TEXTILE INSTITUTE OF PAKISTAN

Final Examination – Spring 2008

Course Title: Fibre Science
Section(s): TS3A & B
Instructor: Aasim Ahmed
Date: May 31, 2008

Course Code: TEXT-321
Max. Marks: 40
Max. Time: 2 hours

Instructions for candidates

Please read the instructions carefully before beginning the paper.

1. This paper comprises of 6 questions. All questions are compulsory.
2. All questions should be answered in the answer booklet.
3. Candidates may take this question paper along with them at the end of the examination.
4. Begin answers to each question on a fresh sheet of paper.
5. All parts of each question should be answered in sequence. If you don't know the answer to any part, list the question number and leave space for the answer.
6. Try keeping answers concise and to the point, read each question carefully before attempting to write out any answers.
7. The number of points carried by each question is written in square brackets [ ] at the end of the question.
8. All questions, except for those that require drawings must be answered in ink. Answers in pencil will not be marked.

Best of luck!

Question 1 [5]

1a. Briefly explain the increase in versatility of fibres from natural through regenerated to synthetics. [2]

1b. Figure 1.1 shows the structure of Polyethylene, the simplest of all synthetic polymers that can be used to make fibres.

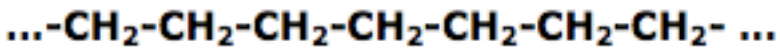

Fig 1.1

Briefly explain the difference between the polymer chains in 'High Density Polyethylene' (HDPE) and 'Ultra High Molecular Weight Polyethylene' (UHMWPE) while emphasizing on their effect on the properties of the fibres. [3]

Question 2 [8]

Figure 2.1 shows how the cuticle layers on wool can lock into adjacent fibres to cause felting.

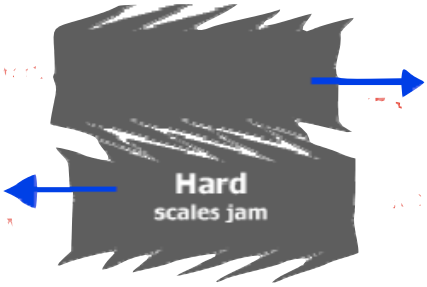

Fig 2.1

2a. This property of felting in wool can be reduced or eliminated altogether by making changes on the surface of the fibres. Explain two types of changes that can be brought about on the surface of wool fibres to achieve this. [4]
(Use appropriate diagrams to supplement your argument. Focus your answer around the physical changes that will result in the desired outcome rather than their methods of application.)

2b. Choose any one of the treatments you explained in 2a and highlight two other properties of wool fibre, yarn or fabric that might be affected due to the changes you brought about on the surface of the fibres. Give reasons as to why these properties will be affected as a result of your chosen surface modification. [4]

Question 3 [10]

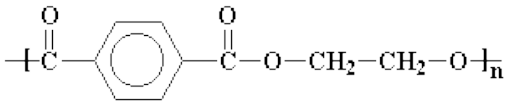

Fig 3.1a

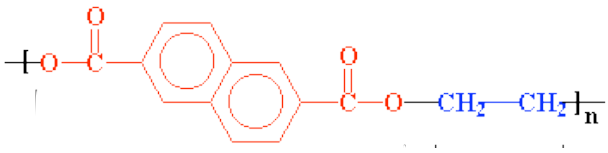

Fig 3.1b

3a. Figures 3.1a and 3.1b are both repeat units of polyester. Comment on the accuracy of this statement. [1]

3b. Based on the differences in the structures of the polymers, present a comparison of the stiffness, glass transition temperature and melting point of the polymers shown in figure 1.1a and 1.1b. [3]

3c. Figure 3.2 is a typical plot showing the tensile properties of a melt spun synthetic fibre achievable through processing.

