

RAMAKRISHNA MISSION VIDYAMANDIRA

(Residential Autonomous College affiliated to University of Calcutta)

M.A./M.Sc. SECOND SEMESTER EXAMINATION, MAY 2017

FIRST YEAR [BATCH 2016-18]

APPLIED CHEMISTRY

Date : 25/5/2017

Time : 11 am – 1 pm

Paper : IX [Polymer Science & Technology]

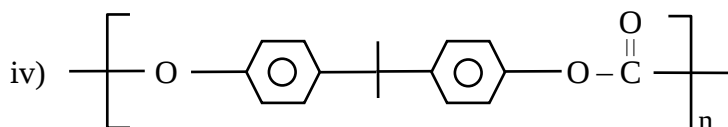
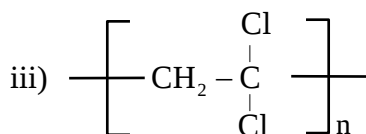
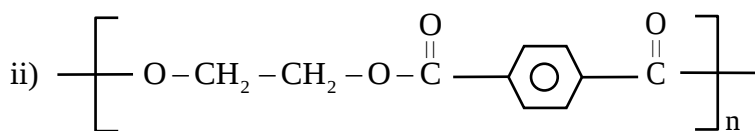
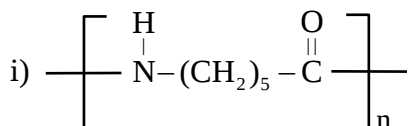
Full Marks : 50

Group – A

(Answer any four questions)

[4×10]

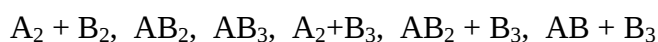
1. a) Calculate the no. average degree of polymerization (DP) of each of the following polymers with M_n 254,000?



[1×4]

- b) For each of the following reactions system indicate whether the product is a linear, branched, cross-lined, or hyper branched polymer.

[6]



2. a) Write characteristics of chain growth and step growth polymerization with respect to the following features if the reaction is stopped before completion (say at 80% conversion)—

i) M_w as a function of conversion (show schematically)

ii) Composition of reaction medium

[4]

- b) A high molecular weight copolyester was synthesized by reacting the two diacids with a diol. The composition of the monomer mixture as $\text{HOOC} \text{---} R^1 \text{---} \text{COOH}$: $\text{HOOC} \text{---} R^2 \text{---} \text{COOH}$: $\text{HO} \text{---} R \text{---} \text{OH} = 1:1:2$ (by mole); reactivity of $R^1 \text{---} \text{COOH}$ group towards $R \text{---} \text{OH}$ is higher compare to the reactivity of $R^2 \text{---} \text{COOH}$ group towards $R \text{---} \text{OH}$. Estimate the composition (mole ratio) of R^1 , R^2 , R in the final copolymer? Justify your answer in brief by assuming that it has the most probable distribution of molar mass.

[4]

- c) Can the following polyester recipe be carried to “complete” conversion without gelling? Pentaerythritol (1.2 mol), phthalic anhydride (0.5 mol) and tricarballic acid (0.49 mol).

[2]

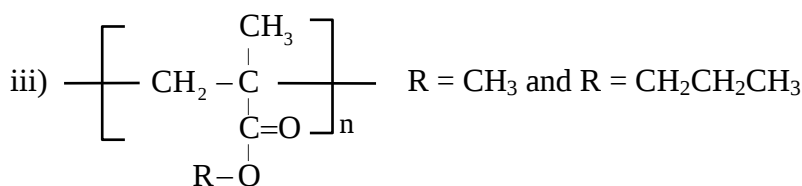
3. a) A typical radical polymerization is being carried out with the following assumptions : initiation by thermal dissociation of initiator, steady state and equal reactivity of propagating radicals, termination of reaction is only by bimolecular coupling, and no chain transfer. What

will happen to the polymer M_w and R_p if on increases : (i) initiator conc. (ii) monomer conc. Justify your answer. [4]

b) Which of the polymers in each pair is expected to have higher T_g and why? [6]

i) Polyethylene and Polypropylene

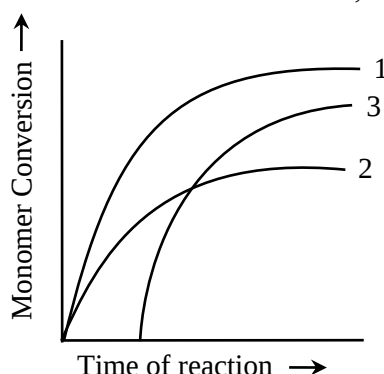
ii) Poly (but-1-ene) and Poly (but-2-ene)



4. a) For a monomer of general structure $\text{CH}_2 = \text{CHX}$, complete the following table. Put '+' if the monomer can be polymerized by the method mentioned at the top of the column, and '-' if polymerization by the method is not feasible. Briefly justify your answer. [4]

X	Free Radical	Anionic	Cationic
-CN			
-Ph			
-OCH ₃			
-OCOCH ₃			

b) Styrene was polymerized by heating to 100°C (self-initiated). Styrene was taken from the three different bottles for three reactions. The following data were obtained from the experiments. Assume all other conditions remained same, explain the reaction (1,2&3) trends. [6]



5. a) In a typical free radical polymerization, rank the following according to their values :

(i) R_i , R_p and R_t (ii) K_d , K_p and K_t [2]

b) What do you mean by 'back biting' for LDPE? [2]

c) Write differences between LDPE and LLDPE. [3]

d) Name the following :

(i) co-ordination polymer. (ii) oil resistant rubber (iii) conducting polymer. [3]

6. a) What is the monomer of PVAc? [1]

b) What do you mean by BOPP? [1]

c) Write down one method to prepare BOPP. [3]

d) Name synergistic stabilizer for PVC. [1]

e) Draw repeating unit structure of Bisphenol-F. [1]

f) What are the differences between synthesis of Novolak and Resol? [2]

g) If acrylonitrile content has been increased, then what happened to the below properties :

(i) oil resistant (ii) Dynamic stress – Strain behaviour. [1]

Group – B

(Answer any one question)

[1×10]

7. Briefly state the principle of a differential scanning calorimeter (DSC). How do you calculate the percentage crystallinity of a polymer from DSC? Explain why, it is scientifically correct to consider the second heating scan instead of the first heating scan for property evaluation? [3+3+4]
8. State the working principle of a Transmission electron microscope (TEM). Mention the difference between a TEM and a SEM. How do you find the chemical composition of a polymeric sample from electron microscope? How do you prepare a polymer test sample for TEM analysis? [2+3+2+3]

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