

## Clase 29 22 septiembre 2015

Título de la nota

22/09/2015

Mezcla perfecta metano y etano a  $25^{\circ}\text{C}$   $p_{\text{total}} = 2 \text{ atm}$

Metano = 2 kg

$$\bar{C}_p \text{ Meta} = 35.74 \text{ J/molK}$$

Etano = 0.5 kg

$$\bar{C}_p \text{ etano} = 52.49 \text{ J/molK}$$

Calcular;  $y_i$ ,  $p_i$ ,  $M_M$ ,  $\Delta G_M$ ,  $\Delta S_M$ ,  $q_M$ ,  $w_M$ ,  $\bar{C}_{pM}$  y  $\bar{C}_{vM}$

$$n_{\text{metano}} = \frac{2000\text{g}}{16\text{g/mol}}$$
$$= 125\text{ mol}$$

$$\text{Metano } \text{CH}_4 = 16\text{g/mol}$$

$$n_{\text{etano}} = \frac{500\text{g}}{30\text{g/mol}}$$
$$= 16.67\text{ mol}$$

$$\text{Etano } \text{CH}_3\text{CH}_3 = 30\text{g/mol}$$

$$n_{\text{total}} = 125\text{ mol} + 16.67\text{ mol}$$
$$= 141.67\text{ mol}$$

$$y_{\text{metano}} = \frac{125\text{ mol}}{141.67\text{ mol}} = 0.8823$$

$$y_{\text{etano}} = \frac{16.67\text{ mol}}{141.67\text{ mol}} = 0.1177$$

$$\Delta S_M = - \left[ n_{\text{total}} R \sum_{i=1}^n y_i \ln y_i \right]$$

$$= - \left[ 141.67 \text{ mol} (8.314 \text{ J/mol}\cdot\text{K}) (0.8823 \ln 0.8823 + 0.1177 \ln 0.1177) \right]$$

$$= 426.65 \frac{\text{J}}{\text{K}}$$

Mezclado espontáneo

$$\Delta G_M = -T\Delta S_M = -(426.65 \text{ J/K})(298.15 \text{ K})$$

$$= -127206.8 \text{ J}$$

$$q_M = w_M = T\Delta S = 127206.8 \text{ J}$$

cálculo de  $\bar{C}_{pM}$

$$\begin{aligned}\bar{C}_{pM} &= \sum_{i=1}^n y_i C_{pi} = y_{\text{Met}} \bar{C}_{p\text{Met}} + y_{\text{etano}} \bar{C}_{p\text{etano}} \\ &= 0.8823 (35.74 \text{ J/molK}) + 0.1177 (52.49 \text{ J/molK}) \\ &= 37.71 \text{ J/molK}\end{aligned}$$

$$\begin{aligned}\bar{C}_{vM} &= \bar{C}_{pM} - R = 37.71 \text{ J/molK} - 8.314 \text{ J/molK} \\ &= 29.39 \text{ J/molK}\end{aligned}$$

Cálculo de  $p_i$  y  $M_M$

$$p_i = y_i P_{\text{total}} \quad \sum_{i=1}^n p_i = p_{\text{total}} \quad \checkmark$$

$$P_{\text{metano}} = (0.8823) (2 \text{ atm}) = 1.7646 \text{ atm}$$

$$P_{\text{etano}} = (0.1177) (2 \text{ atm}) = 0.2354 \text{ atm}$$

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$$2 \text{ atm} \quad \checkmark$$

Calculo de  $M_M$

$$M_M = \sum_{i=1}^n y_i M_i = y_{\text{metano}} M_{\text{metano}} + y_{\text{etano}} M_{\text{etano}}$$

$$M_M = 0.8823 (16 \text{ g/mol}) + 0.1177 (30 \text{ g/mol})$$

$$= 17.6478 \text{ g/mol}$$

Recordar  $M_M$  debe oscilar entre  $16 \text{ g/mol} < M_M < 30 \text{ g/mol}$

Tarea: Realizar el mezclado como compartamiento ideal.

Preguntas:

Si ambos gases se encuentran a diferente temperatura y se mezclan

como calcularía  $\Delta S_M$  ✓