CHE 305 - Homework #4

Seader and Henley - 7.3

From ChemCAD, even at 10 bar the boiling points of methane and ethane are well below -32 oC. Therefore, water would not be a suitable utility for condensation of ethane at the partial condenser in a distillation column. A more suitable refrigerant would be required (e.g.: ethylene).

← Why

Low B.P.

Seader and Henley - 7.9

Temperature (K)	xN2	yN2
77.35	1	1
77.98	0.9	0.9717
78.73	0.79	0.9362
79.44	0.7	0.9031
80.33	0.6	0.8591
81.35	0.5	0.8046
82.54	0.4	0.735
83.94	0.3	0.6405
85.62	0.2	0.5081
87.67	0.1	0.31
90.17	0	0

SOP

0.002	0.002
0.791	0.904386

PART a

Material Balances:

Basis:	100 mol/hr feed	
N2 in	79.1 mol/hr	
O2 in	20.9 mol/hr	
Bottom O2	12.54 mol/hr	(60% of inlet O2)
Top O2	8.36 mol/hr	
B	12.57 mol/hr	← Part B
Bottom N2	0.025 mol/hr	
Top N2	79.07 mol/hr	
V bar	87.43 mol/hr	ok too
F	100 mol/hr	

EQ Line

Slope 3

$y = 3x$

Five stages to (0.03,0.09) on EQ Line

Stage	x	y
5	0.03	0.09
6	0.011341	0.034024
7	0.004228	0.012684
8	0.001516	0.004548

OP

SOP Equation:

Slope	1.143708
V_B	6.958533
Intercept	-0.000287

Number of theoretical plates required 8

Part c

SOLUTION

Seader and Henley - 7.10

mole fraction A

	Test 1		Test 2	
Stage	Vapor	Liquid	Vapor	Liquid
M+2	0.795	0.68	0.75	0.68
M+1	0.74	0.6	0.68	0.605
M	0.679	0.51	0.605	0.53

Feed: 0.4 mole fraction A

Test 1: Passing Stream Compositions

x	y
0.68	0.74
0.6	0.679

Slope	0.7625
R	3.210526
xD	0.932632

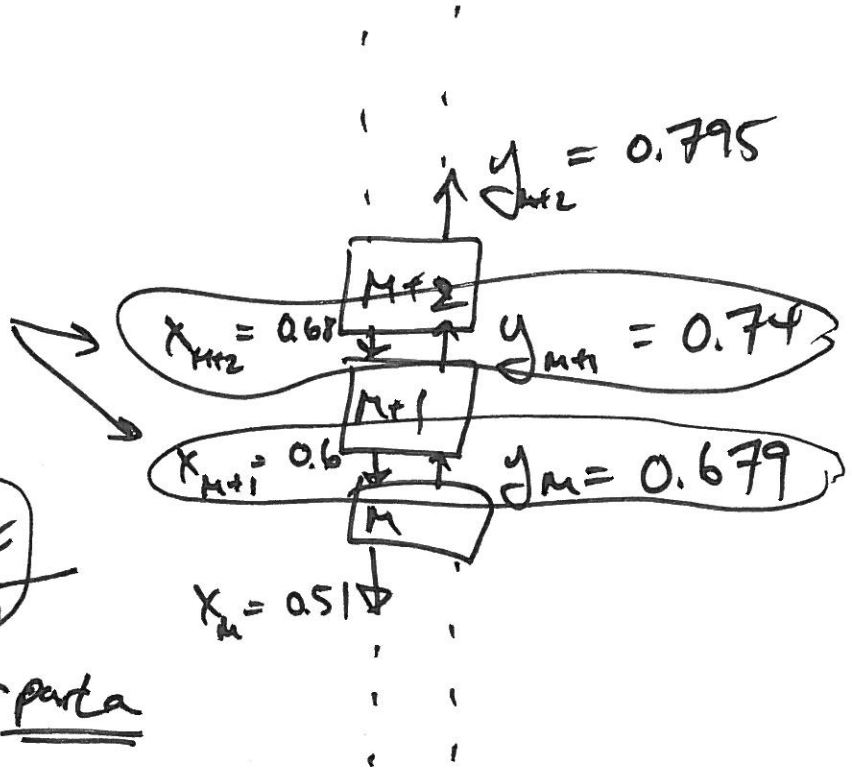
part a

Test 2: Passing Stream Compositions

x	y
0.68	0.68
0.605	0.605

Slope	1
R	Infinity
xD	Can't determine from equation, so go to the data. Therefore xD at least 0.75.

part b



XY Diagram for Problem 7.9