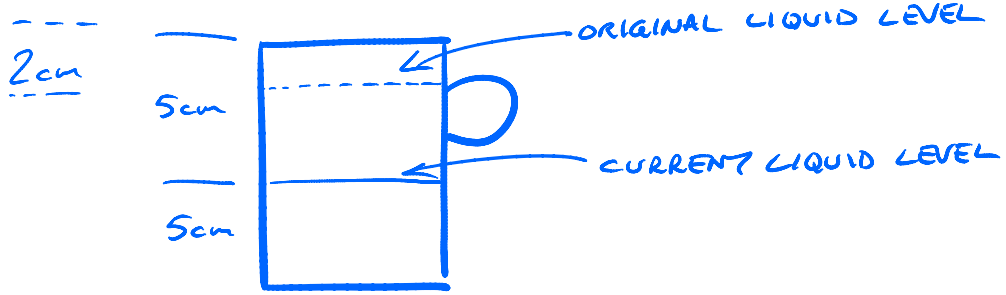

i) ASSUMPTIONS: $T = 25°C = 298K$

$h_r = 0\%$

AIR IN ROOM IS "RELATIVELY STAGNANT"

TEA IS ESSENTIALLY WATER

APPROPRIATE EQUATION IS:

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

$D_{AB} = 2.5\times10^{-5}\ m^2/s = 21600\ cm^2/day$ ← NOTE WE NEED TO CHANGE UNITS TO "cm^2" AND ALSO FOR CONVENIENCE TO "day"

$L_1 = 5.0\ cm$

$L_0 = 2.0\ cm$

$C_{A(WATER)} = 55.5\ mol/L$

$P = 760\ mm\ Hg$

$T = 298K$

$R = 62.36\ L\ mm\ Hg/mol\ K$

$p^*(25°C) = 23.7\ mm\ Hg$ (CH. 1 EQN 1.25)

SO $y_{A0} = \frac{23.7}{760} = 0.0313$

PUTTING VALUES INTO EQUATION $t = 20.8$ days

c) IF $h_r = 50\%$ $\quad Y_{AL} = \dfrac{(0.5)(23.7)}{(760)} = 0.0156$

APPROPRIATE EQUATION IS:

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

DIFFERENCE IS NOTED IN RED

PUTTING VALUES INTO EQUATION (ONLY NEW ONE IS Y_{AL}) $\quad t = 41.0$ days

IT IS HIGHLY UNLIKELY THAT THE ROOM WOULD REMAIN AT THE PERFECT LEVEL OF "STAGNANTNESS" FOR A MONTH OR MORE FOR THE MODEL TO BE GOOD. HOPEFULLY, THE POLICE HAVE SOME OTHER EVIDENCE!