

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

Term-End Examination

June, 2013

00962

MCH-002 : SEPARATION METHODS

Time : 3 hours

Maximum Marks : 75

Note : Attempt any FIVE questions. All questions carry equal marks.

1. (a) What for there is a need of separations in chemical analysis? Name the main properties based on which chemical separations are made. Discuss the special features of separations based on partition and molecular geometry. 1+2+6
- (b) Explain the importance of selecting and detectability in selecting a separation method. 6

2. (a) Explain the terms thermodynamic distribution coefficient, distribution coefficient and distribution ratio used in liquid-liquid extraction. What will be the conditions when all the three will be the same ? 1+1+1+2

- (b) The distribution ratio for a solute "Z" in water-benzene is 5. Calculate the percentage of solute "Z" extracted from 25 mL of water by 50 mL of benzene where (i) the total volume of benzene is used at one time and (ii) the 50 mL of benzene is divided into five 10 mL portions and employed one after the other. 5
- (c) Explain the extraction of metal ions by high molecular weight amines. Cite the relevant equilibria involved. What are the different aqueous and organic phase parameters which affect these extractions? 5
3. (a) Define chromatography as a separation technique. Give a classification of the technique based on the nature of the mobile phase. Also list all the different sub-classes under each head citing the principal operative mechanism responsible for separation. 5
- (b) What is van Deemeter equation ? Explain the importance of each term. How do they affect the performance of the column ? 5
- (c) Two compounds "A" and "B" were found to have retention time 18.00 and 19.50 min., respectively on a 30.0 cm column. The peak widths (at base) for "A" and "B" were 1.20 and 1.30min, respectively. Calculate. 5

- (i) Column resolution,
 - (ii) the average number of plates in the column, and
 - (iii) the plate height.
4. (a) What are the different methods used for the detection of spots in planar chromatography? 3
- (b) What are the main advantages of thin layer chromatography over paper chromatography? 3
- (c) What are the requirements for an ideal support for liquid-liquid partition chromatography? 5
- (d) Name the different methods used for column development in liquid chromatography. Discuss the displacement development method in detail. 4
5. (a) Name the different ion exchange properties which are to be known before putting the ion exchanger to use. Explain the terms capacity and distribution ratio in detail. 6
- (b) What are the advantages of addition polymeric ion exchange resins over their condensation polymers ? 3

- (c) What are the different types of synthetic inorganic ion exchangers ? Give one example of each category. Explain the behaviour of hydrous oxides of polyvalent metals exchangers. What are the advantages of synthetic inorganic ion exchangers over their organic counterparts? 6
- (a) Explain the basic principle of size exclusion chromatography. Give a broad classification of different types of gels used for this technique. 7
- (b) What are the special features of size exclusion chromatography to make it a unique separation technique? 6
- (c) Give one application of size exclusion chromatography in each of the following areas. 2
- (i) Preparation of medicine.
- (ii) Preparation of vaccine.
7. (a) Give a block diagram of a typical gas chromatograph labelling each part. Briefly explain the role of each component. What should be the essential requirements of a carrier gas ? 8

- (b) What are the advantages of GLC over GSC?
 - (c) Compare HPLC and GC pointing out the advantages and limitations of both the techniques.
- 8.
- (a) Discuss the applications of membranes in
 - (i) desalination and water treatment and
 - (ii) hemodialysis.
 - (b) Explain the basic principle of electrophoresis as a separation technique.
 - (c) Write a brief note on capillary electrochromatography.
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