

Clase 53 10 Noviembre 2021

Título de la nota

10/11/2021

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	78.0840	2.7887	0.8016	28.0000	0.5682	96.1946
O2	6.1000e+000	3.2500e-003	-1.0200e-006	0.0000e+000	0.0000e+000	20.9460	0.6546	0.1882	32.0000	0.1334	22.5786
Ne	4.9715e+000			0.0000e+000	0.0000e+000	0.1000	0.0050	0.0014	20.1700	0.0010	0.1710
Ar	4.9715e+000			0.0000e+000	0.0000e+000	0.9340	0.0234	0.0067	39.9400	0.0048	0.8067
H2O	6.4000e+000	1.0200e-002	-3.5600e-006	0.0000e+000	0.0000e+000	0.1300	0.0072	0.0021	18.0000	0.0015	0.2491
ntotal							3.4788	1.0000			

P total (atm)	0.7088
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				
6.3720	1.76e-3	-2.64e-7	0	0	1.9886	298.15	0.7088	120.00

CvM como función de T (cal/molK)				
a	b	c	d	e
4.3834	1.76e-3	-2.64e-7	0	0

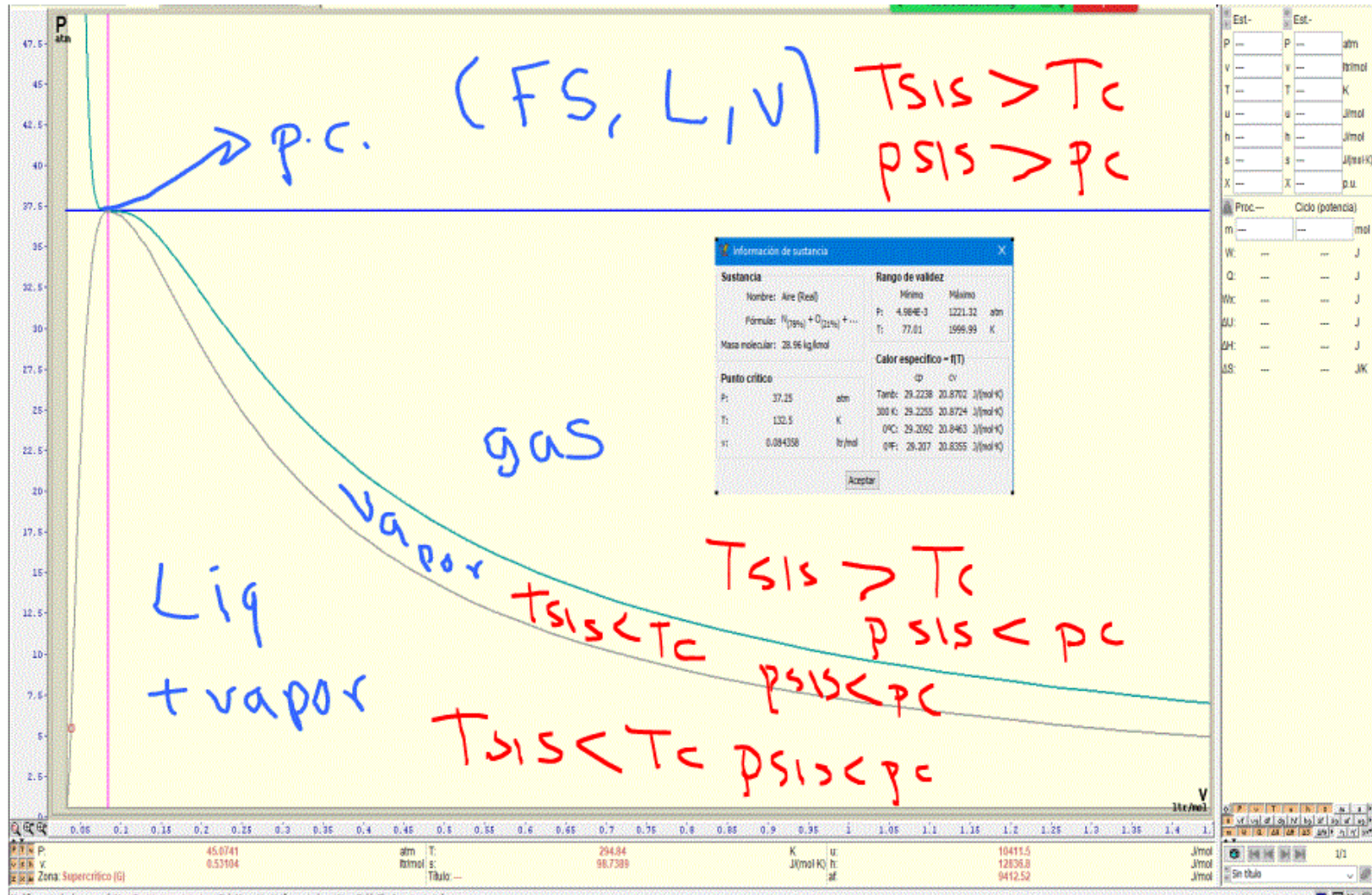


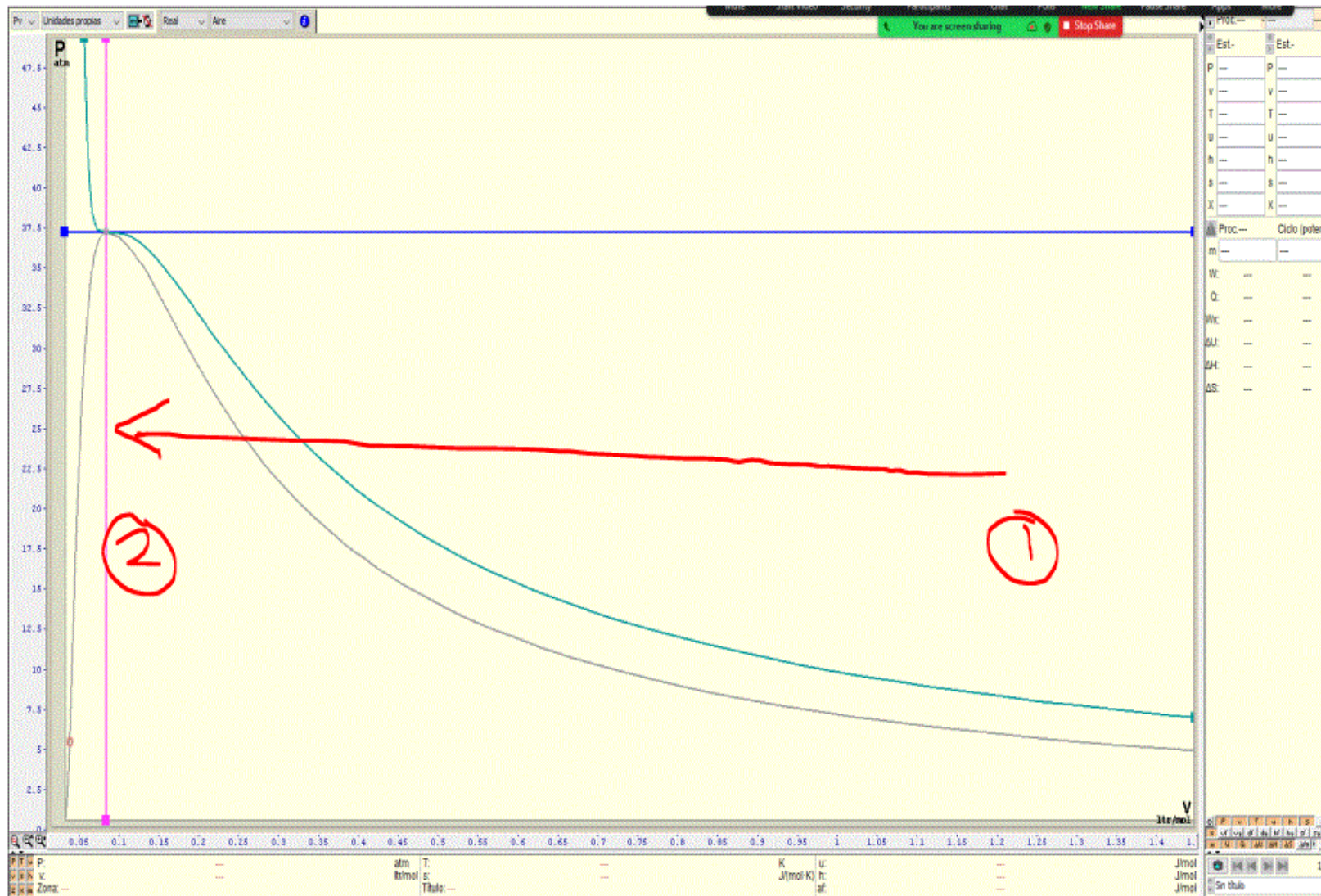
M _M (g/mol)	28.8010	ΔH _M (cal)	0	ΔU _M (cal)	0	ΔS _M (cal/K)	3.6984	ΔG _M (cal)	-1102.6906
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q _M (cal)	1102.6906	w _M (cal)	1102.6906
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Dr. Juan Carlos Vázquez Lira 2020

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





Metano y Etano

Propiedades

Vol real Independiente de Vc

Vol real dependiente de Vc

