



THE OPEN UNIVERSITY OF SRI LANKA  
BACHELOR OF INDUSTRIAL STUDIES/  
BACHELOR OF TECHNOLOGY  
FINAL EXAMINATION 2007/2008  
TTX5131, STRUCTURE AND PROPERTIES OF FIBRES  
DURATION THREE (3) HOURS

019

DATE:23.04.2008

TIME:0930 – 1230 HOURS

Answer Question Number one (1) which is compulsory and five (5) more questions. Question number 1 carries 25 marks and others carry fifteen (15) marks each.

01. a. What are the differences between the two man-made fibre production processes of “Wet Spinning” and “Melt spinning”? (4 marks)
- b. Give one example each for seed fibres, bast fibres, leaf fibres and fine animal fibres. (2 marks)
- c. What are the two basic polymerization mechanisms? (2 marks)
- d. What are the four requirements (or conditions required) of a monomer in order to be polymerized? (4 marks)
- e. Is the following statement true or false?  
“As a rule during polymerization of monomers, the entropy decreases and therefore most polymerization reactions are exothermic.” (2 marks)
- f. When producing nylon yarn, while all the other parameters are kept unchanged, the viscosity of the polymer used for spinning is increased, How would the tenacity of the resultant yarn be affected? Why? (4 marks)
- g. In a nylon yarn production process, if the draw ratio in the drawing process is increased, while keeping all the other parameters unchanged, how would the tenacity and elongation of the resultant yarn be affected? Why? (3 marks)
- h. Is the following statement true or false?  
“As a rule, within a chemically uniform polymer, the density of packing decreases with the increasing *degree of crystallinity*” (1 mark)
- i. What are the four types or forms of moisture present in textile fibres? (2 marks)
- j. Is the following statement true or false?  
“Swelling and dissolving behaviour of polymers is decided by the change of enthalpy and entropy and the temperature” (1 mark)

02. a) Polymers can be classified as i. Homopolymers, ii. Random copolymers, iii. Alternating copolymers, iv. Block copolymers, v. Graft copolymers, based on the chemical composition of polymer chains in terms of monomers in the polymer molecules. If A, B and C are the monomers, illustrate the chain arrangement of the above polymers i to v. **(10 marks)**
- b) Explain the difference in thermal behaviour of “thermoplastics” and “thermosets” and the reason for such behaviour. **(5 marks)**
03. a) Explain how *Dispersion Forces* and *Directional Forces* occur in molecules. Name two fibre forming polymers to illustrate the action of the two forces, indicating which group in the molecule contribute to the relevant force. **(8 marks)**
- b) Explain the following terms.  
i. Orientation ii. Degree of Orientation iii. Barrus Effect **(7 marks)**
04. What is “Drawing”? **(3 marks)**  
What are the five occurrences that take place during drawing, in relation to the yarn or fibre? **(10 marks)**  
What is the test to measure the Orientation at a single point of a fibre called? **(2 marks)**
05. a) There are three fibre materials suspected to be cotton, wool and silk. The samples are randomly marked as A, B and C. Certain tests were performed on these fibres, and the results were as follows. Identify the fibres, marked as A, B and C.

Test	Sample A	Sample B	Sample C
80% H <sub>2</sub> SO <sub>4</sub>	Dissolves	Insoluble	Dissolves to a certain extent
5% NaOH	Swells	Dissolves	Dissolves
Cupramonium Hydroxide	Slowly dissolves	swells	Dissolves slowly

**(6 marks)**

A is .....

B is .....

C is .....

b). Write short notes on the following.

i. Flame resistant Textiles **(3 marks)**

ii. Flame Retardant Textiles **(6 marks)**

06. What do you understand by "Glass Transition Temperature"? What are the factors that affect the glass transition temperature of polymers? **(15 marks)**
07. Explain the "Porous Model" and the Free Volume Model" for the diffusion of dyes into Fibre. Compare the application of these two models on Cellulose and Polyester. **(15 marks)**

rj/2007/2008

