

**P.G. DIPLOMA IN ANALYTICAL CHEMISTRY  
(PGDAC)**

**Term-End Examination**

**June, 2016**

00806

**MCH-002 : SEPARATION METHODS**

*Time : 3 hours*

*Maximum Marks : 75*

**Note :** Attempt any *five* questions. All questions carry equal marks.

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1. (a) Name the non-chromatographic separation process involving equilibrium between the two phases mentioned below. Mention the components of the mixture that can be separated by the said process : 4
- (i) Gas – Liquid
  - (ii) Liquid – Liquid
  - (iii) Liquid – Solid
  - (iv) Solid – Solid
- (b) Distinguish between Osmosis and Reverse Osmosis. Mention the characteristics of the semipermeable membrane used in R.O. 5
- (c) Explain the characteristic features of diluents in solvent extraction process. 6

2. (a) Metal chelates of metal A and metal B are extractable from aqueous solutions into  $\text{CCl}_4$ . What must the ratio of their distribution coefficients be so that 99% of A remains in aqueous phase whereas 99% of B is extracted into the organic phase? Volumes of organic and aqueous phases are the same. 6
- (b) Explain the difference between adsorption and ion-exchange processes. 4
- (c) In the separation of a mixture, solvent was retained at 2.1 min whereas components A and B were retained at 6.7 min and 12.5 min, respectively with corresponding peak widths 11.3 min and 14.1 min. Calculate the number of plates for each component. 5
3. (a) Examine each of the following statements and write whether it is *True* or *False*: 5
- (i) In ion exchange chromatography, the extent of exchange increases with increase in charge of the exchanging ion.
- (ii) Particle size of the gel is responsible for fractionation by size exclusion chromatography.
- (iii) Distribution coefficient,  $K$ , for solute molecules which enter the gel matrix is between 0 and 1.

- (iv) Retention time is independent of the temperature of the column.
- (v) Distribution coefficient and thermodynamic distribution coefficient of a solute between two phases are always same.
- (b) Draw a schematic labelled diagram of gas chromatograph and name the carrier gas. 5
- (c) Which of the following types of paper can be used in paper chromatography ? Give reason in support of your answer. 5
- (i) Butter paper
- (ii) Cellophane paper
- (iii) Cellulose filter paper
- (iv) Ordinary filter paper
- (v) Writing paper
4. (a) Explain the basic principle of HPLC. Draw a schematic labelled diagram of the various components involved. 8
- (b) What is Size Exclusion Chromatography ? Discuss the important properties of gels. 7
5. Write brief notes on the following :  $3 \times 5 = 15$
- (a) Extraction by ion-pair formation
- (b) Stationary phase in HPLC
- (c) HETP and its significance in Chromatography

6. (a) Explain the basic features of ion exchange mechanism. How are the ion exchangers classified? Give an example for each type. 10
- (b) Explain, why  $\text{Al}(\text{NO}_3)_3$  is a better salting out agent than  $\text{NH}_4\text{NO}_3$ . 5
7. (a) Explain the term 'Retention Time' with the help of a plot. What are the consequences when the retention factor is (i) too small, and (ii) too large? 6
- (b) Explain  $R_f$  value and various factors affecting it. 4
- (c) Distinguish between 'Electrophoresis buffer' and 'Loading buffer'. How are these used in DNA gel electrophoresis? 5
8. (a) State the advantages of Supercritical Chromatography. 5
- (b) State Henry's law. Explain why this law is not valid in the case of GLC. 5
- (c) Distinguish between 'Resolution factor' and 'Separation factor'. How are the two related? 5
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