ME 405 Fall 2006 Professor John M. Cimbala Lecture 17 10/16/2006

Today, we will:

- **Review Exam 1** •
- Continue our discussion of the thermodynamics of evaporation in Section 5.2 •
- Do an example problem •
- Discuss dilution ventilation the well mixed model in Section 5.3 •

Results of Exam 1:

- Mean: 76.1 •
- Lowest: 54 -
- Highest: 99 <
- St. Dev: 11.5





Given: 0.55 kg of liquid methyl alcohol (methanol) enters the bottom of a closed tank of volume 3.8 m^3 . Initially the air is pure, but the methanol begins to evaporate. The temperature and pressure in the tank are 21.2° C and 99.5 kPa.

To do:

(*a*) Determine the category of this liquid.

(*b*) Calculate the number of kmols of air and methanol in the container.

(c) Determine whether some or all of the methanol will evaporate.

(*d*) Calculate the final mol fraction of methanol vapor in PPM. Will it explode if there is a spark?

Solution:

(a) - Po 3r1 if
$$Pc > P_{rown}$$
 is $Tc > Tram - Gat 1$
Table A-10 - $Pc = 78.5 \text{ dim} > P_{rown}$
 $Tc = 240^{\circ}c$ $Tc > Trown)$
Table A-9 - $P_{v} @ 21.2^{\circ}C = 100 \text{ mm Hy}$
 $M = 32.1$ (Table A-20)
(b) A:: $PV = n R_{v}T \rightarrow \frac{n_{air} = 0.1545 \text{ kmol}}{M_{mol}}$
Methani : $n_{mol} = \frac{m_{mol}}{M_{mol}} = \frac{n_{mol}}{n_{air} + n_{mol}} = 0.09983 = y_{max}$
(c) IF all everyorates, $y_{mol} = \frac{n_{mol}}{n_{air} + n_{mol}} = 0.13399 = y_{oral}$
 $J_{saturate} = \frac{P_{v}}{P} = \frac{100 \text{ mm Hy}}{93.5 \text{ kFa}} = \frac{101.325 \text{ kFa}}{760 \text{ mm Hy}} = 0.13399 = y_{oral}$
 $J_{max} \leq y_{sat}$, ALL of the Arcta VIII expirate the
(d) $Y_{final} = Y_{max} = 0.03983 \rightarrow = (JJ) 800 \text{ R/M}$
 $LEL = 6\% = 69000 \text{ R/M}$
 $VEL = 36\% = 360000 \text{ R/M}$