

2015

M.Sc. Part-II Examination

CHEMISTRY

PAPER—VIII

Full Marks : 75

Time : 3 Hours

The figures in the right-hand margin indicate full marks.

Candidates are required to give their answers in their own words as far as practicable.

Illustrate the answers wherever necessary.

(Physical + Organic)

Answer any *five* questions.

1. (a) Explain the terms 'monomer', 'mer' and 'polymer' with suitable examples. 3
- (b) Discuss the important properties of polymers. 8
- (c) Classify polymers on the basis of :
 - (i) Thermal response ; and
 - (ii) Applications 2×2

(Turn Over)

2. (a) Write down the structures of the repeat unit of the following polymers : 3×1
- (i) Polyethylenetere phthalate ;
 - (ii) Nylon 6 ;
 - (iii) Nitrile rubber.
- (b) Show how tertiary butyl hydroperoxide decomposes to give free radicals. 1
- (c) Deduce a rate expression for ideal free radical polymerisation. 5
- (d) How would you determine the initiator and monomer exponents for the ideal free radical polymerisation of a vinyl monomer ? 2
- (e) For an ideal free radical polymerisation process if 'b' be the average number of initiator fragments present per polymer molecule and if 'a' be the fraction of chain radicals that undergo termination by coupling then establish a relationship between 'b' and 'a'. 4
3. (a) Deduce the Carother's equation for condensation polymerisation. 5
- (b) For the condensation polymerisation of glycerol and adipic acid taken in the molar ratio of 0.98 : 1.52, calculate the critical extent of reaction at which gelation would occur. 2

- (c) Calculate the number average degree of polymerisation (\bar{X}_n) for the condensation polymerisation of ethylene glycol and sebasic acid taken in the molar ratio of 1.0 : 1.01 at the extent of reaction (p) 0.99. 3
- (d) Write down the mechanism of anionic polymerisation of a vinyl monomer. 5
4. (a) Write down the expression for Z-average molecular weight, \bar{M}_z and suggest a method for the experimental determination of \bar{M}_z . 1+1

- (b) A sample of polyvinylchloride is composed of the following fractions of different-sized molecules :

Fraction	No. of Molecules	Molecular weight
1	40	20,000
2	25	30,000
3	25	50,000
4	10	1,00,000

Calculate the number average degree of polymerisation, \bar{X}_n and the polydispersity index (PDI) of the polymer sample. 6

- (c) Write down the relationship between intrinsic viscosity, $[\eta]$, and viscosity average molecular weight, \bar{M}_v for a polymer. 1
- (d) Define the terms 'inhibitor' and 'retarder'. Give suitable examples. 3
- (e) State the advantages and disadvantages of emulsion polymerisation. 3
5. (a) State the importance of co-polymerisation. 2
- (b) Write down the structures of random, alternate, block and graft copolymers. 2
- (c) For binary copolymerisation deduce the copolymer composition equation. 8
- (d) Draw the ' F_1 ' vs. ' f_1 ' graph for azeotropic copolymerisation. Under what conditions does the azeotropic copolymerisation take place? 2+1
6. (a) Classify polythene on the basis of density. Mention the properties and uses of high density polyethylene. 2+3

- (b) What are phenol-formaldehyde resins? Describe the synthesis of novolac resin. Write down the reactions involved in the synthesis. 1+4
- (c) Name the monomers used to synthesize epoxy resin. How are the monomers prepared? Write down the reactions between the monomers that lead to the formation of epoxy resin. 1+2+2
7. (a) Describe the synthesis of high density polyethylene by Philips process. 5
- (b) Write a short note on additives of plastics. 6
- (c) Mention the properties of polychloroprene rubber. 2
- (d) State the uses of alkyd resins. 2
8. Write short notes on any *three* of the following : 3×5
- (i) Differences between suspension and solution polymerisation.
- (ii) Chain transfer reaction.
- (iii) Manufacture of smoked sheet rubber from natural rubber latex.

- (iv) Synthesis of nylon 66.
- (v) Properties and uses of nitrile rubber.
- (vi) Molecular weight distribution in condensation polymers.