



**NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY**

**FACULTY OF APPLIED SCIENCE**

**DEPARTMENT OF APPLIED CHEMISTRY**

**POLYMER SCIENCE II**

**FOR TTE STUDENTS ONLY**

**SCH 2207**

**First Semester Examination Paper**

**January 2015**

This examination paper consists of 4 pages

**Time Allowed: 3 hours**

**Total Marks: 100**

**Special Requirements: Graph Paper (on request)**

**Examiner's Name: DR C T PAREKH**

**INSTRUCTIONS**

1. Answer **all** questions in Section A and **any three** questions from Section B. Section A carries 40 marks and each question in Section B carries 20 marks.
2. Start each question on a new page.

**MARK ALLOCATION**

QUESTION	MARKS
1.	40
2.	20
3.	20
4.	20
<b>TOTAL</b>	<b>100</b>

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SCH 2207

**SECTION A:**

1. (a) Explain briefly “The degree of crystallinity”. (3 Marks)
- (b) Indicate four characteristics of crystallisable polymers. (4 Marks)
- (c) Differentiate between good and poor solvent. (2 Marks)
- (d) Name five factors that affect the dissolution of polymers. (4 Marks)
- (e) Describe the influence of temperature on viscosity. (4 Marks)
- (f) What do you understand by:  
(i) long range order  
(ii) short range order (4 Marks)
- (g) (i) What is T<sub>g</sub>? (3 Marks)  
(ii) List the factors affecting T<sub>g</sub>. (3 Marks)
- (h) What do you understand by:  
(i) limited swelling (2 Marks)  
(ii) Incomplete swelling (2 Marks)
- (i) What is negative swelling? (2 Marks)
- (j) What do you understand by the term ‘morphology’? (2 Marks)
- (k) How does a polymer solution differ from a micromolecule solution? (2 Marks)
- (l) What are the characteristics of a true polymer solution? (3 Marks)

**SECTION B:**

2. (a) In a solution viscosity experiment the efflux time for the pure solvent was 9.0 sec. The efflux time for the solution of different concentrations is given in the data below:

Concentration kg/M <sup>3</sup>	10	20	30	40	50
Efflux time in sec.	10	11	13	15	17

Find the viscosity average molecular weight ( $M_v$ ) of the polymer if:

$$K = 1.04 \times 10^{-3} \text{ dl/kg}$$

$$a = 1.75$$

(15 Marks)

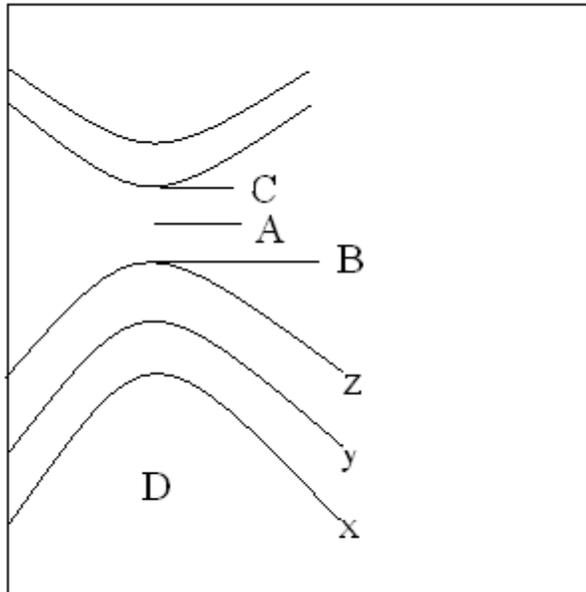
- (b) Draw a graph of stress ( $\delta$ ) against strain ( $r$ ) and show (i) viscosity increases (ii) viscosity decreases and (iii) viscosity remain constant.
- (5 Marks)
3. (a) Given the following information, calculate the solubility parameter ( $\delta$ ) of Poly(methylmethacrylate) (PMMA). Density of PMMA is 1.188g/cm<sup>3</sup>.

GROUP	SMALL/HOY FACTOR [(J-CM <sup>3</sup> ) <sup>1/2</sup> ]
-CH <sub>3</sub>	303
-CH <sub>2</sub>	269
>C<	65
-COO-	668
>CH<	176
>C=O	538

(10 Marks)

- (b) With the aid of a block diagram describe the DTA technique of polymers analysis.
- (10 Marks)
4. (a) Draw labelled schematic diagram for the manufacture of LDPE:
- (10 Marks)

(b) From the labelled diagram below:



- (i) Identify B and C (2 Mark)
- (ii) Comment on position A, D and E (3 Mark)
- (iii) Comment on x, y and z (1 Mark)
- (iv) What does the curve on the diagram indicate? (1 Mark)

(c) Draw three different types of morphological structures of a crystalline polymer. (3 Marks)

5. (a) (i) Techniques for fractionating polymers can be preparative and analytical. Name three preparative methods of fractionations.

(ii) With the aid of diagram describe one of the methods of fractionations. (3+7 Marks)

(b) Suppose in a polymer sample there are 100 polymer molecules of molecular mass 103, 200 molecules of molecular mass 104 and 200 molecules of molecular mass 105. Calculate:

- (i)  $M_n$
- (ii)  $M_w$
- (iii)  $M_w/M_n$
- (iv) Is the polymer monodispersed or polydispersed?

(10 Marks)

\*\*\*\*\**End of question Paper*\*\*\*\*\*

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