

Clase 50 8 Noviembre 2021

Título de la nota

08/11/2021

Mezclado
ideal
o
perfecto

Ley de Dalton
(presiones parciales)

Ley Amagat
(volumenes parciales)

$$pV = nRT$$

Fracción
mol.

Fracción
mol.

Variable Intensiva

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

$$y_i = \frac{n_i}{n_{\text{totales}}}$$
$$= \frac{\text{mol}}{\text{mol}}$$

gases y vapores

x_i = sólidos
y líquidos

Ley de Dalton

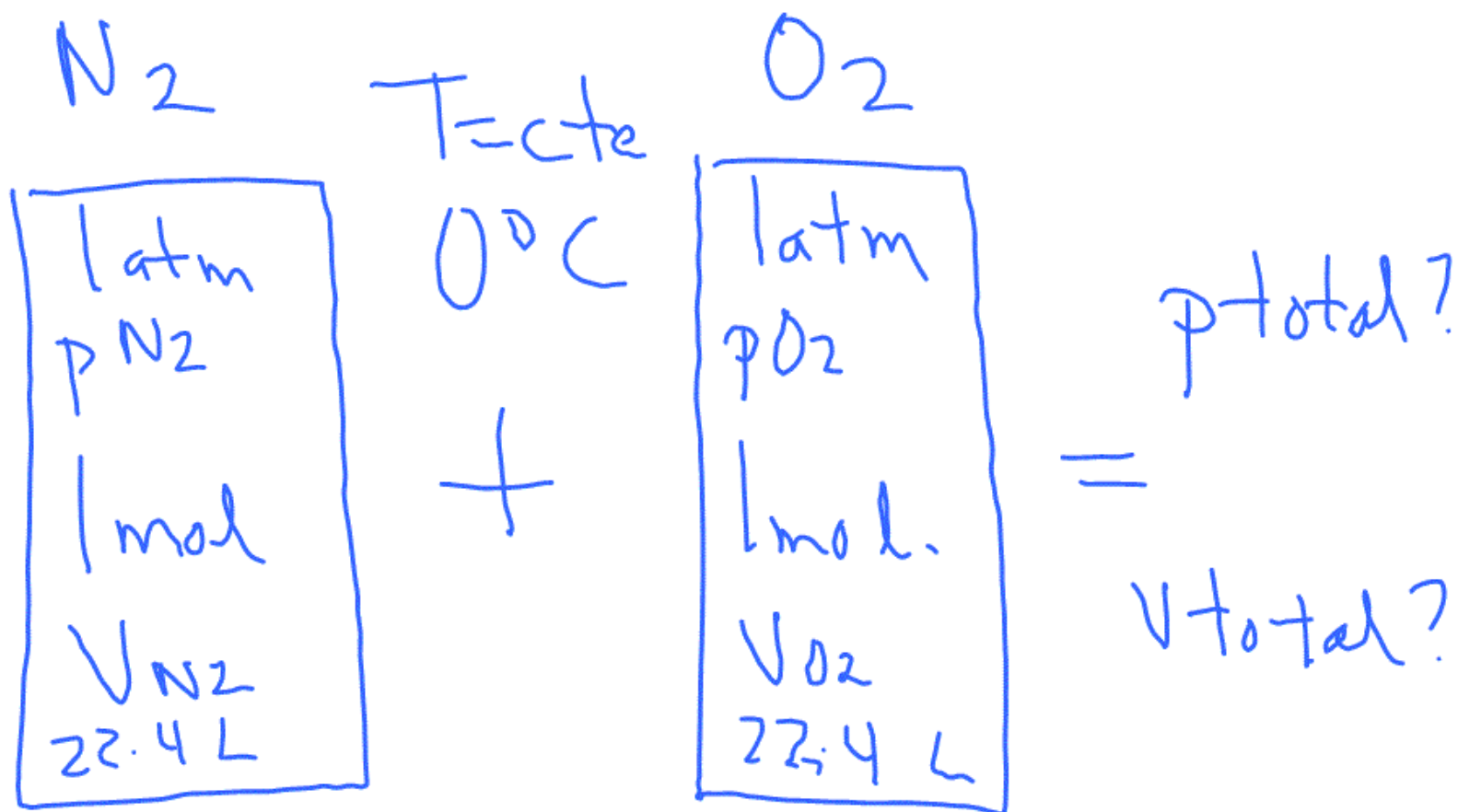
$$p_{\text{total}} = \sum_{i=1}^n p_i$$

$$p_i = y_i p_{\text{total}}$$

Ley de Amagat

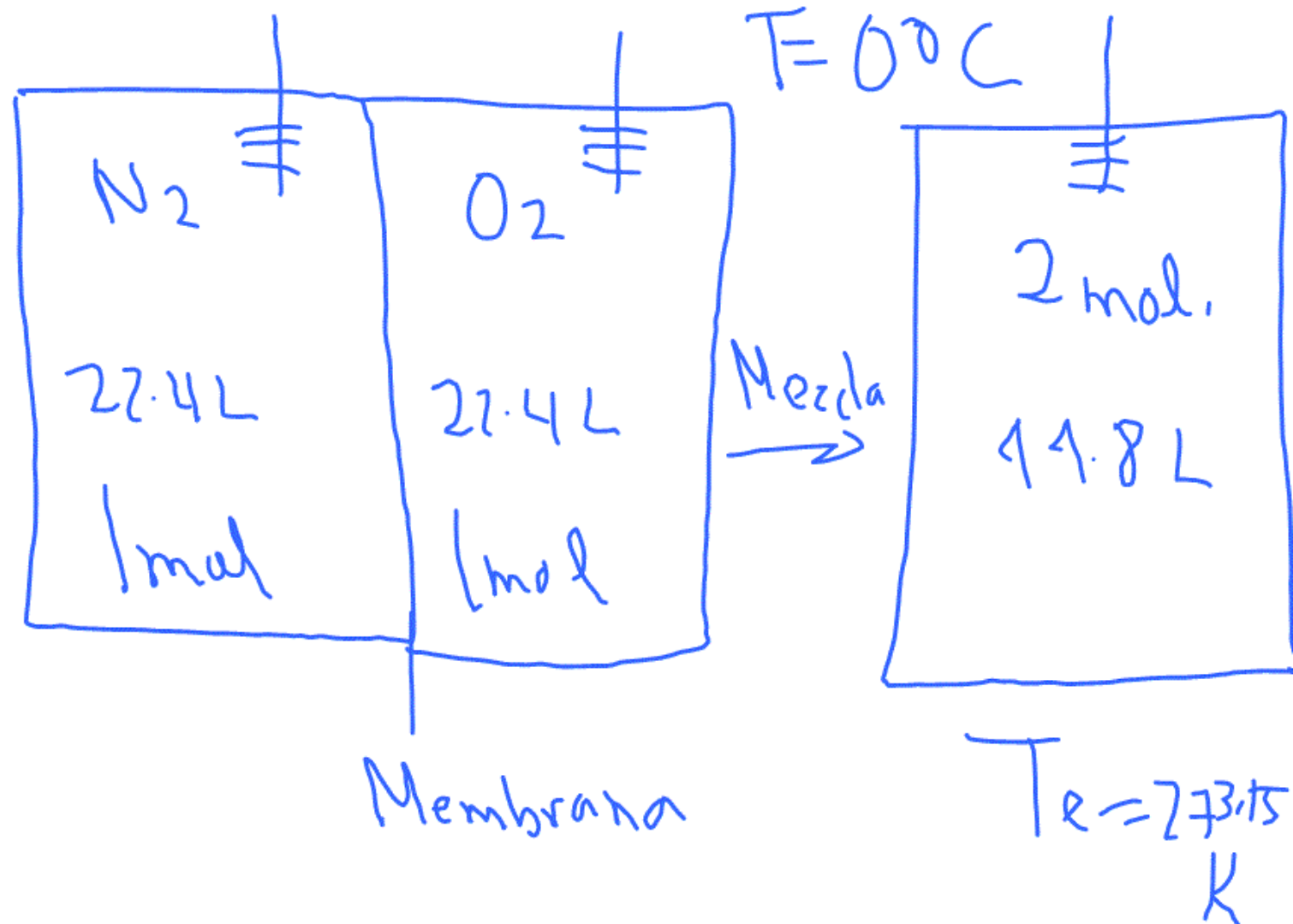
$$V_{\text{total}} = \sum_{i=1}^n V_i$$

$$V_i = y_i V_{\text{total}}$$



$$p_{\text{total}} = \frac{n_{\text{total}} R T_e}{V_{\text{total}}}$$
$$= \frac{(2 \text{ mol})(0.082 \text{ atm L/mol K})(293 \text{ K})}{44.8 \text{ L}}$$

