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MCH–002

POST GRADUATE DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

Term-End Examination
December, 2023

MCH-002 : SEPARATION METHODS

Time : 3 Hours *Maximum Marks : 75*

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

(ii) Marks allotted to parts are indicated on R.H.S.

1. (a) What are the objectives of carrying out separations ? Name any *five* properties which are generally used for achieving separations. 5

   (b) State Nernst's distribution law and give its limitations. 5

   (c) Briefly explain the techniques based on electromigration. 5

2. (a) A metal chelate is formed between M^{n+} and ligand H_2L. Explain which constants of the ligand and/or the chelate should be higher for a higher metal extraction. 5

   (b) Draw a labelled chromatogram between time *vs.* detector response showing (i) Dead time and (ii) Retention time. Give mathematical expression to calculate N, the number of theoretical plates. 5

   (c) List any *five* criteria for the choice of organic phase in solvent extraction. 5

3. (a) What precaution should be taken in handling TLC plates ? Classify the following materials as suitable/not suitable to make a TLC plate : 5

   (i) Asbestos sheet

   (ii) Hard cardboard sheet

   (iii) Glass sheet

   (iv) Granulated glass sheet

   (v) Metal sheet

   (vi) Plastic sheet

   (vii) Plywood sheet

   (viii) Sunmica sheet

(b) Explain the term diluent. Give its example. How is it useful in separations involving solvent extraction ? 5

(c) Briefly discuss the activation and regeneration of adsorbent in liquid-solid chromatography. 5

4. (a) Define chromatography, stationary phase and mobile phase. State various processes responsible for separation of components of a mixture. 5

(b) Explain the term 'Retardation factor', R_f. List various factors affecting it. 5

(c) Explain briefly different types of stationary phase packings used in HPLC. 5

5. (a) In a gas chromatograph, name the gases which are generally used as carrier gas. How is water removed from this gas ? 5

(b) State whether the following statements are True *or* False : 5

(i) Column efficiency of a G. C. is enhanced by increasing the particle size of the packing. (T/F)

(ii) Resolution of chromatographic peaks is related to column efficiency. (T/F)

(iii) For high separation efficiency, a high molecular weight carrier gas should be used. (T/F)

(iv) Larger the diameter after capillary column, greater is the efficiency of separation. (T/F)

(v) Increase in temperature leads to better resolution and faster separation. (T/F)

(c) List any *five* requirements of an HPLC detector. 5

6. (a) Explain the difference between adsorption and ion-exchange chromatography. A sodium phosphate solution is passed through an anion exchanger in the chloride form. The PO_4^{3-} ions are taken up by the ion exchanger. Write the ion exchange equilibria. 5

(b) What is the basic difference between LSC and LLC ? Which of the *two* techniques is generally faster ? Give a brief description of these techniques. 5

(c) Briefly discuss the synthesis of anion exchangers. 5

7. (a) Distinguish between osmosis and reverse osmosis. 5

   (b) Briefly discuss any *two* analytical applications of size exclusion chromatography. 5

   (c) Write the structure of ethidium bromide. Discuss its role in DNA gel electrophoresis. 5

8. (a) Distinguish between dialysis and electrodialysis. 5

   (b) Explain the importance of loading buffer in DNA gel electrophoresis. 5

   (c) Briefly explain any *five* important properties of gels used in size exclusion chromatography. 5