TECHNICAL UNIVERSITY OF MOMBASA

Faculty of Applied and Health Sciences

Department of Pure & Applied Sciences

UNIVERSITY EXAMINATION FOR:

BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY

ACH.4216: POLYMER CHEMISTRY

SPECIAL SUPPLEMENTARY EXAMINATION

SERIES: JULY 2025

TIME:2HOURS

DATE: Pick DateJul2025

Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of **FIVE** questions. Attemptquestion ONE (Compulsory) and any other TWO questions.

Do not write on the question paper.

Question ONE

a) Explain the following terms
   i) Glass transition temperature **(2 marks)**
   ii) Functionality **(2 marks)**

b) Show the mathematical relationship between
   i) Degree of polymerisation and conversion of monomer functional groups **(3 marks)**
   ii) Polydispersity and average molecular weights Mn bar and Mw bar **(3 marks)**

c) Draw the structures of various monomers that are used to form the following condensation polymers.
   i) Polyurethane **(4 marks)**
   ii) Nylon 6,6 **(4 marks)**

d) List three types of properties that depend on the degree of crystallinity of polymers. **(3 marks)**

e) Describe the dissolution of a typical polymer and related thermodynamics. **(5 marks)**

f) List any four techniques used to analyse polymeric fibres **(4 marks)**

Question TWO

a) i) Explain the dilatometric method of determination of Tg of amorphous polymers. **(3 marks)**

ii) Sketch thermomechanical curves for an amorphous polymer and crystalline polymer showing Tg and T_f on the curves **(4 marks)**

iii) Calculate the number average molecular weight of a polymer comprising of 5 moles of polymer molecules having molecular weight of 40,000 g/mol and 15 moles of polymer molecules having molecular weight of 30,000 g/mol.. **(2 marks)**

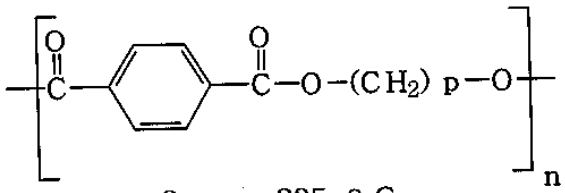
b) i) Explain the concept of copolymerization. **(2marks)**

ii) Provide with relevant examples the different types of copolymers **(6marks)**

iii) Discuss how the arrangement of monomeric units affects the physical properties of the final copolymer. **(3marks)**

Question THREE

a) Use the polyester structures below to answer the questions that follow



p = 2, mp = 235 °C

p = 4, mp = 265 °C

i) Draw and name the structure of possible monomers in each polymer that would release H_2O as the small molecule. **(6 marks)**

ii) Explain the difference in melting points **(3marks)**

iii) Explain the type of polymerisation reaction exhibited above **(3 marks)**

b) i) Explain the role of temperature and initiator initial concentration on free radical polymerization. **(2 marks)**

ii) Derive the expression for overall rate of polymerization R_p in free radical polymerization as a function of efficiency factor f assuming steady state free radical concentration $[M^{\cdot}]$. **(6 marks)**

Question FOUR

a) i) Differentiate between homopolymer and copolymers **(2 marks)**

ii) Describe the mechanism of polycondensation in the synthesis of polymers. **(3 marks)**

iii) Discuss the role of functional groups and the importance of molecular weight control in polycondensation. **(4 marks)**

b) Explain role played by the following additives in a blood pouch formulation

i) plasticiser **(2 marks)**

ii) stabilizer **(2 marks)**

iii) fillers **(2 marks)**

iv) impact modifier **(2 marks)**

c) Give three applications of acrylic fibres **(3 marks)**

Question FIVE

a) i) Explain the significance of solubility parameter δ in polymer dissolution. **(3 marks)**

ii) Describe the mathematical determination of solubility parameter δ of a substance of given structural formula. **(5 marks)**

b) i) Define the term hydrodynamic volume. **(2 marks)**

ii) Explain the variation of expansion factor in relation to hydrodynamic volume of linear and branched polymers. **(2 marks)**

c) Describe the initiation and propagation steps in typical free radical polymerization of polyethene. **(4 marks)**

d) Discuss the significance of temperature and reaction time in the kinetics of polycondensation. **(4 marks)**