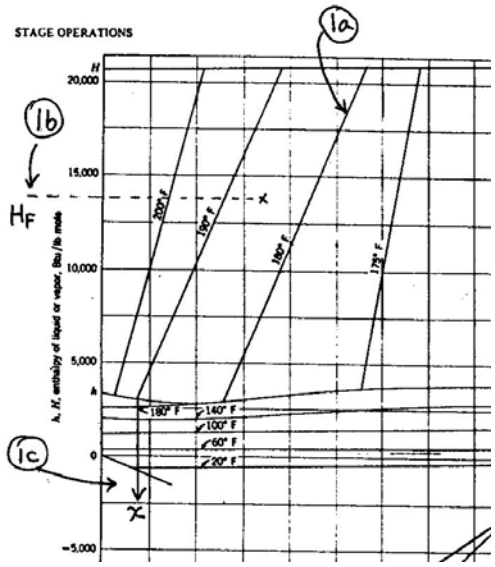
ChE 3660 – Separation Principles **Summer 2001**
Chemical Engineering Department **EXAM 3**
T.D. Placek **Auburn University**

Closed Book **Name:**_____



Instructions:

(1) Read each problem carefully before attempting to work.
(2) Show your work.
(3) Use your time wisely.
(4) Clearly indicate final answers.
(5) Accuracy of graphical solutions will be considered.

(6) Identify all important points and lines clearly on diagrams. For example, see the graph to the immediate left. This graph IS ONLY AN EXAMPLE. IT IS NOT PART OF THE EXAM MATERIALS.

1. (70%) The following problem uses the K-chart provided on a separate page.

A feed consisting of 20 mol% n-butane, 30 mol% n-pentane, 30 mol% n-hexane, and 20 mol% n-heptane is to be distilled at a pressure of 4.0 atm. The column employs a total condenser and a partial reboiler. The feed to the process is a saturated liquid. It is desired to recover 80% of the n-pentane in the feed in the distillate and 80% of the n-hexane in the feed in the bottoms. Use the appropriate shortcut methods determine the following:

a. What α values should be used based on the feed conditions? (Compute these values assuming HK=ref).**
b. The minimum number of stages required (in the column) to perform this separation
c. The composition* and flowrate of the distillate
d. The composition* and flowrate of the bottoms

- *Note: You may NOT assume the LNK and HNK's do NOT distribute. You MUST use the Fenske equation to determine the distribution of ALL NK's.*
- *** You can use the weighted average of appropriate boiling points for this calculation.*

2. (30%) The following problem uses the K-chart provided on a separate page. Assume the column described in Problem 1 is going to be operated at R=2.5. Using the bottom's composition determined in Problem 1, determine the following?

a. What is the temperature of the liquid product leaving the reboiler?
b. Using K values appropriate for the bottom stage conditions, determine the composition of the liquid (mole fractions) leaving the bottom stage of the column?

Note: If you do not have bottom composition values from Problem 1, use the assumption of "all or nothing" to establish approximate compositions.