NATIONAL UNIVERSITY OF SCIENCE AND TECHNOLOGY

FACULTY OF APPLIED SCIENCE

DEPARTMENT OF APPLIED CHEMISTRY

POLYMER SCIENCE II

FOR SCH AND TTE STUDENTS

SCH 2207

Supplementary Examination Paper

August 2015

This examination paper consists of 3 pages

Time Allowed: 3 hours

Total Marks: 100

Special Requirements: Graph Paper (on request)

Examiner's Name: DR C T PAREKH

INSTRUCTIONS

1. Answer <u>all</u> questions in Section A and <u>any three</u> 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
TOTAL	100

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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 9.0 sec. The efflux time for the solution of different concentrations are given in the data below:

Concentration g/dl	10	20	30	40	50
Efflux time in sec,	10	11	13	15	17

Find the viscosity average molecular weight (Mv) of the polymer if:
$K = 1,04 \times 10^{-3} dl\ g^{-1}$ and $a = 1.75$

(15 Marks)

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(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-CM^3)$^{1/2}$]
-CH3	303
-CH2-	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 Tg ? List the factors affecting the Tg? 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) Draw labelled schematic diagram for the manufacture of HDPE.

(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!!!!

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