00122

P.G. DIPLOMA IN ANALYTICAL CHEMISTRY

Term-End Examination

December, 2010

MCH-002 : SEPARATION METHODS

Time : 3 hours *Maximum Marks : 75*

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

1. (a) Explain various methods of separation based on volatility and partition properties. Describe each one of these briefly (in two lines). 5

(b) Define the terms 'distribution ratio' and 'percent extraction'. Explain the difference between the two and discuss their significance. 5

(c) What type of organophosphorus compounds are used as extractants ? Give names of three such extractants and explain their characteristics. 5

2. (a) Define the terms 'diluent' and 'modifier', giving suitable examples. Explain their role in metal ion extraction, and the difference between the two. 2x2+1

(b) What do you understand by 'stripping' and 'masking' ? Give two examples of each and discuss their role in metal ion separation. 5

(c) Explain the terms retention factor, retention time and separation factor giving mathematical expressions for each. Discuss their significance in separation process. 5

3. (a) Give Van Deemter equation. Explain all the terms on the basis of rate theory. Draw the nature of plot showing H_{min} and U_{opt}. 5

(b) Define R_f value and explain its characteristic features. If compounds of Mn, Fe and Co travel 4.5, 3.9 and 6.8 cm, respectively where as the solvent goes up to 8.3 cm. Calculate R_f values in each case. 2+3

(c) Describe the experimental procedure to illustrate the use of CO_2 in photosynthesis in plants. Explain, the detection method used. 4+1

4. (a) Discuss and compare the various development techniques used in chromatography. Illustrate your answer with suitable examples. 5

(b) Draw a labelled block diagram of a gas chromatograph showing all its components. What are the various prerequisites of the detectors used ? Mention names of any two detectors. 5

(c) What are the various steps involved in sampling process ? Explain the importance of sample size, injection systems and sample injection part with illustration. 5

5. (a) What are the various structural types used as ion - exchange packings ? Explain how the properties of an ion exchanger may be improved by silylation. 5

(b) Compare various forms of liquid chromatography - classical, HPLC with pellicular packing and HPLC with microparticulate packing with illustration. 5

(c) What are the advantages of HPLC over other chromatographic methods ? Explain how HPLC can be modified for the separation of ionic substances. Give a suitable examples. 5

6. (a) What is the mechanism of an ion exchange separation process ? Explain the difference between adsorption and ion exchange. 5

(b) Discuss various properties of ion exchange resins. Explain briefly resin selectivity and various factors affecting the selectivity. 5

(c) Explain the difficulties encountered in the separation of lanthanides. How ion exchange chromatography has been used for the separation of actinides ? 5

7. (a) Describe briefly different types of inorganic ion exchangers. Enumerate their special properties. 5

(b) Explain the basic principle of size exclusion chromatography. Schematically represent the separation in a column. 5

(c) Describe structural features of Sephadex, Bio-gel, Agrose and Styragel. Mention their applications briefly. 5

8. (a) What are various membrane processes used for separation ? Explain each briefly. 3

(b) Write a brief account of capillary electrophoresis with schematic representation of experimental set up. 3

(c) Write explanatory notes on the following : 3x3=9

(i) Dialysis.

(ii) Osmotic phenomenon.

(iii) Capillary Electrochromatography.