

January 2006

Polymer and Surface Coatings Science and Technology

Level 5

ADVANCED POLYMER AND MATERIALS SCIENCE

Time allowed: 2 hours

Answer **Four** Questions

Candidates should answer Section A **and** at least one question from each of Section B and Section C.

Section A

ALL parts of this section should be attempted.

1. (a) Discuss the general factors that are of relevance to the creation and the use of polymeric materials in biomedical applications. [9]
- (b) Give details of the polymeric material types used in **two** of the following applications: [8]
 - (i) drug delivery systems;
 - (ii) ocular lens systems;
 - (iii) surgical implants.
- (c) Describe the classification of polymers according to their physical properties. Give examples for each family within your classification. [8]

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Section B

Answer at least one question from this section

2. Discuss four major techniques of polymerisation for large scale production. Your answer should include the advantages and disadvantages inherent to each technique, and highlight the most appropriate of these techniques for industrial use. [25]
3. Describe the general processes of chain-growth polymerisation, highlighting the different mechanisms available. Illustrate your answer by considering the mechanism of free radical polymerisation of styrene, highlighting the various steps involved in the reaction. [25]
4. Describe the general process of step-growth polymerisation by considering the synthesis of polyamides. Illustrate your answer with a description of the two major mechanisms available for the production of polyamides. [25]

Section C

Answer at least one question from this section

5. (a) Give, with suitable examples, the synthesis routes for the preparation of the various types of block copolymers. [9]
- (b) State the copolymerisation equation. Define the terms contained within the equation and explain their significance. [7]
- (c) Discuss developments that have taken place in the creation of polymers from liquefied wood. [9]
6. Write an essay on the theme “Additive immobilisation methods and the applications of polymer supported additives”. Your answer also should include the properties and benefits of the resulting composites and the limitations of such materials. [25]
7. (a) Give an account of **each** of the following methods for the surface modification of polymeric materials, providing details whereby the effectiveness of such treatments has been demonstrated: [16]
- (i) corona discharge treatment;
- (ii) plasma processing.
- (b) Sustainability in polymer use and production has taken on global significance in recent times. Discuss this point using the theme of “feedstock recycling of PET (poly(ethylene terephthalate))” as the basis of your discussion. [9]