SEAT No._____ No. of Printed Pages : 2

[37]

SARDAR PATEL UNIVERSITY

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M.Sc.(Chemistry) Examination, III[rd] Semester (under CBCS)

Date:04/01/2021 Monday **PS03CIPC23** 10.00am -12.00 pm (Two Hours)

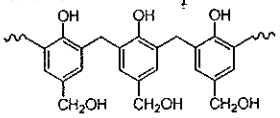
Polymer Structure and Properties Total Marks: /70/

Note: Figures to the right indicates maximum marks.

QUE.1 **Give the appropriate answer of the following Multi Choice Question.** [8]

[A]

i. Which technique is not useful to determine the MW of the following polymer-



(a) Viscometry (b) End-group analysis (c) GPC/SEC (d) Light scattering

ii. Generally, the broad molecular weight obtained by this technique.
(a) Bulk polymerization (b) Solution polymerization
(c) Suspension polymerization (d) Emulsion polymerization

iii. Which equation is correct for reduced viscosity?
(a) $\eta - \eta_0 / \eta_0$ (b) η / η_0 (c) $\eta_r - 1/c$ (d) $\ln \eta_r / c$

iv. Processibility is best at _____, while properties are best at _____.
(a) high MW, low MW, (b) high MW, high MW
(c) low MW, high MW, (d) low MW, low MW

v. If repeating monomer unit contain even number of atoms, then produce-
(a) higher crystallinity (b) lower crystallinity
(c) higher amorphous region (d) lower amorphous region

vi. The addition of plasticizer in polymers causes less regular structure and hence_____.
(a) increases crystallinity (b) reduce crystallinity
(c) increase T_g (d) increase melting temperature

vii. All of the bond angles around each Carbon atom in the backbone are _____.
(a) 45.5° (b) 120.5° (c) 105.9° (d) 109.5°

viii. Lengthening of n-alkyl side chain results in-
(a) lower modulus (b) greater flexibility (c) lower T_g and M.P (d) All of them

[B] **Answer the following questions as per "do as directed".** [16]

Fill in the Blanks (No.1 to 8)

1. Extensive cross-linking formed by _____bonds.
2. Tromms-Dorff effect observed in _____polymerization.
3. _____ are the most linear condensation polymers and are inherently regular and readily crystallize.
4. To permit reasonable segmental mobility, the polymer must be above its _____.
5. The _____ring in terephthalates produce high strength and high melting point.
6. The ultimate tensile strength, generally _____ in the direction of orientation and _____ perpendicular to it.

7. Poly quaternary ammonium ions will increase _____ of solutions.
8. Conjugated alternating double & single bonds are stabilized by resonance between them and hence imposes _____ structure.

Write the following sentence whether "True" or "False" (No.9 to 16).

9. The problem of dissipating heat of polymerization is occurs in bulk polymerization technique.
10. In GPC, separation method involves flash chromatography.
11. The crystalline state of the polymer having precise position in a tightly-packed i.e. highly order molecular geometry.
12. The polymer molecules move further apart upon heat and leaving more and more free volume between them and producing 2.5% critical free volume, is called ceiling temperature.
13. Long chain structure, restricts mobility and movement into preferred position in lattice structure.
14. Methyl side-chain in polypropylene produce considerable steric hindrance, which forcing the molecule into helical coil.
15. Extremely bulky aliphatic side-chain branching lowers the melting point.
16. Polystyrene contributes high impact resistance.

QUE.2 Answer the following questions in short (attempt any 7 out of 9). [14]

1. In vapor pressure osmometry, $\Delta T \propto 1/ \bar{M}n$, which means-
2. Write only the equations for the determination of $\bar{M}n$, $\bar{M}w$, $\bar{M}v$ and $\bar{M}z$.
3. Complete the following reaction mechanism for free radical polymerization.

$$I\,M_{x-1}M\bullet + \bullet MM_{y-1}\,I \xrightarrow{K_{td}}$$

4. Draw the schematic diagram of mono and biaxial orientation.
5. How do you improve properties of finished coatings (from solution)?
6. How the thermal conductivity travels in a polymer?
7. Why the diene rubbers retain the freedom of rotation, softness and flexibility?
8. What is ceiling temperature?
9. What is the effect of cyclic side groups with respect to steric hindrance?

QUE.3 What is Ziegler-Natta catalyst and its advantages? Describes the Z-N polymerization. [8]

OR

Write a note on Vapor Pressure Osmometry.

QUE.4 Describe "Viscometry" for the determination of viscosity average molecular weight ($\bar{M}v$). [8]

OR

Elaborate the effects of molecular weight on Thermal Mechanical properties.

QUE.5 Describe the Kinetic factors affecting the rate and extent of crystallization. [8]

OR

Write a note on effect of orientation on mechanical properties.

QUE.6 Discuss the Effect of side chain structure. [8]

OR

Describe the effect of polar side chain substituents on flexibility.

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