

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

**Term-End Examination**

**February, 2021**

**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) Examine the given statements and indicate if it is *True* or *False*. *10×1=10*
- (i) HPLC may rightly be called 'High Resolution Liquid Chromatography'. (T/F)
  - (ii) Silica used in chromatography is basic in nature. (T/F)
  - (iii) Non-polar solvent molecules can replace water molecules in the metal complex,  $MX_n \cdot xH_2O$ . (T/F)
  - (iv) An alkyl phosphorus acid is preferred to a carboxylic acid for extraction of a metal ion. (T/F)

- (v) Liquid solid chromatography is based on the difference in adsorption of the solute. (T/F)
  - (vi) High pressure is not applied in case of HPTLC. (T/F)
  - (vii) In case of a gas chromatograph, increase in diameter of the capillary increases the separation efficiency. (T/F)
  - (viii) Components of an azeotropic mixture can be separated by pervaporation. (T/F)
  - (ix) Retention time is the most common factor between G.C. and HPLC. (T/F)
  - (x) Amperometry can be used to detect sample after capillary electrophoresis. (T/F)
- (b) (i) A metal ion,  $M^{n+}$ , forms a chelate  $MX_n \cdot xH_2O$  which is poorly extracted in benzene but is readily extracted in polar solvents. Explain. 2
- (ii) State limitations of dialysis process. 3
2. (a) State the parameters on which the osmotic pressure of an ionic salt depends. Calculate the osmotic pressure of a 500 ppm sodium sulphate solution at  $27^\circ C$  ( $R = 0.082 \text{ L atm/degree/mole}$ ) 5

- (b) Explain DNA gel electrophoresis. 5
- (c) List various methods of detecting samples in capillary electrophoresis. 5
3. (a) State salient features of optical detector, electrochemical detector and mass spectrometric detector used in HPLC. Which of these detectors is insensitive to temperature variations? Give reasons. 10
- (b) Briefly explain the method of two-dimensional paper chromatography. 5
4. (a) In a 25.0 cm long column, solvent took 2.35 min to run through whereas two compounds X and Y took 9.87 min and 10.63 min with peak half-width of 45.6 S and 53.4 S respectively. Calculate 5
- (i) Capacity factor for X
- (ii) Separation factor  $\alpha$
- (b) Explain the principle of separation of components using fractional distillation. 5
- (c) How does the presence of salting out agents affect solvent extraction? Explain. 5
5. (a) Explain the fractionation of solutes of different molecular weights by size exclusion chromatography using gel. 5
- (b) Name two organic resinous ion exchangers. Under what conditions do these deteriorate fast? 5

- (c) Write expanded form of Van Deemter equation and explain the terms involved in it. 5
- 6.** (a) Chelates of metal X and Y are extracted with chloroform. What should be the ratio of their distribution coefficients so that 99% of Y remains in aqueous phase while 99% of X goes into organic layer ? Assume equal volumes of the two phases. 5
- (b) What is a chelating resin ? Give example. Mention two limitations of such resins. 5
- (c) Explain the detection of gallic acid in triphala using TLC. 5
- 7.** (a) Explain the term “Retention factor”. What are the problems if its value is too small or too large ? 5
- (b) Which of the following may be used for making TLC plates : 5
- (i) Stainless steel
- (ii) Frosted glass
- (iii) Hard cardboard
- (iv) Plane glass
- (v) Asbestos
- (c) Explain the applications of gas chromatography in environmental analysis. 5

8. (a) Explain the influence of pH on the extraction of metal chelates. 5
- (b) Differentiate between adsorption and ion exchange. 5
- (c) How are molecular masses of proteins determined by a chromatographic method ? Explain. 5
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