Analytical Chemistry (2)

1. Ion exchange chromatography is based on
   (a) Electrostatic attraction (b) Electrical mobility of ionic species
   (c) Adsorption chromatography (d) Partition chromatography
2. In which of the following type of paper chromatography does the mobile phase move horizontally over a circular sheet of paper?
   (a) Ascending paper chromatography (b) Descending paper chromatography
   (c) Radial paper chromatography (d) Ascending – descending chromatography
3. In which chromatography. The pH of the mobile phase buffer must be between the pI (isoelectric point) or the pKa (acid dissociation constant) of the charged molecule and the pKa of the charged group of solids.
   (a) Affinity chromatography (b) HPLC
   (c) column chromatography (d) Ion exchange chromatography
4. In anion exchange chromatography
   (a) The column contains negatively charged beads where positively charged protein binds.
   (b) The column contains positively charged beads where negatively charged protein binds.
   (c) Column contains both negatively and positively charged beads where proteins bind on a net basis.
   (d) all of these
5. Ion exchange process is also called as _____.
   (a) Permutit's process (b) Demineralization
   (c) Zeolite process (d) Lime soda process
6. Ion exchange process is the clean process because it has _____.
   (a) Sludge formation (b) No sludge formation
   (c) Little sludge is formed (d) Other precipitates are formed
7. For gel filtration chromatography of proteins, which of the following is true?
   (a) Large or elongated proteins enter the pores in the beads.
   (b) Small proteins enter the pores in the beads.
   (c) Large of elongated proteins elute from the bottom of column later.
   (d) Small proteins elute from the bottom of the column first.
8. Which of the following types of chromatography involves the process, where mobile phase moves through the stationary phase by the influence of gravity or capillary action?
   (a) Column chromatography
   (b) High pressure liquid chromatography

(c) Gas chromatography

(d) Planar chromatography

9. Which of the following are stationary phases commonly used for the gel filtratiion column?

i. Dextran ii. Agarose iii. Silica

(a) i and ii (b) ii and iii only (c) i and iii only (d) All the them

10. Which of the following is/are another term of gel filtration?

i. Desalting

ii. Size exclusion chromatography

iii. Permeation chromatography

iv. Molecular sieve chromatography

(a) i and ii only (b) i and iii only (c) ii and iii only (iv) ii, iii and iv only

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1. The acidic solution containing trimethylamine (A), dimethylamine (B) and methyl amine (C) (pK_a of cations 9.8, 10.8 and 10.6, respectively) was loaded on a cation exchange column. The order of their elution with a gradient of increasing pH > 7 is

(a) A < C < B (b) B < C < A (c) B < A < C (d) C < B < A

2. The correct order of the retention of cations on a sulfonated cation exchange resin column is

(a) $Ag^+ > K^+ > Na^+ > Li^+$ (b) $K^+ > Na^+ > Ag^+ > Li^+$

(c) $Li^+ > Na^+ > K^+ > Ag^+$ (d) $Li^+ > Na^+ > Ag^+ > K^+$

3. A column is packed with 5 g of a strongly acidic ion exchange resin in H^+ form. A 1.0 M NaCl solution is passed through the column until the eluant coming out becomes natural. The collected eluant is completely neutralized by 17 ml. of 0.5 M NaOH. The ion exchange capacity of the resin is:

(a) 1.00 meq/g (b) 1.25 meq/g (c) 1.50 meq/g (d) 1.75 meq/g

4. Gel permeation chromatography can be used to separate which of the following

(A) Lanthanides (B) Alkaline earths

(C) Fatty acids (D) Peptides

The correct answer is

(a) A and B (b) B and C (c) C and D (d) A and D

ANSWER KEY

ASSIGNMENT (2)

1. (a) 2. (c) 3. (d) 4. (b) 5. (b) 6. (b) 7. (b)
8. (d) 9. (d) 10. (d)

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1. (a) 2. (a) 3. (d) 4. (c)

SOLUTIONS

ASSIGNMENT - 2

1. Ion exchange chromatography separation is based on ionic (or electrostatic) interactions between ionic and polar analytes, ions present in the eluent and ionic functional groups fixed to the chromatographic support.

   So, correct option is (a)

2. In radial paper chromatography, the mobile phase moves horizontally over a circular sheet of paper. Separation takes place based on partition.

   So, correct option is (c)

3. In ion exchange chromatography pH of mobile phase must between pI or pKa of charged molecule and pKa of charged group of solids.

   So, correct option is (d)

4. In anion exchange chromatography, there is exchange of anions, so column contains +vely charged resin with –vely charged functional groups and then proteins –ve charge replaces –ve charge of functional group and binds to +vely charged resin.

   So, correct option is (b)

5. Ion exchange process is also called as the demineralization. The zeolite process is otherwise called as the ion exchange process.

6. In ion exchange process, there is no formation of sludge. So, it is called as the clean process.

7. Small proteins enter the pores in the beads and large particles are first to elute out.

   So, correct option is (b)

8. In planar chromatography, stationary phase is supported on flat plate of paper. The mobile phase moves by the influence of gravity or capillary action

9. Stationary phase $\Rightarrow$ Dextran
   Agarose
   Silica

   So, correct option is (d)

10. Gel filtration is also known as size exclusion, gel permeation or molecular seive chromatography.

    So, correct option is (d)

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1. (A) trimethylamine $\rightarrow pK_a$ 9.8
   (B) dimethylamine $\rightarrow pK_a$ 10.8
   (C) methyl amine $\rightarrow pK_a$ 10.6
   pH > 7 is a basic pH and amine with lower pK_a value will give the proton easily, and will elute at last.
   Correct option is (a)

2. The retention of ion in exchanges column depends upon the size of ion. Smaller the size of cation, stronger will be its binding ability. In cation exchanger column the aqueous solution of ion is passed where binding ability depends upon hydrated radii.

   $K^+(aq)$ $Na^+(aq)$ $Li^+(aq)$ $\longrightarrow$

Since, size of hydrated ion increases

Therefore, binding ability decreases

$Ag^+(aq)$ show polarization effect, hence, has high binding ability.

Correct answer is (a)

3. Ion exchange capacity (IEC) express the total of active sites of a resin in which ions are attached because of the greater molecular weight.

The exchange reaction can be represented as:-

$R - H^+ + Na^+ + Cl^- \rightarrow R - Na^+ + HCl$ aq.

$$IEC\left(meq/g\right) = \frac{\left(ml\ of\ NaOH\right)\times\left(M\ of\ NaOH\right)}{mass\ of\ resin\ \left(g\right)} = \frac{17\times.05\ M}{5g} = 1.7\ meq/g$$

So, correct option is (d)

4. Gel permeation chromatography is a type of size exclusion chromatography that separates analytes on basis of size. This technique is often used for analysis of polymer. So, fatty acids and low molecular weight peptides can be separated.

So, correct option is (c)