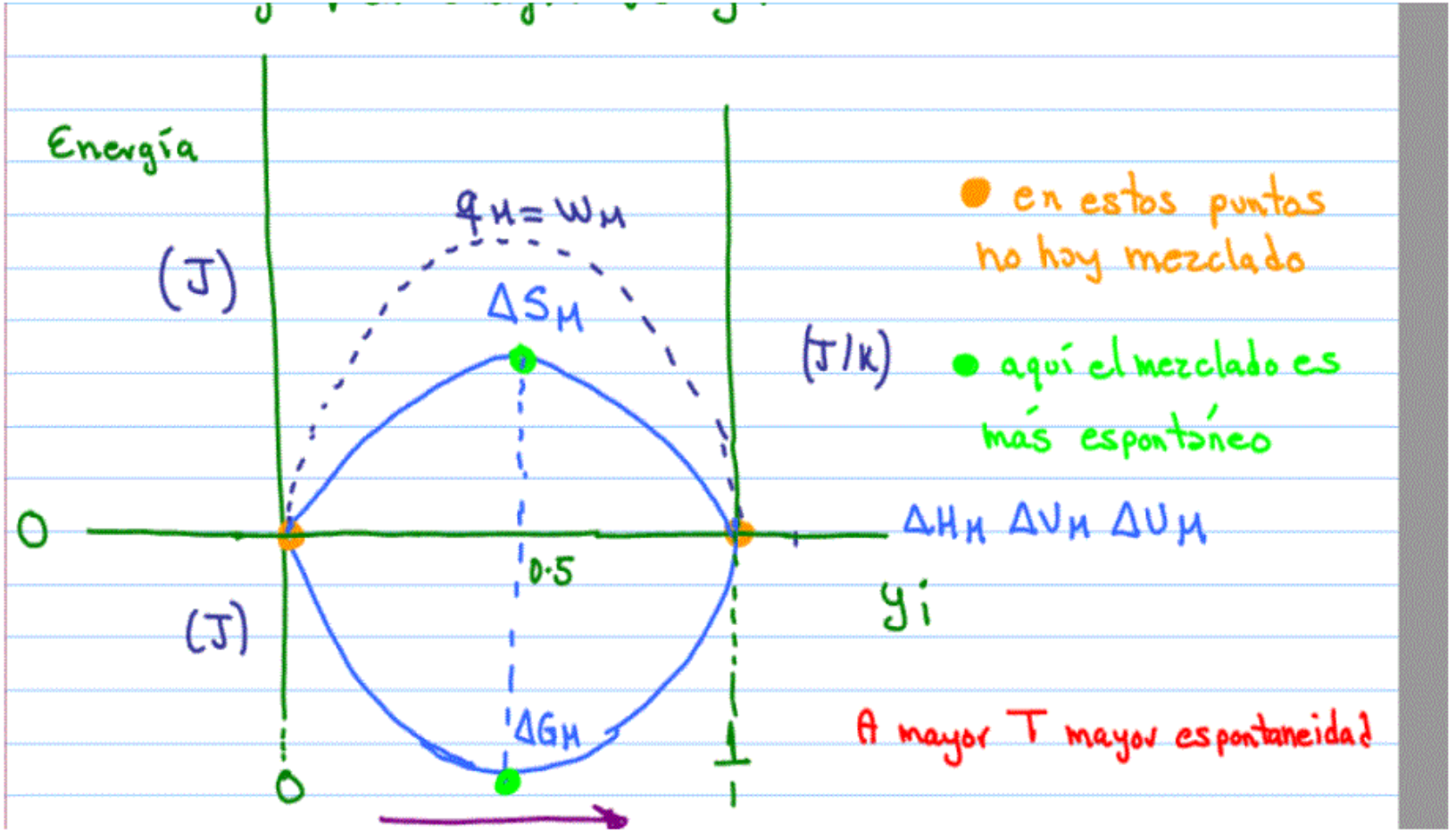
Clase 47 18 Noviembre 2020

Título de la nota 18/11/2020



			M
Metano	2000g	CH_4	16 g/mol
Etano	500g	CH_3CH_3	30 g/mol

$p_{total} = 2\ atm$

$T = 298.15\ K$

Metano $\overline{C_p} = 35.74\ J/molK$

Etano $\overline{C_p} = 52.49\ J/molK$

a) V_{total}

I Mezclado $\begin{cases} \Delta H_M \quad \Delta U_M \quad \Delta V_M = 0 \\ \Delta S_M = + \quad \Delta G_M = - \end{cases}$ $\quad q_M = w_M$

II Exp. Isot. Rev. $\begin{cases} \Delta \underset{II}{U} = 0 \quad \Delta \underset{II}{V} = 0 \quad \Delta \underset{I}{V} > 0 \\ \Delta \underset{II}{S} = + \quad \Delta \underset{II}{G} = - \quad q_{II} = w_I \end{cases}$

b) n_i c) y_i d) p_i e) V_i

f) I , g) II

b) ni

$$n_{CH_4} = \frac{2.000\,g}{16\,g/mol} = 125\,mol$$

$$n_{CH_3CH_3} = \frac{500\,g}{30\,g/mol} = 16.6667\,mol$$

$$n_{total} = 141.6667\,mol$$

$$V_{total} = V_{Total} = \frac{n_{total} R T_c}{p_{total}} = \frac{(141.6667\,mol)\left(0.082\,\frac{atm\,L}{mol\,K}\right)(798\,K)}{2\,atm}$$

$$= 1731.67\,L$$

Yi $y_{CH_4} = \frac{125\ mol}{141.6667\ mol} = 0.8824$

$y_{CH_3CH_3} = \frac{16.6667\ mol}{141.6667\ mol} = 0.1176$

$p_{CH_4} = (2\ atm)(0.8824) = 1.7648\ atm$

$p_{CH_3CH_3} = (2\ atm)(0.1176) = 0.2356\ atm$

