P.G. DIPLOMA IN ANALYTICAL CHEMISTRY

Term-End Examination

June, 2011

MCH-002 : SEPARATION METHODS

Time : 3 hours   *Maximum Marks : 75*

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

1. (a)   Define 'separation' and explain its   5.
         objectives. Describe the scope of separation
         methods.

    (b)   Explain the basis of classification of   5
         separation methods. Describe any two
         properties briefly and name the methods
         based on these properties.

    (c)   Name various criteria used for the selection   5
         of separation methods. Explain the
         importance of speed of a separation method.

2. (a) Explain Nernst distribution law and discuss its limitations. How is it different from distribution ratio ? **3+2**

(b) How extraction systems may be classified on the basis of mechanism ? Name three extractants containing phosphorus - oxygen bonds and draw their structures and explain characteristics. **2+3**

(c) Explain how metal ions can be extracted by ion pair formation ? Consider a suitable example and draw the nature of plot between log (amine) and log D. **5**

3. (a) Define retention time and explain its usefulness. If retention time for a compound is 12.7 min where solvent showed its peak at 4.9 min then calculate retention factor. **3+2**

(b) Write van Deemter equation and explain all three terms-Eddys diffusion, longitudinal diffusion and non-equilibrium mass transfer briefly. With the help of a plot between H and U. **2+3**

(c) Define R_f value. Discuss the factors affecting it. In the separation of Mn and Co, if the solvent phase moved up to 11.3 cm where metal ions were spotted at 9.7 and 8.5 cm respectively. Calculate R_f values for metal ions. **1+2+2**

4. (a) What are the various column development techniques ? Explain briefly. 5

(b) What are ion-exchange resins ? Explain their applications in the separation of various metal ions. 5

(c) Draw the structure of silica gel depicting three types of - OH bonds. Explain the order of their activity. 5

5. (a) What are various types of pumps used to maintain flow rate and pressure of the mobile phase ? Explain gradient elution and its uses in HPLC. 4+1

(b) Draw a block diagram of a typical gas chromatograph and label all the components. Name any four detectors used in GC. 3+2

(c) What are the characteristics of stationary phase in LSC ? Name any four adsorbents and mobile phases used in LSC. 5

6. (a) What are various properties for the choice of resin materials ? Explain any three briefly. 5

(b) What is the basic principle of size exclusion chromatography ? Explain it schematically and draw the nature of plot between retention volume and molecular wt. of the solute. 3+2

(c) Explain the role of polyacrylamide gels and agar/agrose gels in gel permeation chromatography (GPC). Discuss their structure, advantages and limitations. 5

7. (a) Explain any one of the following mechanisms of separation through membrances : 5
   (i) Facilitated diffusional transport
   (ii) Active transport

   (b) Explain the phenomenon of osmosis and define osmotic pressure. What do you understand by reverse osmosis ? 5

   (c) What do you understand by capillary electrophoresis ? Explain it schematically. Describe capillary zone electrophoresis and capillary gel electrophoresis. 5

8. Explain **any three** of the following briefly using suitable representation and/or example. **5x3=15**
   (a) Presence of masking agents in extraction.
   (b) Elution analysis in chromatography.
   (c) Characteristics of stationary phase support in gas chromatography.
   (d) Application of size exclusion chromatography for diagnostic purposes.
   (e) Ion selective membrane electrodes and their application for the determination of metal ions.

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