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2. Three methods for improving resolution include:
   
   a) adjustment of $k_A'$ and $k_B'$ by employing a multi-component mobile phase and varying the ratio of the components to find an optimal mixture;
   
   b) variation in the chemical composition of the solvent system and/or stationary phase to increase $\alpha$;
   
   c) use of a longer column.

3. In partition chromatography, $k'$ is conveniently varied by using a two- (or more) component mobile phase and varying the ratio of the components.

5. In adsorption chromatography on an alumina packing, the polarity of the mobile phase should increase as the elution proceeds. Thus, the ratio of acetone to hexane should be increased as the elution proceeds.

6. The linear response range of a detector is the range of analyte concentration or mass over which the detector responds linearly.

7. b) In an isocratic elution, the mobile phase composition is held constant throughout the elution.

   c) In a gradient elution, the mobile phase consists of two or more components and the composition of the eluent is changed continuously or in steps during the elution.

   d) A reversed-phase packing is a nonpolar material used in partition chromatography with a more polar mobile phase.

   e) A normal-phase packing is a polar material used in partition chromatography with a less polar mobile phase.

   f) In ion-pair chromatography a large organic counter-ion is added to the mobile phase as an ion-pairing reagent. Separation is achieved either through partitioning of the neutral ion-pair or as a result of electrostatic interactions between the ions in solution and charges on the stationary phase resulting from adsorption of the organic counter-ion.

   g) In ion chromatography, the stationary phase is an ion-exchange resin, and separation is achieved by differing attractions of solute ions to oppositely charged sites in the stationary phase.
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8. A guard column is a short column placed before the analytical column. It is packed with the same material as the main column except the particles are generally larger. The guard column removes impurities that might irreversibly bind to and degrade the main column.

10. a) The analytes will elute in the order of decreasing polarity for a reverse-phase separation: diethyl ether, benzene, n-hexane.

14. Nonvolatile and thermally unstable compounds can be separated by HPLC but typically not by GC.

16. In suppressor-column ion chromatography the chromatographic column is followed by a suppressor column whose purpose is to convert the ions used for elution into molecular species that are largely nonionic and thus do not interfere with conductometric detection of the analyte species. In single-column ion chromatography, low capacity ion exchangers are used so that the concentrations of ions in the eluting solution can be kept low. Detection then is based on the small differences in conductivity caused by the presence of eluted sample components.

17. A gas-phase sample is needed for mass spectrometry. The output of the LC column is a solute dissolved in a solvent, whereas the output of the GC column is a gas and thus is directly compatible. As a first step in LC/MS, the solvent must be vaporized. When vaporized, however, the LC solvent produces a gas volume that is 10-1000 times greater than the carrier gas in GC. Hence, most of the solvent must also be removed.