EXAMPLE 1C

WHAT IF LIQUID "A" EVAPORATES INTO A GAS THAT IS NOT DEVOID OF "A".

SAME PROBLEM EXCEPT BOUNDARY CONDITION #2

$$y_A = y_{AL} \quad @ \quad z = L \qquad (\text{INSTEAD OF } y_A = 0 \ @ \ z = L)$$

B.C. #1

$$C_2 = cD_{AB} \ln[1 - y_{A0}]$$

B.C. #2

$$cD_{AB} \ln[1 - y_{AL}] = C_1 L + C_2$$

$$cD_{AB} \ln[1 - y_{AL}] = C_1 L + cD_{AB} \ln[1 - y_{A0}]$$

$$C_1 = \frac{cD_{AB}}{L} \ln\left[\frac{1 - y_{AL}}{1 - y_{A0}}\right]$$

VARIOUS PARAMETERS BECOME:

CONC.

$$y_A = 1 - (1 - y_{AL})^{z/L} (1 - y_{A0})^{1 - z/L}$$

FLUX

$$\Phi_A = - \frac{P D_{AB}}{L R T} \ln\left[\frac{1 - y_{A0}}{1 - y_{AL}}\right]$$

MOLAR FLOW

$$\dot{n}_A = - \frac{P D_{AB} S}{L R T} \ln\left[\frac{1 - y_{A0}}{1 - y_{AL}}\right]$$

— NEW TERM IN EACH EQUATION

TIME FOR EVAPORATION (FROM 1B)

$$\boxed{\frac{C_{A(LIQ)}}{2}\left[L_1^2 - L_0^2\right] = \frac{-PD_{AB}\ln\left[\frac{1-y_{A0}}{1-y_{AL}}\right]t_1}{RT}}$$

$$\frac{\text{TIME FOR EVAPORATION WITH } y_{AL} \neq 0}{\text{TIME FOR EVAPORATION WITH } y_{AL} = 0} = \frac{t_1^L}{t_1^0} = \boxed{\frac{\ln\left[1-y_{A0}\right]}{\ln\left[\frac{1-y_{A0}}{1-y_{AL}}\right]}}$$

PRECISE

CAN MAKE AN APPROXIMATION:

$$\ln\left[1+x\right] = x - \underbrace{\frac{1}{2}x^2 + \frac{1}{3}x^3 - \frac{1}{4}x^4 + \ldots}$$

IF x IS CLOSE TO ZERO THEN

$$\underbrace{\ln\left[1+x\right] \cong x} \qquad \underbrace{\ln\left[1-x\right] \cong -x}$$