2 atm Dalton ✓

$V_{CH_4} = (1731.67\ L)(0.8824) = 1527.9441\ L$

$V_{CH_3CH_3} = (1731.67\ L)(0.1176) = 203.7259\ L$ ✓

1731.67 L Amagat

$$M_M = \sum_{i=1}^{n} M_i y_i$$

$$= (16\ g/mol)(0.8824) + (30\ g/mol)(0.1176)$$

$$= 17.6471\ g/mol.$$

Esto indica mayor proporción de Metano en la mezcla

MEZCLADO DE GASES

Modelo perfecto e ideal

Insertar en las celdas de color amarillo los valores correspondientes

Los resultados en las celdas de color verde

Constantes de Cp como función de T (cal/molK)

Gases	a	b	c	d	e	mi (g)	ni (mol)	yi	Mi (g/mol)	pi (atm)	Vi (L)
Metano	8.54e+0	0.00e+0	0.00e+0	0.00e+000	0.00e+000	2000.0000	125.0000	0.8824	16.0000	1.7648	1527.9441
Etano	1.25e+1	0.00e+0	0.00e+0	0.00e+000	0.00e+000	500.0000	16.6667	0.1176	30.0000	0.2353	203.7259
	0.00e+0			0.00e+000	0.00e+000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000
	0.00e+0			0.00e+000	0.00e+000	0.0000	0.0000	0.0000	39.9400	0.0000	0.0000
	0.00e+0	0.00e+0	0.00e+0	0.00e+000	0.00e+000	0.0000	0.0000	0.0000	44.0000	0.0000	0.0000
						ntotal	141.6667	1.0000			

p_{total} (atm)	2.0001
V_{total} (L)	1731.67

Cp_M como función de T (cal/molK

a	b	c	d	e	R (cal/molK)	T (K)	p_{total} (atm)	V_{total} (L)
9.0059	0.00e+0	0.00e+0	0	0	1.9886	298.15	2.0001	1731.67

