M.Sc. 3rd Semester Examination, 2012

CHEMISTRY

PAPER—CEM-304

The figures in the right-hand margin indicate marks

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

Illustrate the answers wherever necessary

(*Organic + Physical*)

[*Marks* : 40]

Time : 2 hours

Answer **Q. No. 1** and any *three* from the rest

1. (*a*) Write down the structures of the repeat unit of the following polymers :

   (*i*) Polyvinyl acetate

   (*ii*) Nylon 6

   (*b*) Define the term "glass transition temperature', T_g as applicable to polymers.

(c) Account for the very high melt and solution viscosity of polymers.

(d) How is molecular weight of polymer controlled in condensation polymerisation process ?

(e) 90% molecules of a polymer mass have molecular weight of 1,00,000 and the molecular weight of the rest is 30,000. Calculate $\overline{M_n}$ and $\overline{M_w}$ of the polymer sample.   2 × 5

2. (a) Write down the mechanism for free radical polymerisation of vinyl chloride using benzoyl peroxide as initiator.   4

(b) Deduce the rate expression for the cationic polymerisation of isobutylene using the mixture of BF_3 and H_2O as the initiating system.   6

3. (a) What is chain transfer ?   2

(b) For a free radical polymerisation involving chain transfer reactions establish the Mayo equation.   6

(c) Write down the relationship between kinetic chain length (ν) and number average degree of polymerisation ($\overline{X_n}$).   2

4. (a) 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 $\overline{X_n}$ with extent of reaction 'p' and 'r', where 'r' is a measure of stoichiometric imbalance. 5

(b) Calculate the number average degree of polymerisation of an equimolar mixture of adipic acid and hexamethylene diamine for extents of reaction 0·60, 0·75 and 0·90. 3

(c) Give examples of an inhibitor and a retarder. 2

5. (a) Derive the copolymer composition equation for a binary copolymerisation system using free radical initiator. 8

(b) What is azeotropic copolymerisation ? 2

6. (a) Differentiate between addition and condensation polymerisation. 4

(b) Calculate the viscosity average molecular weight $\overline{M}_v$ of a polymer if the intrinsic viscosity is 2·3 dL/g. Given $k = 3·6 \times 10^{-3}$ and $\propto = 0·60$. 2

(c) Suggest methods for determining $\overline{M}_n$, $\overline{M}_w$ and $\overline{M}_z$ of a polymer sample. Show the relative positions of $\overline{M}_n$, $\overline{M}_w$ and $\overline{M}_v$ in a molecular weight distribution curve. 4

7. Write short notes on any *two* of the following : 5 × 2

   (i) Emulsion polymerisation

   (ii) Anionic polymerisation

   (iii) Kinetics of self-catalysed polyesterification reaction

   (iv) Morphology of polymer.

(*Inorganic*)

(*Environmental Chemistry*)

[*Marks* : 40]

Time : 2 hours

Answer any *four* questions

1. (a) Discuss the structure of atmosphere in brief with temperature profile. 4

   (b) Comment on the origin of soot particle. 2

(*Continued*)

   (c) What is Van Allen belts ?   2

   (d) Define following nomenclatures :   2

      (i) Speciation

      (ii) Threshold Limit Value (TLV).

2. (a) What is EI Nino ? How does it affect the global climate ?   4

   (b) NOx plays an effective role in removing O_3 in the stratosphere. Explain.   3

   (c) Illustrate the concentration profiles of smog forming chemical in Los Angeles air.   3

3. (a) Discuss the role of NOx as primary air-pollutant on the basis of concentration profile and control techniques.   3 + 3

   (b) Illustrate how PAN is formed in a smog-producing chain reaction.   2

   (c) How can internal combustion engines be modified to make autoexhausts free from pollutants ?   2

4. (a) Illustrate the nitrogen pathways in soil.   4

(b) Why is the pH of sea water constant at $8 \cdot 1 \pm 0 \cdot 2$? 3

(c) P^E of sea water is constant at $12 \cdot 5 \pm 0 \cdot 2$. Explain. 3

5. (a) Enumerate the biochemical effects of arsenic (As) with particular reference to its sources, species and pathways in the environment and impact on humans. 4

(b) Explain the mechanism of action of persistent pesticide in the environment. 4

(c) Explain the propagation of DDT in food chain. 2

6. (a) Discuss the biochemical effects of cyanide. 4

(b) Discuss the inorganic and organic components in soil. 4

(c) Define mist, fog and aerosol. 2

7. (a) What do you mean by solid waste ? Write down the classification of solid wastes. 1 + 3

(Continued)

(b) Write down the problem associated with the discharge of synthetic compounds like pesticides, detergents etc. in the waste water.   2

(c) Write a short note on biomineralogy.   4

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