon 6,6 is produced starting with 1,6 diamine hexane and hexane 1,6 diomic acid **(6marks)**

## QUESTION THREE

- a) Explain how the following factors affect glass transition temperature
- (i) Side group effects **(3marks)**
  - (ii) Symmetry **(3marks)**
  - (iii) Chain flexibility **(3marks)**
  - (iv) Steric hindrances **(3marks)**
- b) (i) Using chemical reactions show the synthesis of acrylonitrice (cyanoethane) from ethene. **(6marks)**
- (ii) What are the conditions required in (i) **(2marks)**

## QUESTION FOUR

- a) (i) Describe THREE ways used to produce chain-polymers **( 6marks)**
- (ii) What steps are common in the methods in (i) **(3marks)**
- b) (i) Show how polymerization of styrene is achieved with ethyl Lithium **(5marks)**

- (ii) How can the reaction be monitored spectroscopically **(3marks)**
- (iii) Explain why a polar solvent e.g. water is not recommended in reaction b(i) above? **(3marks)**

#### **QUESTION FIVE**

- a) Differentiate between Bulk polymerization and suspension polymerization **(10marks)**
- b) Briefly discuss the following thermal methods of polymer analysis
- (i) Thermogravimetry **(5marks)**
  - (ii) Dilatometry **(5marks)**