



Department of Chemistry
Obafemi Awolowo University
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2010/2011 Session Harmattan Semester Examination

ICH 401 – Chemistry and Technology of Fibers Time Allowed: 2½ Hours

Instructions: Answer All Questions. Use separate answer booklets for each section.

Section A

- 1a Classify fibres into three (3) main categories and state the main requirement for the consideration of a material as a fibre.
- b What is the primary difference between natural fibres like cotton and wool on one hand and jute, sisal and hemp on the other?
- c What does orientation achieve in the use of fibres for textile applications and why are synthetic fibres considered more useful as fibres than natural fibres?
- d What is Glass Transition Temperature and of what use is it in garment production?
- e State the properties of cellulose that makes it suitable for fibre production and draw the structure of a portion of the cellulose fibre.
- f In what ways are acetates inferior to most other fibres?
- 2a Make a list of the major natural fibres and their sources. Which is the most suitable for a tropical climate like Nigeria and why?
- b What interesting properties does biaxial orientation of fibres provide and what properties make uniaxially oriented films suitable for package closures?
- c Draw the stress-strain curve for silk fibre and use it to explain the properties of this fibre
- d Write an equation to represent the dyeing of cotton via its free hydroxyl groups. Why does cotton and polyester fibres have high moduli?
- e Name the three chemically modified natural polymers.
- f Which was the first man-made fibre to be introduced into the fibre market and why?
- 3a Mention four (4) fibre properties that make them suitable for textile use. Why are fibres chosen to meet specific needs?
- b What is wool made up of and what is responsible for its resilience and warmth?
- c Compare and contrast wool and cotton in terms of environmental considerations. Which is better?
- d What is the principal disadvantage of cotton and what can be done to ameliorate it?

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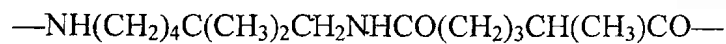
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Which is the most common process for modifying natural polymers like cellulose and what process makes cotton stable to repeated laundering and high temperature ironing that would destroy other fibres ?

- f Which polymer comes closer than any other synthetics to the properties of silk. If this polymer is to have adequate stiffness, what must be done to it?

Section B

4.(a) A new polyamide fiber has the structure,



- (i) Give the structures of the co-monomers of the polyamide.
- (ii) What is the name of the new polyamide?
- (iii) With plausible reasons, arrange in order of increasing glass transition temperature, T_g , the new polyamide, Nylon 8, Nylon 6,6 and Nylon 6.
- (iv) Using a similar procedure as that of any polyamide of your choice, give the flowchart that will be suitable for the manufacture of the new polyamide:

(b) Write the equations for the synthesis of each of the following fiber-materials :

- (i) Glospan (ii) Saran (iii) Dynel and (iv) Dacron

(c) (i) State, with reasons, the appropriate processing technique for each of 4b(i)-(iv) above

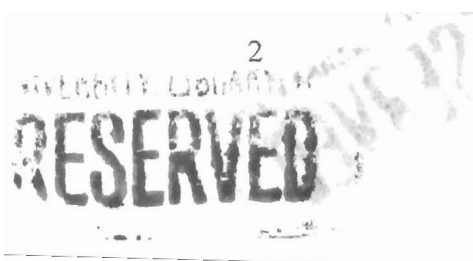
(ii) Describe in detail, without diagram, the processing technique for 4b (ii) above.

5.(a) Study carefully the table below containing the data of fibers A,B,C,D and E.

Parameter	Fibers				
	A	B	C	D	E
Solubility of main monomer	Practically insoluble	soluble in polar solvent	soluble in polar solvent	soluble in polar solvent	soluble in THF
Spinning Technique	melt	dry	dry	melt	wet
Drawing condition	hot	hot	cold	cold	cold
Modification required	wettability	aesthetics	retention of extensibility	high heat resistance	-
A manufacturing operation unit	flaking	Dissolu-tion	filtration	Dowtherm heating	filtra-tion

Using the data provided,

- (i) Identify fibers A ,B,C,D and E.



- (ii) State one industrial application of each fiber.
(iii) Briefly describe how the wettability and aesthetics problems of fibers A and B respectively, can be resolved.
(iv) Give the equations for the synthesis of each of the polymers forming fibers C,D and E.
(v) Give reasons for the choice of the spinning techniques of fibers B and D.

(b) Account for the following observations in synthetic fiber technology and applications.

- (i) Drawing of fibers is very necessary after spinning.
(ii) Low moisture absorption is a common disadvantage for synthetic fibers but it can be rectified in many of them.
(iii) There is generally loss of aesthetic properties during fiber exposure to sunlight although there is usually resistance to moth attack.