$$p_{\text{total}} = 1 \text{ atm}$$



$$y_{N_2} = \frac{1 \text{ mol } N_2}{2 \text{ mol.}}$$
$$= 0.5$$

$$y_{O_2} = \frac{1 \text{ mol } O_2}{2 \text{ mol}}$$
$$= 0.5$$

$$p_{N_2} = 0.5 p_{\text{total}}$$
$$= 0.5 (1 \text{ atm})$$
$$= 0.5 \text{ atm}$$

$$p_{O_2} = 0.5 (1 \text{ atm})$$
$$= 0.5 \text{ atm}$$

$$p_{\text{total}} = \sum_{i=1}^n p_i = \underline{0.5 + 0.5 = 1 \text{ atm}}$$

Ley Amagat

$$\begin{aligned}V_{N_2} &= 0.5 V_{total} \\ &= 0.5 (44.8 L) \\ &= 22.4 L\end{aligned}$$

$$\begin{aligned}V_{O_2} &= 0.5 V_{total} \\ &= 0.5 (44.8 L) \\ &= 22.4 L\end{aligned}$$

$$\begin{aligned}V_{total} &= \sum_{i=1}^n V_i \\ &= 22.4 L + 22.4 L \\ &= 44.8 L\end{aligned}$$

Isotérmico (mezclado)

$$\Delta U_M = 0 \quad \Delta H_M = 0$$

ideal o perfecto

$$\Delta V_M = 0 = V_{\text{mezcla}} - \sum_{i=1}^n v_i$$

Si es real.

$$\Delta H_M \neq 0 \quad \Delta U_M \neq 0$$

$$\Delta V_M > 0$$

Rechazo

$$\Delta V_M < 0$$

Afinidad

$$\Delta S_M = +$$

$$\Delta S_M = \Delta S_{\text{I}}^{\text{O}_2} + \Delta S_{\text{II}}^{\text{N}_2}$$

$$\Delta S_{\text{N}_2} = n_{\text{N}_2} R \ln \frac{V_{\text{total}}}{V_{\text{N}_2}}$$

$$\Delta S_{\text{O}_2} = n_{\text{O}_2} R \ln \frac{V_{\text{total}}}{V_{\text{O}_2}}$$

Avogadro $V \propto n$

$$\Delta S_{O_2} = n_{O_2} R \ln \frac{n_{total}}{n_{O_2}}$$

$$\Delta S_{N_2} = n_{N_2} R \ln \frac{n_{total}}{n_{N_2}}$$

$$y_{O_2} = \frac{n_{O_2}}{n_{total}}$$

$$y_{N_2} = \frac{n_{N_2}}{n_{total}}$$

$$\Delta S_M = \Delta S_{O_2} + \Delta S_{N_2}$$

$$= n_{O_2} R \ln \frac{1}{y_{O_2}} + n_{N_2} R \ln \frac{1}{y_{N_2}}$$

$$= -n_{O_2} R \ln y_{O_2} - n_{N_2} R \ln y_{N_2}$$

$$\Delta S_M = - \left[n_{O_2} R \ln y_{O_2} + n_{N_2} R \ln y_{N_2} \right]$$

$$n_{O_2} = y_{O_2} n_{total}$$

$$n_{N_2} = y_{N_2} n_{total}$$

$$\Delta S_M = - \left[y_{O_2} n_{total} R \ln y_{O_2} + y_{N_2} n_{total} R \ln y_{N_2} \right]$$

$$\Delta S_M = - \left[n_{total} R (y_{O_2} \ln y_{O_2} + y_{N_2} \ln y_{N_2}) \right]$$

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

Mezcla binaria.

