2014

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) State the differences between monomer and mer with suitable examples.   3

   (b) Write down the structures of the repeat unit of the following polymers :   3

   (i) Polyvinyl acetate ;

(ii) Polyethyleneterephthalate ;

(iii) Polychloroprene rubber.

(c) Define the term 'glass transition temperature', Tg and explain why it is also called second order transition temperature. 3

(d) Classify polymers on the basis of :

(i) Thermal behaviour ; and

(ii) Applications. 2+2

(e) Account for the abnormally high melt and solution viscosity of polymers. 2

2. (a) Give two examples of free radical initiators and show how they decompose to generate free radicals. 2

(b) Deduce the rate expression for the ideal free radical polymerisation of a vinyl monomer. 5

(c) State the differences in the nature of the dead polymer molecules formed in an ideal free radical polymerisation process when termination takes place exclusively by coupling and when termination takes place exclusively by disproportionation. 2

(d) How would you determine the initiator and monomer exponents for the ideal free radical polymerisation of a vinyl monomer ? 2

(Continued)

(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) Calculate the average functionality of the monomer mixture of glycerol and adipic acid having the molar ratio of 0·95 : 1·50. 2

(b) Derive the Carother's equation for condensation polymerisation. 5

(c) Explain why condensation polymerisation is also called step growth polymerisation. 2

(d) Calculate the number average degree of polymerisation of polymers formed for the condensation polymerisation of an equimolar mixture of adipic acid and hexamethylene diamine for extents of reaction 0·80, 0·90, 0·95 and 0·99. 4

(e) How would you control the molecular weight of polymer in condensation polymerisation ? 2

4. (a) Define the term 'copolymer'. What is the utility of copolymerisation ? 1+2

(Turn Over)

(b) Write down the copolymer composition equation relating copolymer composition with feed composition and monomer reactivity ratios. Starting with this equation derive the copolymer composition equation in terms of mole fractions of monomer in the copolymer and in the monomer feed and monomer reactivity ratios. 1+4

(c) Define the terms 'inhibitor' and 'retarder'. Draw the % conversion *vs.* time graphs for the free radical polymerisation of a vinyl monomer in the presence of an inhibitor and in the presence of a retarder. 2+2

(d) State for what values of 'r_1' and 'r_2' the azeotropic copolymerisation takes place and draw the 'F_1' *vs.* 'f_1' graph for azeotropic copolymerisation. 1+1

(e) Name one chain transfer agent used for controlling the molecular weight of polymer in free radical polymerisation. 1

5. (a) Write down the mechanism of cationic polymerization of vinyl monomers. 5

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

Fraction	No. of Molecules	Molecular Weight
1	50	10,000
2	20	25,000
3	20	60,000
4	10	1,00,000

Calculate the polydispersity index of the polymer sample. 5

(c) Derive the rate expression for the acid catalysed polyesterification reaction. 5

6. (a) What are phenol-formaldehyde resins ? Describe the synthesis of novolac resin. Write down the reactions involved in the synthesis. 1+5

(b) Name the monomers used to synthesize epoxy resin. How are the monomers prepared ? Write down the reaction between the monomers that leads to the formation of epoxy resin. 1+2+2

(c) Write a short note on additives of plastics. 4

7. (a) Describe the synthesis of styrene-butadiene rubber.

6

(b) Discuss the properties of butyl rubber and mention its major uses. 2+2

(c) What are accelerators ? Give examples. 1+1

(d) Write a short note on vulcanisation of rubber. 3

8. Write short notes on any *three* of the following : 5×3

(i) Synthesis of high density polyethylene by Philips process ;

(ii) Properties and uses of nitrile rubber ;

(iii) Anionic polymerisation ;

(iv) Polycarbonates ;

(v) Viscose rayon ;

(vi) Manufacture of smoked sheet rubber from natural rubber latex.

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