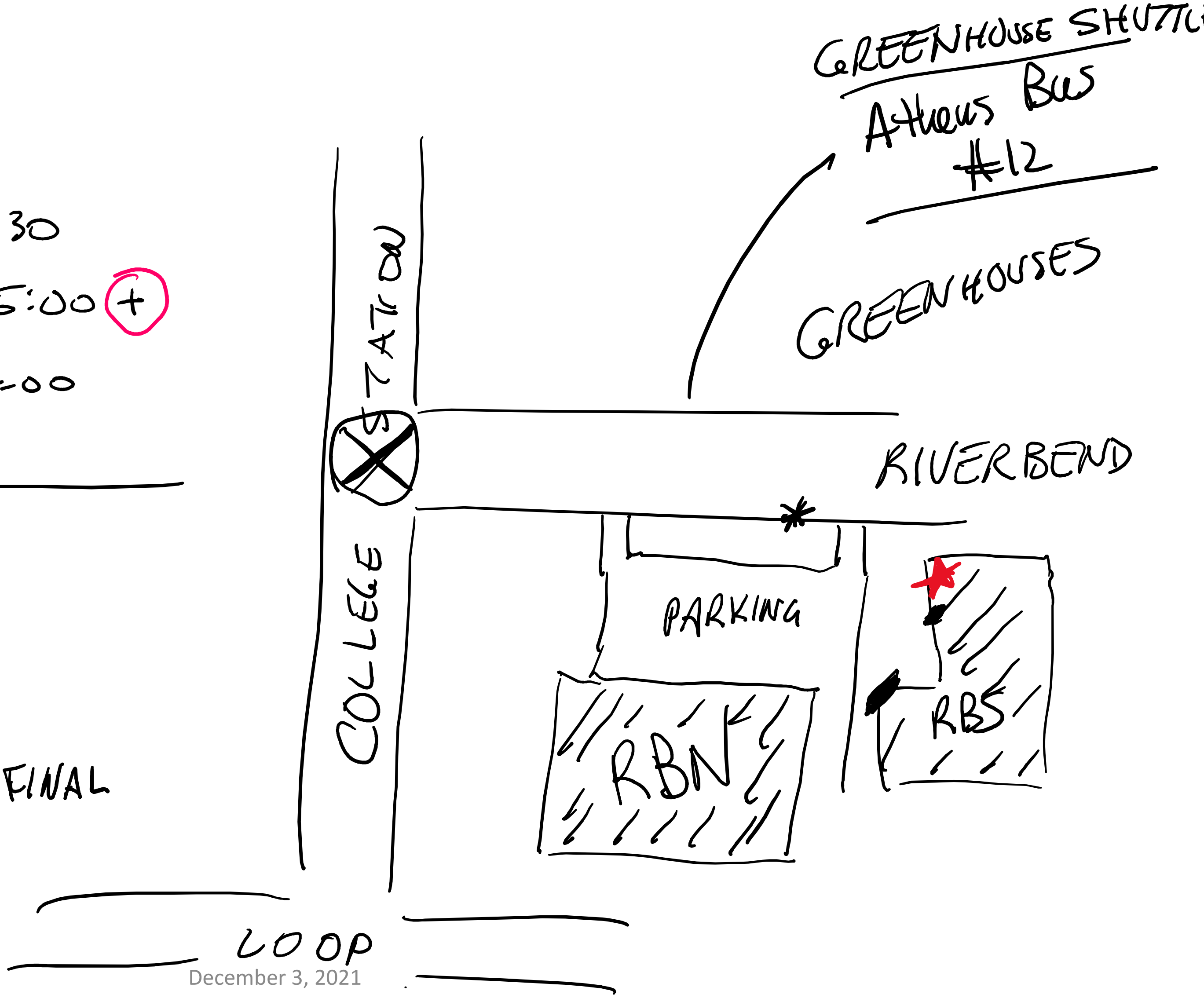
HELP SESSIONS

TODAY	2:00 – 3:30
WED	4:00 – 5:00 +
THUR	2:30 – 4:00

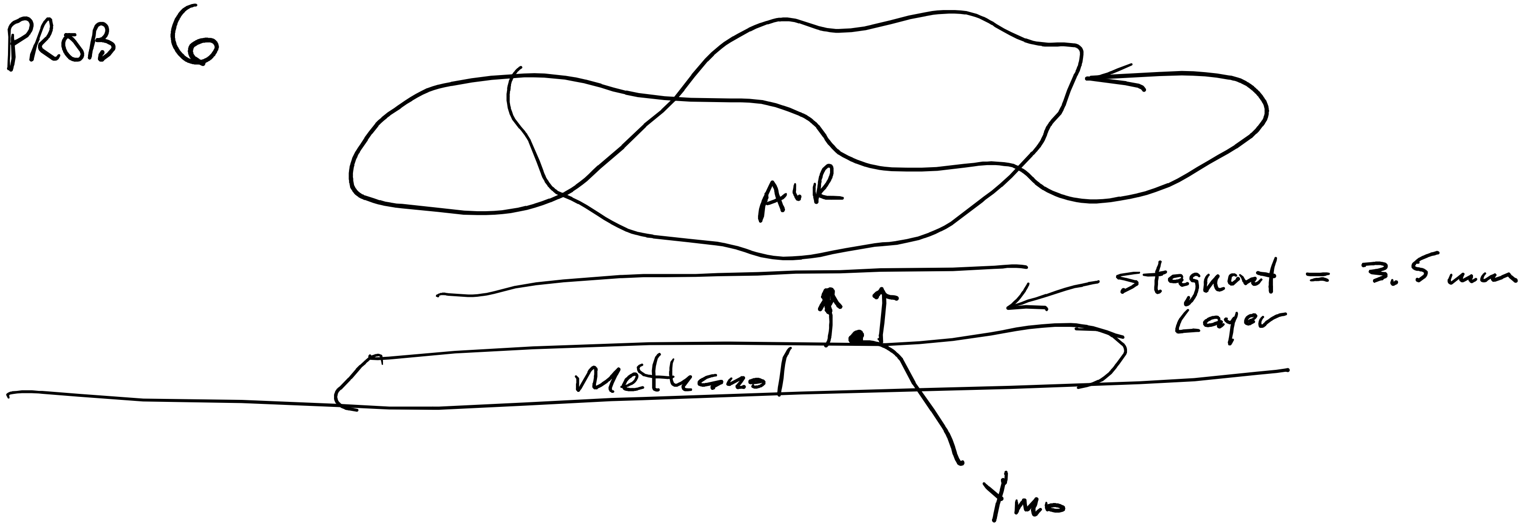
ZHELP

8:15 – 9:00

SUNDAY
MONDAY
TUESDAY
THURSDAY } FINAL



PROB 6



x	$\ln[1-x]$	ERROR
0.01	−0.01005	0.5%
0.02	−0.0202	1.0%
0.05	−0.0513	2.5%
0.10	−0.1054	5.1%

SO $\ln[1-y_{A0}] \cong -y_{A0}$ $\quad \ln[1-y_{AL}] \cong -y_{AL}$

AS AN APPROXIMATION

$$\frac{t_1^{L}}{t_1^{0}} \cong \frac{-y_{A0}}{-y_{A0}+y_{AL}} = \boxed{\frac{y_{A0}}{y_{A0}-y_{AL}}}$$

APPROXIMATION

REAL NUMBERS: A) IF "A" IS WATER AND rel. humidity IS 50%

THEN $y_{AL} = \frac{1}{2} y_{A0}$

50% - TWICE AS LONG
75% - FOUR TIMES AS LONG.

ESTIMATE: $$\frac{t_i^L}{t_i^0} = \frac{y_{A0}}{y_{A0} - y_{AL}} = \frac{y_{A0}}{y_{A0} - \frac{1}{2} y_{A0}} = 2.00$$

EXACT: $y_{A0} = 0.0311$ (25°C)

$y_{AL} = 0.0155$

$$\frac{t_i^L}{t_i^0} = \frac{\ln[1 - 0.0311]}{\ln\left[\frac{1 - 0.0311}{1 - 0.0155}\right]} = 1.98$$