$$\Delta S_M = - \left[2 \text{ mol} \left(8.314 \frac{\text{J}}{\text{mol K}} \right) 0.5 \ln 0.5 + 0.5 \ln 0.5 \right]$$

$$\Delta S_M = - \left[(2 \text{ mol}) (8.314 \text{ J/mol K}) (-0.6931) \right]$$

$$= 11.52 \text{ J/K}$$

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G_M = \Delta H_M - T\Delta S_M$$

$$\Delta G_M = 0 - T\Delta S_M$$

$$\Delta G_M = - (273.15 \text{ K})(11.52 \text{ J/K})$$
$$= -3148.05 \text{ J} \text{ espontáneo}$$

$$\Delta G_M = n_{\text{total}} R T_e \sum_{i=1}^n y_i \ln y_i$$

$$g_M = T \Delta S_M$$

$$w_M = g_M$$

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

$$= y_{N_2} M_{N_2} + y_{O_2} M_{O_2}$$

$$\overline{C_{PM}} = \sum_{i=1}^n C_{pi} = y_{N_2} \overline{C_{PN_2}} + y_{O_2} \overline{C_{PO_2}}$$

$$\overline{C_{VM}} = \overline{C_{PM}} - R$$

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)
N2	6.4500e+000	1.4100e-003	-8.1000e-008	0.0000e+000	0.0000e+000	14.0000	0.5000	0.5000	28.0000	0.1019	60.0000
O2	6.1000e+000	3.2500e-003	-1.0200e-006	0.0000e+000	0.0000e+000	16.0000	0.5000	0.5000	32.0000	0.1019	60.0000
Ne	4.9715e+000			0.0000e+000	0.0000e+000	0.0000	0.0000	0.0000	20.1700	0.0000	0.0000
Ar	4.9715e+000			0.0000e+000	0.0000e+000	0.0000	0.0000	0.0000	39.9400	0.0000	0.0000
CO2	6.4000e+000	1.0200e-002	-3.5600e-006	0.0000e+000	0.0000e+000	0.0000	0.0000	0.0000	44.0000	0.0000	0.0000

ntotal 1.0000 1.0000

p total (atm)	0.2037
V total (L)	120.00

CpM como función de T (cal/molK)

a	b	c	d	e	R (cal/molK)	T (K)	p total (atm)	V total (L)
6.2750	2.33e-3	-5.50e-7	0	0	1.9886	298.15	0.2037	120.00

CvM como función de T (cal/molK)

a	b	c	d	e
4.2864	2.33e-3	-5.50e-7	0	0



M _M (g/mol)	30.0000	ΔH _M (cal)	0	ΔU _M (cal)	0	ΔS _M (cal/K)	1.3784	ΔG _M (cal)	-410.9677
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q _M (cal)	410.9677	w _M (cal)	410.9677
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Dr. Juan Carlos Vázquez Lira 2020

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

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)
N2	6.4500e+000	1.4100e-003	-8.1000e-008	0.0000e+000	0.0000e+000	60.0000	2.1429	0.8108	28.0000	0.4366	97.2973
O2	6.1000e+000	3.2500e-003	-1.0200e-006	0.0000e+000	0.0000e+000	16.0000	0.5000	0.1892	32.0000	0.1019	22.7027
Ne	4.9715e+000			0.0000e+000	0.0000e+000	0.0000	0.0000	0.0000	20.1700	0.0000	0.0000
Ar	4.9715e+000			0.0000e+000	0.0000e+000	0.0000	0.0000	0.0000	39.9400	0.0000	0.0000
CO2	6.4000e+000	1.0200e-002	-3.5600e-006	0.0000e+000	0.0000e+000	0.0000	0.0000	0.0000	44.0000	0.0000	0.0000
ntotal							2.6429	1.0000			

P total (atm)	0.5384
V total (L)	120.00

CpM como función de T (cal/molK)					R (cal/molK)	T (K)	P total (atm)	V total (L)
a	b	c	d	e				
6.3838	1.76e-3	-2.59e-7	0	0	1.9886	298.15	0.5384	120.00
CvM como función de T (cal/molK)								
a	b	c	d	e				
4.3952	1.76e-3	-2.59e-7	0	0				



M _M (g/mol)	28.7568	ΔH _M (cal)	0	ΔU _M (cal)	0	ΔS _M (cal/K)	2.5492	ΔG _M (cal)	-760.0429
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q _M (cal)	760.0429	w _M (cal)	760.0429
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