

ATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCES DEPARTMENT OF APPLIED CHEMISTRY

POLYMER SCIENCE I

SCH 2107

First Semester Examination Paper

December 2015

This examination paper consists of 3 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements:

Examiner's Name: Dr C T Parekh

INSTRUCTIONS

- **1.** Answer all questions from Section A and any three from Section B. Section A carries 40 Marks and each question in Section B carries 20 marks.
- 2. Use of calculators is permissible

MARK ALLOCATION

| QUESTION | MARKS |
|----------------------|-------|
| 1. | 40 |
| 2. | 20 |
| 3. | 20 |
| 4. | 20 |
| 5. | 20 |
| TOTAL POSSIBLE MARKS | 100 |

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SECTION A:

| (b) What is the degree of polymerisation of each of the following? (i) PE with molecular weight 24976 (ii) PVC with molecular weight 27500 (iii) PS with molecular weight 6032 (6 Marks) (c) Suggest four ways by which free radical initiation reaction can be carried out. (4 Marks) (d) Draw the repeating unit of each of the following polymers: (i) polyvinyl acetate, (ii) poly(methyl acrylate), (2 Marks) (e) How can Ziegler/Natta catalyst be synthesised? Write chemical equation for one of the known catalysts. (f) Give five factors that characterise step-growth polymerisation. (f) Give five factors that characterise step-growth polymerisation. (g) Draw a possible structure of ABS if it is described as'a graft of styrene and acrylonitrile on a butadiene backbone.' (Do not use abbreviation) (4 Marks) (h) Draw structures of Nomex and Kevlar polyamide. Indicate one use of each. (4 Marks) (i) What properties distinguish a thermoplastic polymer from a thermosetting polymer? (a Marks) (j) What is the difference between a polymer and a macromolecule? 2. (a) Natural rubber is a cis-isomer of isoprene while gutta percha is the trans isomer. Write the repeating units of each of these polymers. (d) Marks) (b) Describe (i) the art of latex tapping and (ii) creaming method for concentration of rubber. (10 Marks) (c) What is the purpose of vulcanisation of rubber? Draw the structure of vulcanised rubber. | 1. | (a) Define the concept 'degree of polymerisation'. | () Marke) |
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3. (a) Taking styrene as an example, write chemical equations for the initiation, propagation and termination steps involved in anionic polymerisation of this monomer.

(10 Marks)

(b) Given the following pairs:

| Compound | Q | e |
|---------------|------|-------|
| styrene | 1.00 | -0.80 |
| Vinyl acetate | 0.03 | -0.22 |

| | Calculate r_1 and r_2 and suggest the type of polymer that will be produced. | | | |
|----------------------------|---|----------------------------|--|--|
| | (a) What do you understand by margarization? | (6 Marks) | | |
| | (c) what do you understand by mercensation? | (A Marks) | | |
| 4 . | (a) Describe how Tencel fibre is produced from wood pulp. | (+ Warks) | | |
| | (b) Spandex is synthesised from toluene diisocyanate and adipate ester 1,2-propanediol. Draw the structure of the spandex indicating ureth ester linkage. | (5 Marks) of ane and | | |
| | (a) White synthetic stars with reaction conditions for the formation of | (6 Marks) | | |
| | (c) write synthetic steps with reaction conditions for the formation of fibre from acrylonitrile. | carbon | | |
| | | (7 Marks) | | |
| | (d) Suggest with the aid of structures why polystyrene does form throut tail orientation | igh head to | | |
| | | (4 Marks) | | |
| 5. | (a) Write chemical equations for the following reactions in benzoyl pe initiated polymerisation of ethene. (i) initiation (ii) propagation (iii) termination by shein transfor | roxide | | |
| | (iii) termination by chain transfer. | (10 Marks) | | |
| | (b) Draw the labelled schematic diagram for emulsion polymerisation. | State | | |
| | advantages and disadvantages of the polymensation. | (6 Marks) | | |
| | (c) Draw the structure of PET. | (0 Iviarks) | | |
| | (d) What is the name used to describe the negatively charged counterior cationic chain reaction polymerisation? Draw the structure of the ic | (2 Marks) on in on. | | |
| | | (2 Marks) | | |
| END OF QUESTION PAPER !!!! | | | | |

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