

**P.G. DIPLOMA IN ANALYTICAL CHEMISTRY
(PGDAC)****Term-End Examination****December, 2012****MCH-002 : SEPARATION METHODS***Time : 3 hours**Maximum Marks : 75*

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

1. (a) What are the various properties on the basis of which a mixture of more than two components may be separated ? Explain the use of any one property. 5
- (b) What is the basis of classification of various separation methods ? Explain the methods based on solubility, ion exchange and volatility. 5
- (c) Define distribution ratio and percent extraction. Partition coefficient of I_2 between CCl_4 and water is 110. Calculate the percent extraction of I_2 if 0.5g I_2 is shaken in 25 mL CCl_4 and 15 mL water. 5

2. (a) Explain 'Extraction by solvation' by giving equations for the case of Fe (III) in ether with increasing concentration of HCl in aqueous medium. 5
- (b) Define 'resolution' of a chromatogram. Draw a chromatogram showing the two components with a resolution of 0.80, 1.0 and 1.3. Give the expression for resolution using half-widths. 5
- (c) What is paper chromatography ? Explain the criteria for selection of paper and solvent. Define R_f value and explain the factors on which it depends. 5
3. (a) What are the various extractants containing P-O bonds giving structures of TBP, TOPO and butyl dibutyl phosphinate ? Discuss their extraction characteristics. 5
- (b) What are the various mechanisms operative in different chromatographic methods ? Explain any three of these briefly. 5
- (c) Define resolution with a suitable illustration. Calculate resolution if retention times of two components A and B are 1.73 and 1.97 min with peak widths 0.65 and 0.78 min respectively. 5

4. (a) What do you understand by synergism ? 5
Give suitable example. How synergistic effect of solvating molecules TBP, TOPO and TPP increases in conjunction with HTTA ?
- (b) Define column efficiency. Explain how it can 5
be improved on the basis of rate theory of Van Deemter.
- (c) Discuss and compare various development 5
techniques used in chromatography. Illustrate your answer with suitable examples.
5. (a) Illustrate the separation of three components 5
with carrier flow in a chromatographic column. Discuss the characteristics of stationary phase support and liquid phase.
- (b) Draw a labelled schematic diagram of a gas 5
chromatograph explaining the role of mobile phase and detectors with two examples for each of these.
- (c) Draw the structure of silica gel showing 5
different types of OH groups. How these are converted into siloxanes by reacting with organohalosilanes ?
6. (a) Explain briefly the advantages and 5
disadvantages of HPLC.
- (b) What are the various operating methods of 5
ion exchange chromatography ? Discuss column operation briefly.

- (c) What are gels ? Discuss their important properties which make them suitable for chromatography. 5
7. (a) Explain dialysis and electro dialysis with a suitable schematic illustration for each. In what respects these differ from each other ? $2+2+1=5$
- (b) Explain reverse osmosis process. Derive an expression for solution retention R in terms of effective pressure difference (P- π) 5
- (c) Explain slab electrophoresis and capillary electrophoresis. In what respects these differ from each other. $2+2+1=5$
8. (a) What are liquid membrane processes ? Explain the mechanism of transport in supported liquid membranes. 6
- (b) Write brief notes on *any three* of the following : $3 \times 3 = 9$
- (i) Salting out agents
 - (ii) Elution analysis
 - (iii) Resin selectivity
 - (iv) DNA gel electrophoresis
 - (v) Ion chromatography
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