

NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY
DEPARTMENT OF APPLIED CHEMISTRY
END OF SEMESTER EXAMINATIONS – MAY 2005
POLYMER SCIENCE II – SCH 2207
TIME : THREE (3) HOURS

INSTRUCTIONS TO CANDIDATES:

ANSWER **ALL** QUESTIONS FROM SECTION A AND **ANY THREE** QUESTIONS FROM SECTION B.

GRAPH PAPER WILL BE PROVIDED ON REQUEST.

SECTION A:

1. (a) Define the following concept in your own words.
- (i) long range order
 - (ii) short range order
- (4 Marks)
- (b) Explain briefly "The degree of crystallinity".
- (3 Marks)
- (c) What is the difference between state of aggregation and the basic parameters of a phase?
- (3 Marks)
- (d) Explain why all crystallisable polymers are considered to be semicrystalline?
- (2 Marks)
- (e) Give three factors which determine the crystallisability of polymers.
- (3 Marks)
- (f) Name five factors that affect the dissolution of polymers.
- (5 Marks)
- (g) Differentiate between crystallinity and orientation of a polymer.
- (2 Marks)
- (h) Indicate four characteristics of crystallisable polymer.
- (4 Marks)
- (i) Indicate three different types of solutions and state the difference thermodynamically between them.
- (6 Marks)
- (j) Give an expression of the degree of crystallinity based on densities of components involved.
- (3 Marks)
- (k) Define second order phase transition in your own words.
- (3 Marks)
- (l) Differentiate between good and poor solvent.
- (2 marks)

SECTION B:

2. (a) In a solution viscosity experiment the efflux time for the pure solvent was 84.5 sec. The efflux time for the solution of different concentrations are given in the data below:

Concentration g/dl	0.30	0.40	0.55	0.70	0.90
Efflux time in sec,	105	113	125	138	156

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

$$K = 1,34 \times 10^{-4} \text{ dl g}^{-1} \text{ and } a = 0.71$$

(15 Marks)

- (b) State five properties necessary to produce good polymer solutions.

(5 Marks)

3. (a) Given the following information, calculate the solubility parameter (δ) of Poly(vinyl acetate). Density of poly(vinyl acetate) is 0.932 g/cm^3 .

GROUP	SMALL/HOY FACTOR $[(J\text{-CM}^3)^{1/2}]$
-CH ₃	303
-CH ₂ -	269
>CH<	176
>C<	65
- O -	235
-COO-	668
>C=O	538
-COO-	668
-CHO-	599

(10 Marks)

- (b) .What do you understand by;

- (i) limited swelling
- (ii) unlimited swelling
- (iii) degree of swelling

(10 Marks)

4. (a) What is T_g ? List the factors affecting the T_g ? Describe in detail any three factors.

(12 Marks)

- (b) What is an amorphous state?

(2 Marks)

Sketch a graph of Relaxation modulus vs temperature. Indicate all distinguishable stages which are within the amorphous range.

(6 marks)

5. (a) With the aid of a block diagram describe the DTA technique of polymers.

(10 Marks)

- (b) Out line the mechanism of polymer crystallization with special emphasis on:

- (i) Nucleation
- (ii) Rate of growth of crystallites (kinetic equations not required)

(10 Marks)

-END OF EXAMINATION PAPER-