P.G. DIPLOMA IN ANALYTICAL CHEMISTRY

00945

Term-End Examination

December, 2011

MCH-002 : SEPARATION METHODS

Time : 3 hours   *Maximum Marks : 75*

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

1. (a) Explain the importance of separation   5
         methods. How these are useful in our daily
         life ?

    (b) Define 'chromatography'. How it evolved   5
         from the beginning to the present day ?
         Name the Nobel awardees in
         chromatography.   5

    (c) What do you understand by 'partition' and
         'ion exchange' ? Explain the separation
         methods based on these properties and
         discuss their importance.

2. (a) Define percent extraction. Draw the nature 2+3
         of plot between percent extraction and
         distribution ratio explaining its significance.

    (b) Define and differentiate between a diluent 3+2
         and modifier. Give two examples for each.

    (c) Explain synergism with a suitable example. 5
         Predict the synergistic effect of solvating
         molecules TBP, TOPO and TPP in
         conjunction with HTTA.

3. (a) Define distribution constant (K) and derive   5
    the relationship between solution migration
    and K. Draw the nature of chromatogram
    depicting retention time, peak width and
    resolution.

   (b) Explain the concept of theoretical plates.
    Give expressions for the number of plates
    using full peak width and half peak width.
    Calculate the number of plates if retention
    time is 9.7 min and full peak width is
    0.65 min.   2+1+2

   (c) What is 'autoradiography' ? In what
    respects it differs from ordinary paper
    chromatography ? Explain its typical
    application.   1+2+2

4. (a) Discuss the characteristics of stationary   5
    phases used in liquid-solid column and
    liquid-liquid column chromatography.
    How do these differ from each other ?

   (b) Define chromatographic resolution. Draw   5
    the plots for R=0.50 and 1.0 and give
    expressions for R based on full width and
    half width.

   (c) Draw a schematic illustration of the   5
    experimental set up of HPLC, Label all the
    components and describe each briefly.

5. (a) What is reverse phase HPLC ?   **2+3**

Explain the reationship between polarity of the sample with that of packing and the mobile phase in RPHPLC.

(b) In a chromatographic separation of two   **2+3** components A and B, retention times are 6.9 and 8.7 min with peak widths 0.46 and 0.59 min respectively. Draw the nature of chromatogram and calculate resolution and average number of plates.

(c) Write Van Deemter equation (expanded   **5** form) and define all the terms. Also show the plot of U Vs H showing contribution of all three terms.

6. (a) What are ion exchange resins ? Describe a   **5** method for the synthesis of cation and a anion exchanger.

(b) What do you understand by resin selectivity ? Explain various factors affecting it. Predict the order of decreasing ion exchange for Na^+, Ca^{2+}, Al^{3+} and Th^{4+} at < 0.1 M concn.   **1+3+1**

(c) Explain various properties and classification of gels used in size exclusion chromatography. Draw the structure of sephadex.   **2+2+1**

7. (a) Explain the basic principle of separation by membrane process and list various mechanism of separation by membrane processes. 5

    (b) Explain dialysis and electrodialysis. In what respects these differ from each other ? 5

    (c) Describe the basic principle of electrophoresis. Explain the terms slab electrophoresis and capillary electrophoresis. 5

8. Explain *any three* of the following briefly using suitable representation and / or example; 5x3=15

    (a) Stripping in metal ion extraction.

    (b) Choice of mobile phase in liquid column chromatography and solvent strength

    (c) Optical detectors in High Performance Liquid Chromatography (HPLC)

    (d) Ion exchange properties of insoluble ferrocyanides

    (e) Reverse Osmosis (RO) phemenon and its application in water purification.