



NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCE

DEPARTMENT OF APPLIED CHEMISTRY

POLYMER SCIENCE II (FOR SCH STUDENTS ONLY)

SCH 2207

Second Semester Examination Paper

May 2015

This examination paper consists of 5 printed pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: Graph paper will be provided on request.

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. START EACH QUESTION ON A NEW PAGE.

MARK ALLOCATION

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

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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 long range order (4 Marks)
- (g) (i) What is T_g? (3 Marks)
(ii) List the factors affecting T_g. (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. In a solution viscosity experiment the efflux time for the pure solvent was 84.2 sec. The efflux time for the solution of different concentrations is given in the data below:

Concentration g/cm ³	0.30	0.45	0.60	0.75	0.95
Efflux time in sec.	105.25	119.23	128.91	141.79	159.81

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

$$K = 1.34 \times 10^{-4} \text{ dl/kg} \quad a = 0.71$$

(20 Marks)

3. (a) Given the following information, calculate the solubility parameter (δ) of Poly(methylmethacrylate) (PMMA). Density of PMMA is 1.188g/cm³.

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

(10 Marks)

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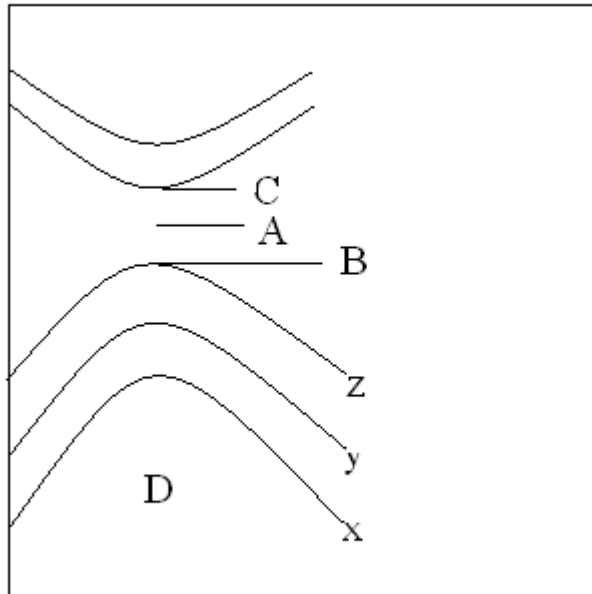
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- (b) With the aid of a block diagram describe the DTA technique of polymer analysis. (10 Marks)

4. (a) Draw a graph of stress (δ) against strain (r) and show:
- (i) viscosity increases
 - (ii) viscosity decreases and
 - (iii) viscosity remains constant.

What is the name given to the polymers (i) and (ii) respectively? (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 200 polymer molecules of molecular mass 206, 400 molecules of molecular mass 208 and 400 molecules of molecular mass 210. 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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