

M.Sc. 3rd Semester Examination, 2013

CHEMISTRY

PAPER—CEM-304

The figures in the right-hand margin indicate marks

(Organic + Physical Special)

[Marks : 40]

Time : 2 hours

Answer any **four** questions from the following

1. (a) State the differences between 'monomer' and 'mer' with suitable examples. 2
- (b) Define the term 'glass transition temperature', T_g and explain why it is also called second order transition temperature. 2
- (c) Write down the structures of the repeat unit of the following polymers : 2
 - (i) Poly vinylidene chloride

(Turn Over)

- (ii) Polyisobutylene
- (iii) Polyhexamethylene adipamide
- (iv) Nitrile rubber.

(d) Calculate the extent of reaction at which gelation would occur for the condensation polymerisation of the following mixture :

Phthalic anhydride and glycerol in the molar ratio 1.50 : 0.980. 2

(e) 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

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. 4

- (c) How would you determine the initiator and monomer exponents for the ideal free radical polymerisation of a vinyl monomer? 2
- (d) 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 '. 2
3. (a) For condensation polymerisation state the minimum functionality requirements for the monomer. 1
- (b) Derive the Carother's equation for condensation polymerisation. 4
- (c) Derive the rate expression for the self-catalysed polyesterification reaction. 4
- (d) How is molecular weight of polymer controlled in free radical polymerisation? 1

4. (a) 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
- (b) Write down the copolymer composition eqⁿ relating copolymer composition with monomer feed composition and monomer reactivity ratios. Starting with this equation derive the copolymer composition equation in terms of mole fraction of monomers in the copolymer and in the monomer feed and monomer reactivity ratios. 1 + 3
- (c) 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
5. (a) An absolute value of molecular weight can not be assigned to any polymer. Explain. 2
- (b) Suggest a method for determining the z-average molecular weight, \bar{M}_z for a polymer sample. 1

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

<u>Fraction</u>	<u>No. of Molecules</u>	<u>Molecular Weight</u>
1	50	10,000
2	20	25,000
3	20	60,000
4	10	100,000

Calculate the polydispersity index for the polymer sample. 5

- (d) Show the structures of random, alternate, block and graft copolymers. 2
6. Make a comparative study for different polymerisation techniques. 10
7. Write short notes on any *two* of the following : 5×2
- (i) Mechanism and kinetics of anionic polymerisation.
- (ii) Determination of viscosity average molecular weight.

(iii) Control of molecular weight of polymer in condensation polymerisation.

(iv) Chain transfer and Mayo equation.

(*Inorganic Special*)

(Environmental Chemistry)

[*Marks : 40*]

Time : 2 hours

Answer any **five** questions taking at least **two** from each Group

GROUP – A

1. (a) Write the industrial sources of CO, NO_x, hydrocarbons, SO₂ and particulate matters. 3
- (b) Define the following terms : 3
 - (i) Receptor of a pollutant
 - (ii) Pathways of pollutant.

- (c) Lead poisoning can be cured by chelating agents. Explain. 2
2. (a) "Earth manage its radiation balance to maintain an average temperature of 15 °C" – Explain. 4
- (b) Write explanatory notes on "Oxygen Cycle". 4
3. (a) Discuss the role of CO as primary pollutant on the basis of concentration profile. 3
- (b) Write the role of catalytic converter for treating auto-emissions. 3
- (c) List the five primary pollutants in order of their increasing relative toxicity. 2
4. What is CFC ? How does it affect the ozone layer in the atmosphere ? Comment on the possible substitutes of CFC. 2 + 4 + 2

GROUP – B

5. (a) How inorganic particulates are formed in atmosphere ? 2

- (b) Give some examples of microbially mediated redox reactions in natural water. 3
- (c) Write short note on "Photochemical Smog" or "Ozone Hole". 3
6. (a) Explain with illustration the control of SO_2 . 4
- (b) Write a short note on acid rain. 4
7. (a) Explain acid-base and ion-exchange reactions in soil. 4
- (b) How ozone is formed and removed from atmosphere? 4
8. Explain the biochemical effects of Mercury (Hg) with particular reference to its sources, species and pathways in the environment and impacts on human. 1 + 2 + 3 + 2
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