

Chem 310
8th Homework Set
Due Date: Apr. 13, 2004

1. Liquid chromatography was performed using a packed column 15 cm long. The analyte naphthalene was injected and a peak appeared with a retention time of 2.10 minutes and a half width of 0.134 minutes. The deadtime for the column was 1.21 minutes. Calculate (a) the adjusted retention time, (b) the capacity factor, (c) the number of theoretical plates N , and (d) the plate height H of the column.
2. Phenanthrene and anthracene were injected on the same column as in Question 1. Phenanthrene eluted at 2.64 minutes with a half width of 0.144 minutes and anthracene eluted at 2.76 minutes with a base width of 0.097 minutes. Calculate (a) the resolution R and (b) the selectivity factor α .
3. In Question 2, resolution could be improved by lengthening the column used. (a) How long would the column have to be to achieve a resolution of 1.00 for phenanthrene and anthracene? (b) What would be the length of time needed for the separation assuming that the linear flow rate does not change?
4. Discussion question: What is a van Deemter plot? Sketch a van Deemter plot. What are the three factors that affect the shape of the curve? What useful information does the van Deemter plot give about the operation of a chromatograph?
5. What is the general elution problem? How is it addressed in GC and LC?
6. Harris, Problem 23-27.
7. (a) Explain this statement: Van Deemter plots show that hydrogen and helium are the best mobile phase gases for gas chromatography.
(b) Explain why helium rather than hydrogen is used. Note - see Harris.
8. Sketch a split/splitless injector and describe how it is used with a capillary column.
9. (a) Sketch a chromatogram showing peak fronting. Explain the cause of peak fronting and the cure.
(b) Sketch a chromatogram showing peak tailing. Explain the cause of peak tailing and the cure.
10. Predict the order of elution of the following compounds on a polydimethylsiloxane column: *n*-hexane, *n*-octane, *n*-decane, benzene, toluene, styrene. Explain your prediction. Hint: look up the boiling points of these compounds.