

P.G. DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

Term-End Examination

December, 2019

MCH-002 : SEPARATION METHODS

Time : 3 hours

Maximum Marks : 75

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

1. (a) List various types of distillation processes used to separate components. Give details of the process employed if components of the mixture are known to decompose below their boiling points. 5
- (b) Extraction efficiency of high molecular weight amines increases in the order p < sec < ter < quar. In what situation a deviation in the above sequence is generally observed ? 5
- (c) A mixture of two components analysed by chromatography showed retention times of 6.53 and 8.75 min. with respective band widths of 0.27 and 0.34 min. The solvent peak showed at 2.41 min. calculate (i) retention factors, (ii) resolution, and (iii) number of plates. 5
2. (a) List any four permeable barriers used in separation methods based on molecular geometry. Illustrate the separation of components using any method of your choice. 5
- (b) (i) How is reproducibility of a separation expressed ? 1,2,2=5
- (ii) Under what conditions, the speed of carrying out separation is important and relevant.
- (iii) Name atleast two separation methods performed using an electric field.
- (c) Describe the technique of super critical fluid chromatography. Mention its two important advantages. 5

3. (a) A mixture contains cations of 4f and 5f block elements. Since the mixture cannot be separated by chemical methods, an alternative method is to be used. Describe, how the separation of various components can be achieved ? 5
- (b) Partition coefficient of iodine between  $\text{CHCl}_3$  and water is 132. Calculate the fraction of iodine that will remain in aqueous phase at equilibrium when iodine is equilibrated between equal volumes of  $\text{CHCl}_3$  and  $\text{H}_2\text{O}$ ; say 100 ml. 5
- (c) What are GLC and GSC techniques ? What are the main drawbacks of GSC ? 5
4. (a) Which of the following surfaces cannot be used as an inert support for coating of the adsorbent in TLC ? 4
- (i) Asbestos sheet
- (ii) Cardboard sheet
- (iii) Glass sheet
- (iv) Glass sheet with granulated surface
- (v) Metal sheet
- (vi) Plastic sheet
- (vii) Plywood sheet
- (b) Mark the given choices as true or false : Efficiency of a capillary gas chromatographic column increases by increase in : 3
- (i) Size of particle used in packing the column.
- (ii) Molecular weight of the carrier gas.
- (iii) The internal diameter of the capillary.
- (c) What do you understand by the term, "Liquid ion Exchanger" ? Give two examples of each type of such exchangers. 8
5. (a) Explain 'Size Exclusion Chromatography'. State its advantages over other commonly used separation methods. 5
- (b) Briefly explain gel filtration chromatography. Discuss its uses for medical purposes. 5
- (c) Explain the process of Reverse Osmosis. How is it useful for making drinking water safe ? 5

6. (a) Explain the working of a ion-selective electrode. 5  
(b) What do you understand by the term "loading buffer" ? What is its importance in DNA gel electrophoresis ? 5  
(c) List any five advantages of HPLC. 5
7. (a) Describe the salient features of High Performance Thin Layer Chromatography (HPTLC). What are its advantages over normal TLC ? 8  
(b) Name and explain the factors on which resolution of peaks in a gas chromatogram depends. 7
8. Write short notes on the following : 3x5=15  
(a) Guard and suppressor columns - In what respects they differ from each other ?  
(b) Under what conditions the organic resinous ion exchangers deteriorate fast ? Explain the chemical reactions involved.  
(c) What is macro - microreticular gel ? Give its special advantage for chromatographic work.
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