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MCH-002

P.G. DIPLOMA IN ANALYTICAL CHEMISTRY (PGDAC)

Term-End Examination

December, 2013

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 different properties based on which chemical separations are made ? Discuss the characteristic features of separations which are based on solubility and molecular geometry. 8

(b) Discuss the different criteria used for the selection of a separation technique. Highlight the importance of each of these criteria. 7

2. (a) The distribution coefficient of a solute "AB" between carbon tetrachloride and water is 10. What percentage of "AB" dissolved in 100ml of water will remain in the aqueous phase if it is contacted with 50ml of carbon tetrachloride ? 4

(b) Give a broad classification of solvent extraction systems based on the extraction mechanism and the extractant used. Discuss the extraction equilibria of a metal chelate. 8

What different factors will affect the distribution ratio of the metal ?

(c) What is meant by salting out effect in liquid-liquid extraction ? How does it operate ? Explain it by proper examples. 3

3. (a) Give a classification of liquid chromatography based on different operative mechanisms. 5

(b) Explain the concept of theoretical plates in column chromatography. How is number of plates related with retention time and band width ? 5

(c) In a 25.0cm long column the solvent took 2.50min to run through whereas two compounds "A" and "B" took 9.80 min. and 10.60min with peak half width 45.0sec. and 53.0sec. respectively. Calculate 5

(i) Capacity factor for "A" and "B".

(ii) Separation factor α.

(iii) Average number of plates and plate height.

4. (a) What are the essential requirements for an ideal support for liquid-liquid partition chromatography ? 5

(b) What important factors govern the choice of a mobile phase for liquid column chromatography ? Enumerate the requirements of an appropriate mobile phase for liquid column chromatography. 5

(c) Comment on the quantitative aspects of thin layer chromatography. Explain the different approaches adopted for this purpose. 5

5. (a) What are the important characteristics of a useful ion exchanger ? 4

(b) What is the role of divinylbenzene in the synthesis of styrene-divinylbenzene polymeric ion exchange resins ? 3

(c) Give a classification of synthetic inorganic ion exchangers. Cite one example of each category. Discuss insoluble acidic salts of polyvalent metals as ion exchangers in detail. What are the general advantages of synthetic inorganic ion exchangers over organic resinous ion exchangers ? Cite one example of application of synthetic inorganic ion exchanger particularly based on each of the advantages. 8

6. (a) Discuss the different properties of gels which have to be considered for them to be useful for size exclusion chromatography. 5

(b) Give a broad classification of different types of gels used for size exclusion chromatography. Discuss the preparation, special features and advantages of Dextran gels (Sephadex). 6

(c) How is gel filtration chromatography used for the determination of molecular weight of proteins ? 4

7. (a) What are the advantages of gas-liquid chromatography over gas-solid chromatography ? 3

(b) Discuss the essential requirements for : 9

(i) stationary phase support

(ii) liquid phase, and

(iii) detector

for use in a gas chromatograph.

(c) Give the important advantages of high performance liquid chromatography over normal liquid chromatography. 3

8. (a) Explain the principle of ion selective membrane electrodes. What are their main applications ? 6

(b) Distinguish between 4

(i) osmosis and reverse osmosis

(ii) dialysis and electrodialysis in membrane processes.

(c) Explain the principle of capillary electrochromatography. Mention its advantages. 5