

2017

CHEMISTRY

Paper : 401 (P)

POLYMER SCIENCE

Full Marks: 80

Time: 3 hours

The Figures in the margin indicate full marks for the questions

All questions are compulsory :

- 1 Give one example (name and chemical structure) of (a) addition polymer, (b) condensation polymer, (c) copolymer. 3
- 2 Draw structural formulae indicating the stereoregular chain configuration in (a) atactic polystyrene, (b) isotactic polypropylene, and (c) syndiotactic poly (vinyl chloride). 3
- 3 How would you prepare poly(vinyl alcohol)? How poly(vinyl alcohol) can be distinguished from poly(vinyl acetate)? 2+2= 4
- 4 Explain the terms LLDPE & HDPE 2
- 5 Give the structures of Natural Rubber and Gutta-Percha 2
- 6 Describe how ATRP can be used to graft styrene onto polyvinyl alcohol 3
- 7 What method would you use to synthesize a ABA type tri-block copolymer and how? Explain the procedure. 1+5= 6

- 8 Derive the copolymer equation, stating the assumptions used. How the equation can be used to interpret the morphology of a copolymer? 5+2= 7
- 9 "T_m is considered as first order transition but T_g is considered as second ordered transition" Explain Why? 4
- 10 What is plasticizer? 1
- 11 Estimate the solubility parameter of polyvinyl alcohol and HDPE if densities of the polymers are 1.19 g/cm³ and 0.95 g/cm³ respectively. Given, molar attraction constant (E) for -CH₂-; >CH- and -OH are 131.5, 86 and 226 respectively. Calculate cohesive energy densities for the two polymers. 2+2+1+1+1= 7
Find a suitable solvent for these two polymers from the following (solubility parameters are given within bracket): n-pentane (7.0), methanol (14.5), n-propanol (11.9) and methyl propionate (8.9)
- 12 What is living polymer? 1
- 13 What is resilience? 1
- 14 Name two polymers which undergo strain-induced crystallization. 2
- 15 Draw stress-strain plots for a plastic and a rubber (or elastomer) together. What is toughness? 2+1= 3
- 16 How chain transfer constant is evaluated experimentally? 2
- 17 What is mastication and nip gap? 2

- 18 What are the Newtonian and non-Newtonian liquids? Draw sketches to illustrate the behaviour of different non-Newtonian liquids. Discuss briefly the time-dependent behaviour of polymer fluids. 2+3+4= 9
- 19 What DIN & ASTM stands for? 2
- 20 What are the different monomers that can be synthesized (and hence different polymers) from monomer propylene? Draw a flowchart diagram to show these. 5
- 21 Draw typical DSC thermogram for a polymer showing the glass transition, crystallization, and crystalline melting 2
- 22 How XRD, GPC and TGA help in polymer analysis? 3x2= 6
- 23 Write short note on (any one) 3
- a. Compression moulding
- b. Solution Casting
