

**P.G. DIPLOMA IN ANALYTICAL  
CHEMISTRY (PGDAC)**

**Term-End Examination**

**MCH-002 : Separation Methods**

*Time : 3 Hours]*

*[Maximum Marks : 75*

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

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1. (a) Mark if the given statement is 'true' or 'false':
- 1×10=10
- (i) Electrolysis of sea water is carried out to produce potable water (T/F)
  - (ii) Membrane electrodes are used for analytical purpose. (T/F).
  - (iii) Coions are the ions having similar charge as on the fixed group of the membrane polymer matrix. (T/F)
  - (iv) Charge on the counter ions and mobile ions diffusing into the membrane from the external solution, is not same. (T/F)
  - v) HPLC is also known as "High Speed Liquid Chromatography" (T/F)



- (v) HPLC involves application of high pressure. (T/F)
  - (vii) Van Deemeter equation is applicable to TLC. (T/F)
  - (viii) Pervaporation is a separation technique useful to separate liquid components that form azeotropes (T/F).
  - (ix) Components of mixture which have boiling points very close to each other are separated by fractional distillation. (T/F)
  - (x) Liquid solid chromatograph (LSC) is based on differences in the partition coefficients of the components. (T/F)
- (b) Distribution ratio of solute X in water carbon tetrachloride is 10. Calculate the percent of solute extracted from 50 mL of water by 100 mL of carbon tetra chloride. 5
2. (a) List five properties of components such that any suitable difference in any one of these can be used to separate components. Illustrate giving example.
- (b) Explain the extraction of anionic metal complexes by high molecular weight amines. 10
3. (a) What are the important parameters to characterize dialysis process? Discuss the role of membrane thickness.

- (b) Describe the type of distillation used to separate components of a mixture which decompose below their normal boiling point. Give example. 5
- (c) Explain the basic principle and operation of gel electrophoresis. 5
4. (a) State and explain distribution law. Mention the conditions when distribution coefficient, distribution ratio and thermodynamic distillation coefficient are equal.
- (b) What do you understand by the minimum detectable quantity of a detector? Explain how is it affected by the temperature of the gas chromatographic column?
- (c) Compare HPLC and GC. 5
5. (a) Exhaust of a mobike was tested for heavy toxic metals by paper chromatography. Only one spot was obtained at  $R_f$  value of 0.32. A mixture of  $Ag^+$ ,  $Pb^{2+}$  and  $1+g^{2+}$  was separated by paper chromatography. The solvent front rose to 18.4cm while cationic spots were observed at 15.8, 12.1 and 5.9 cm respectively. Identify the pollutant toxic metal in the exhaust. 5
- (b) Compare paper chromatography and TLC techniques. Which one is better? Give reason. 5
- (c) Explain synthetic ion exchanges with suitable example. 5
6. (a) Distinguish between osmosis and reverse osmosis. 5
- (b) Explain the use of size exclusion

- chromatography for separation of solutes of different molecular weight. 5
- (c) Briefly describe, giving examples the relevance of separation methods in improving the environment. 5
7. (a) State Henry's law. Why is this law not valid in case of GLC? 5
- (b) On what factors the resolution of peaks depends in case of gas chromatography? Explain. 5
- (c) (i) 15cm long HPLC column has 10200 theoretical plates. A solute has a retention time of 20 min. When a 1:1  $\text{CHCl}_3 + \text{C}_3\text{H}_3$  mixture is the mobile phase. Calculate the height of theoretical plate. 3
- (ii) What are two synonyms for HPLC? 2
8. (a) Explain the functioning of a natural ion exchanger which may act both as an anion and cation exchanger. 5
- (b) Briefly explain capillary electrophoresis. 5
- (c) Calculate the osmotic pressure of a 1000ppm calcium chloride solution at  $27^\circ\text{C}$ . ( $R=0.082\text{Latm/degree.mole}$ ). 5

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