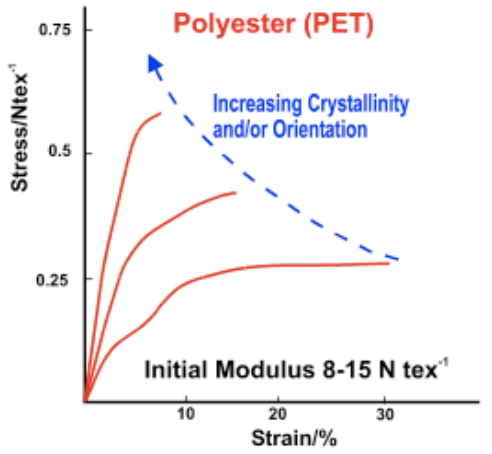

Fig 3.2

Explain how the changes in crystallinity and/or orientation denoted by the dotted arrow may be achieved during melt spinning and subsequent drawing. [2]

3d. The initial modulus of Nylon 6 is 2-5 N/tex in contrast to that of PET, shown in figure 1.2. Explain this difference in terms of the molecular structures of Nylon and PET. [2]

3e. Name one other property of PET (not shown in Fig 1.2) which might be affected as its crystallinity is increased and explain why it is affected. [2]

Question 4 [6]

Figure 4.1 shows a hollow polyester fibre called Wellkey (developed by Teijin LTD) which has micro pores on its surface that allow liquids to seep through.

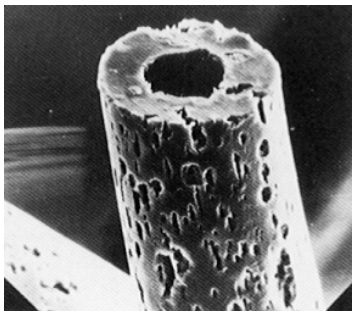

Fig 4.2

4a. Explain one functional application of a knitted fabric made with staple fibre yarn of Wellkey fibres. Your answer must include how the fibre will be able to carry out your stated application. [2]

4b. Suppose a fiber 'A' is sensitive to pressure and capable of conducting electricity when it is subject to pressure. Present one innovative use of such material and explain how it may be implemented. [2]

4c. Briefly outline how genetic engineering has opened up new frontiers production of spider silk on an industrial scale. [2]

Question 5 [6]

Figure 5.1 shows a technique for making non woven nano-fibre fabric.

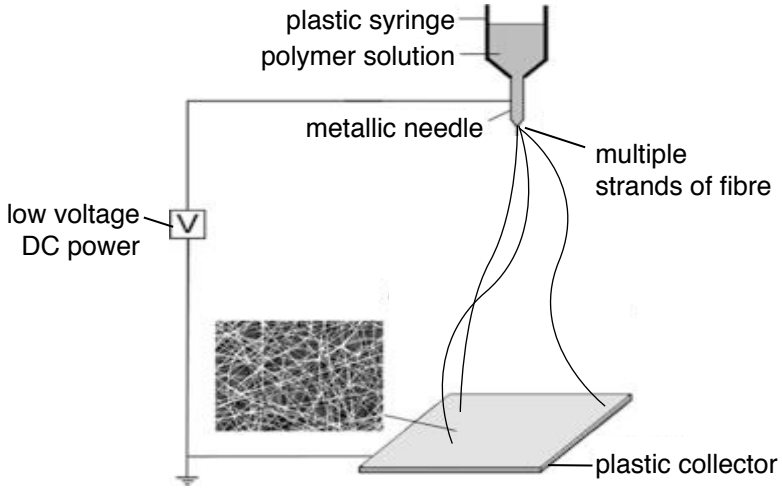

Fig 5.1

5a. Identify and correct three mistakes in figure 5.1. [3]

5b. Name the technique used to make fibres, shown in figure 5.1. [1]

5c. Explain one end use of non woven nano-fibre fabric. Your answer should be able to elucidate how the nano structure of the fabric is suited for your chosen application. [2]

Question 6 [5]

6a. From the list below, choose any **one** technical textile product and use the 'TRIC Product Development Model' to present a case study on the type of fibres that can be used to make the product. Your answer must explain how your chosen fibre will have suitable properties to perform the required functions as well explain how the fibre will be incorporated into the end product (loose fibre, special yarn or woven or knitted fabric etc.). [5]

i. Geotextile for road lining,
ii. Artificial lungs,
iii. Bulletproof vest, or
iv. Clothing for clean room (dust free room where micro electronic components are assembled)