Cv_M como función de T (cal/molK)

a	b	c	d	e
7.0173	0.00e+0	0.00e+0	0	0

M_M (g/mol)	17.6471	ΔH_M (cal)	0	ΔU_M (cal)	0	ΔS_M (cal/K)	102.0414	ΔG_M (cal)	-30423.6298

q_M (cal)	30423.6298	w_M (cal)	30423.6298

Dr. Juan Carlos Vázquez Lira 2020

Con apoyo del programa DGAPA-UNAM-PAPIME PE-200419

$$\overline{C_{pM}} = \sum_{i=1}^{n} C_{pi}\, y_i$$

$$= \left(8.5379 \frac{cal}{mol\,K}\right)(0.8824) + \left(12.5296 \frac{cal}{mol\,K}\right)(0.1174)$$

$$= 9.0059 \frac{cal}{mol\,K}$$

$$\overline{C_{vM}} = \sum_{i=1}^{n} C_{vi}\, y_i = \overline{C}_{pM} - R$$

$$9.0059 \frac{cal}{mol\,K} - 1.9886 \frac{cal}{mol\,K} = 7.0173 \frac{cal}{mol\,K}$$

$$\Delta S_M = -n_{total} R \sum_{i=1}^{n} y_i \ln y_i$$

$$= -(141.6667 \text{ mol})\left(1.9886 \frac{\text{cal}}{\text{mol K}}\right)\left[0.8824 \ln 0.8824 + 0.1176 \ln 0.1176\right]$$

$$= 102.0414 \frac{\text{cal}}{\text{K}}$$

$$\Delta G_M = -T\Delta S_M = (-298.15\text{K})\left(102.0414 \frac{\text{cal}}{\text{K}}\right)$$

$$= -30423.6298 \text{ cal}$$

$$q_M = W_M = T\Delta S$$

$$= (298.15\,K)\left(102.0414\,\frac{cal}{K}\right)$$

$$= 30423.6298\,cal.$$

$$\Delta S_{II} = nR\ln\frac{V_2}{V_1}$$

$$= \left(141.6667\,mol\right)\left(1.9886\,\frac{cal}{mol\,K}\right)\ln 2$$

$$= 195.27\,\frac{cal}{K}$$

$$q_{II} = w_{II} = T\Delta S$$

$$= (298.15\,K)\left(195.27\,\frac{cal}{K}\right)$$

$$= 58221.7967\,cal.$$

$$\Delta G_{II} = \Delta H^{0} - T\Delta S = -58221.7967\,cal$$

$$C_{pM} = (a_i + b_i T + c_i T^2 + d_i T^3)\, y_i + (a_2 + b_2 T + c_2 T^2 + d_2 T^3)\, y_i$$

$$C_{pM} = a_M \; b_M \; c_M \; d_M \; -$$

Gases	a	b	c	d	e	gi (g)	ni (mol)	yi
N2	6.45e+000	1.41e-003	-8.10e-008	0.00e+000	0.00e+000	78.0000	2.7857	0.8166
O2	6.10e+000	3.25e-003	-1.02e-006	0.00e+000	0.00e+000	20.0150	0.6255	0.1834

$$\left(6.45 + 1.41\times10^{-3} - 8.1\times10^{-8}\right)(0.8166)$$

$$\left(6.1 + 3.25\times10^{-3} - 1.02\times10^{-6}\right)(0.1834)$$

$$a + bT + cT^2$$

$$\bar{C}_{pM} = \frac{5.2682 + 1.193\times10^{-3} - 6.61\times10^{-8} + 1.1977 + 5.96\times10^{-4} - 1.87\times10^{-7}}{6.3864 + 1.789\times10^{-3} - 2.531\times10^{-7}}$$

Cp de mezclado como función de T (cal /molK)				
a	b	c	d	e
6.3858	1.75e-3	-2.53e-7	0	0