

**M.Sc. 3rd Semester Examination, 2014**

**CHEMISTRY**

**PAPER – CEM-304**

*Full Marks : 40*

*Time : 2 hours*

*The figures in the right-hand margin indicate marks*

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

**Answer any four questions**

1. (a) Classify polymers on the basis of :  $1\frac{1}{2} \times 2$
- (i) Thermal response ; and
  - (ii) Morphology.
- (b) Write down the structures of the repeat unit of the following polymers :  $1 \times 2$
- (i) Nylon 6
  - (ii) Polyvinyl acetate.

( Turn Over )

- (c) Discuss the important properties of polymer molecules. 5
2. (a) Write down the mechanism for ideal free radical polymerisation of vinyl monomers. 4
- (b) Define the terms-kinetic chain length ( $\nu$ ) and number average degree of polymerisation ( $\bar{X}_n$ ) and write down the relationship between them. 1 + 1 + 1
- (c) State the nature of monomers that undergo free radical, cationic and anionic polymerisation with suitable examples. 1 + 1 + 1
3. (a) What is chain transfer? 2
- (b) For a free radical polymerisation involving chain transfer reactions establish the Mayo equation. 5
- (c) How is the molecular weight of polymer controlled in free radical polymerisation? 2
- (d) Define the term-initiator efficiency 'f'. 1
4. (a) Calculate the number average degree of polymerisation of polymers formed through

condensation polymerisation of an equimolar mixture of adipic acid and hexamethylene diamine for extents of reaction 0.80, 0.95 and 0.99. 3

(b) For condensation polymerisation of two monomers of A – A and B – B type where A and B represent functional groups, deduce an expression relating the number average degree of polymerisation  $\bar{X}_n$  with extent of reaction 'p' and 'r', where 'r' is a measure of stoichiometric imbalance. 5

(c) Give two examples of inhibitors and show how they inhibit free radical polymerisation. 2

5. (a) Write down the expressions for number average molecular weight,  $\bar{M}_n$ , and weight average molecular weight,  $\bar{M}_w$  and hence define polydispersity index. 1 + 1 + 1

(b) Suggest methods for determining  $\bar{M}_n$ ,  $\bar{M}_w$  and  $\bar{M}_z$  of a polymer sample. Show the relative positions of  $\bar{M}_n$ ,  $\bar{M}_w$  and  $\bar{M}_z$  in a molecular weight distribution curve. 1 + 1 + 1 + 1

- (c) Calculate the viscosity average molecular weight  $\bar{M}_v$  of a polymer if the intrinsic viscosity is 2.3 dL/g. Given  $k = 3.6 \times 10^{-3}$  and  $\alpha = 0.60$ . 3
6. (a) For binary copolymerisation deduce the copolymer composition equation in terms of mole fractions of two monomers in the copolymer and in the feed and monomer reactivity ratios. 7
- (b) Draw  $F_1$  vs.  $f_1$  curves for ideal copolymerisation. 2
- (c) State for what values of  $r_1$  and  $r_2$  block copolymerisation takes place. 1
7. Write short notes on any *two* of the following :  $5 \times 2$
- (i) Mechanism and kinetics of cationic polymerisation
- (ii) Advantages and disadvantages of emulsion polymerisation

(iii) Determination of viscosity average molecular weight of polymers

(iv) Interfacial polymerisation.

( *Environmental Chemistry, Inorganic Special* )

Answer any five questions taking at least two from each Group

GROUP – A

1. (a) Write an account on monitoring of  $\text{NO}_x$  and  $\text{SO}_x$ . 5
- (b) Comment on the origin of soot particles. 3
2. (a) How would you broadly divide the major regions of the atmosphere? State their respective altitudes and temperature ranges with temperature profile diagram. What are the important chemical species in each region? 1 + 2 + 2
- (b) Trace the origin of organic particulate matter in the atmosphere. 3

3. (a) "Carbon dioxide, a non pollutant, is perhaps the single most important environmental question facing us at present." Discuss in terms of the greenhouse effect. 4
- (b) What is  $\text{NO}_x$ ? How does it affect the ozone layer in the atmosphere? Explain with diagram. 1 + 3
4. (a) Illustrate how PAN is formed in a smog producing chain reaction? 2
- (b) How can internal combustion engines be modified to make auto exhausts free from pollutants? 4
- (c) Explain the reactions of  $\text{Pb}(\text{C}_2\text{H}_5)_4$  on combustion of gasoline. 2

GROUP – B

5. (a) Explain the biochemical effects of Lead(Pb) with particular reference to its sources, species and pathways in the environment and impact on humans. 5

- (b) Define following nomenclatures : 3
- (i) Speciation
  - (ii) Chemical oxygen demand.
6. (a) Discuss the biochemical effects of cyanide. 3
- (b) Explain how cyanide poisoning can be treated ? 3
- (c) What is Van Allen belts ? 2
7. (a) Illustrate and explain the hydrological cycle. 4
- (b) Write notes on nitrogen transformation by bacteria in aquatic environment. 4
8. (a) What is albedo ? 1
- (b) Define Aitken particles. 1
- (c) List the major organic compounds in soil and mention their significances. 3
- (d) Mention all possible buffer actions which help to maintain the pH of sea water constant. 3