

8405

SETC

Your Roll No.-----

Unique Paper Code : 32177906
Name of the Course : B.Sc. (H) Chemistry
Name of the Paper : DSE: Polymer Chemistry
Semester : VI
Duration : 3 hours
Maximum Marks : 75 Marks

Instruction for the candidates

1. Write your Roll no on the top immediately on the receipt of the question paper
2. *In total six questions to be attempted*
3. Calculator be allowed

Question No 1

(a) Write the points of differences between any *three* of the following:

- (i) Thermoplastic and thermoset polymers
- (ii) Crystalline and amorphous polymers
- (iii) Syndiotactic and Atactic polymers
- (iv) Linear and cross-linked polymers

(b) Derive Carother's Equation. Calculate the average functionality for a reaction system containing 3 mol of glycerol and 4 mol of phthalic acid.

(c) Identify the following polymers as homopolymer or copolymer and write the structure of repeating unit :

- i) Nylon 6
- ii) Polyacrylonitrile
- iii) PET

(6, 3.5, 3)

Question No.2

- a) Write a note on the viscosity and average molecular weight of the polymer. If the value of K and a in the Mark-Houwink Equation are 1×10^{-5} and 0.76 g/cm^3 , respectively, what is the average molecular weight of the polymer whose solution has an intrinsic viscosity of 180 g/cm^3 ?

- b) Define co-polymerization and its classification, giving suitable examples. An equimolar mixture of two monomers 1 and 2 is copolymerized with reactivity ratios $r_1 = 2$ and $r_2 = 1$. What kind of copolymers would be formed? Give the structure of the polymer.

OR

Derive the kinetic expression for step growth condensation in the presence of acid and without acids.

(6, 6.5)

Question No.3

- (a) Write chemical equations for the following reactions in the benzoyl peroxide-initiated polymerization of vinyl chloride: initiation, propagation, termination by combination and disproportionation, and transfer to polymer and to monomer.
- (b) Which one is greater and why – M_n or M_w ? 28 g of ethylene was polymerized and average degree of polymerization of polyethylene (PE) so produced was found to be 1500. Calculate the number of PE molecules formed?

OR

Explain the method of 'End Group Analysis' / light scattering method for the determination of Molecular Weight of Polymers. What type of molecular weight of polymer is obtained from this method?

Question No. 4

(6, 6.5)

- a) Consider the reaction of adipic acid with the following compounds:

- (i) Glycerol
- (ii) 1, 4-butanediol
- (iii) n-butanol

In each case, write the reaction and indicate whether a linear polymer or a network polymer is formed.

- (b) Write the method of preparation of PMMA/PVC. Mention any three applications.

OR

. Discuss the steps involved in the anionic polymerisation.

Question No.5

(6, 6.5)

- (a) Write the method of preparation and applications of any *two* of the following:
- (i) Polyethylene
 - (ii) PVC
 - (iii) Bakelite
 - (iv) Silicone polymers

- (b) Define Kinetic Chain Length. How is it related to degree of polymerization when:
- Termination occurs via coupling of chains
 - Termination occurs via disproportionation.
- (c) Explain the process involved in the photo degradation of polymers and role of photostabilizers
(6, 3, 3.5)

Question No. 6

- (a) Explain the thermodynamics of dissolution of polymers using Flory Huggins theory.

OR

Describe Hildebrand Scott's equation for solubility of polymers. How does crystallinity affect solubility?

- Mention any two factors on which the crystallizability of the polymer depends.
- Discuss the oxidative degradation of rubber.

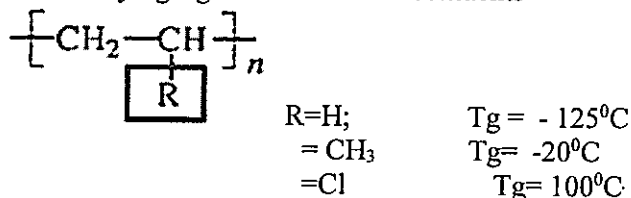
(4.5, 4, 4)

Question No.7

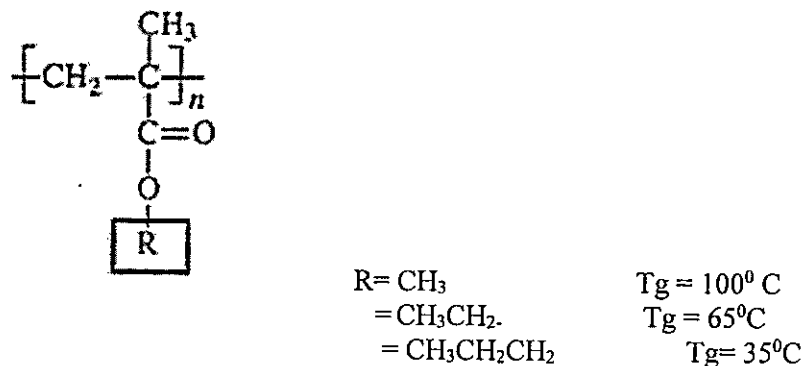
- a) Explain the following trends : (Attempt any *two*)

- melting temperatures T_m ($^{\circ}\text{C}$) of the polymers
 - $-\text{CH}_2-\text{CH}_2-$ 137-146
 - $-\text{CH}_2-\text{CH}_2-\text{CO}-\text{O}-$ 122
 - $-\text{CH}_2-\text{CH}_2-\text{O}-$ 67
 - $-\text{CH}_2-\text{Ph}-\text{CH}_2-$ 397

- Varying T_g with different substituents



- Varying T_g with different substituents



- (a) A steep melting point increase is observed when the p-phenylene group is introduced into the polymer. Explain why?

OR

Atmospheric oxygen acts as an inhibitor explain.

- (c) Write a note on Free-Volume Theory for the transition of polymers from glassy to rubbery.

OR

Write the WLF equation and explain the terms involved.

- (d) What are the applications of chain transfer agents?

(4, 2.5, 4, 2)

Question No.8

- (a) Write the repeating unit for the following polymers (any three)

- i) Poly(α -methyl-styrene)
- ii) Poly(tetrafluoroethylene)
- iii) Nylon 6
- iv) Polyester

- (b) What is cohesive energy density? How does the texture of the polymer change with temperature and intermolecular forces?

- (c) Explain how does the tacticity affect the T_g and T_m of polymer?

(6, 4, 2.5)