T y p dependiente de Vc

T y p Independiente de Vc

Obtención de parámetros de mezclado binario y ternario

Introducir los valores en las celdas de color amarillo

Componente	M (g/mol)	m (g)	pc (atm)	Tc (K)	Vc (L/mol)	ni
Metano	16.00	10.00	45.40	190.60	0.0990	0.6250
Etano	30.00	100.00	48.20	305.40	0.1480	3.3333
Propano	44.00	0.00	41.90	369.80	0.2030	0.0000
n total						3.9583

Componente	Dependiente de Vc		R (atmL/molK)	Independiente de Vc		y
	a (atmL ² /mol ²)	b (L/mol)	yi	a (atmL ² /mol ²)	b (L/mol)	
Metano	1.3349	0.0330	0.1579	2.2699	0.0430	1.0000
Etano	3.1673	0.0493	0.8421	5.4891	0.0649	
Propano	5.1800	0.0677	0.0000	9.2583	0.0905	

Dependiente de Vc				
a _M (atmL ² /mol ²)	b _M (L/mol)	pc _M (atm)	Tc _M (K)	Vc _M (L/mol)
2.8262	0.0467	47.7579	287.2737	0.1403

Independiente de Vc				
a _M (atmL ² /mol ²)	b _M (L/mol)	pc _M (atm)	Tc _M (K)	Vc _M (L/mol)
4.8878	0.0615	47.7579	287.2737	0.1403



Dr. Juan Carlos Vázquez Lira UNAM FES Zaragoza 2020

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

$$P_{CM} = \sum_{i=1}^5 P_{C_i}$$

$$= y_{Met} P_{C_{Met}} + y_{Et} P_{C_{Etano}}$$

$$= (0.1579)(45.4 \text{ atm}) + (0.8421)(48.2 \text{ atm})$$

$$= 47.76 \text{ atm}$$

$$T_{CM} = \sum_{i=1}^n T_{ci}$$

$$= y_{met} T_{cmet} + y_{etano} T_{cetano}$$

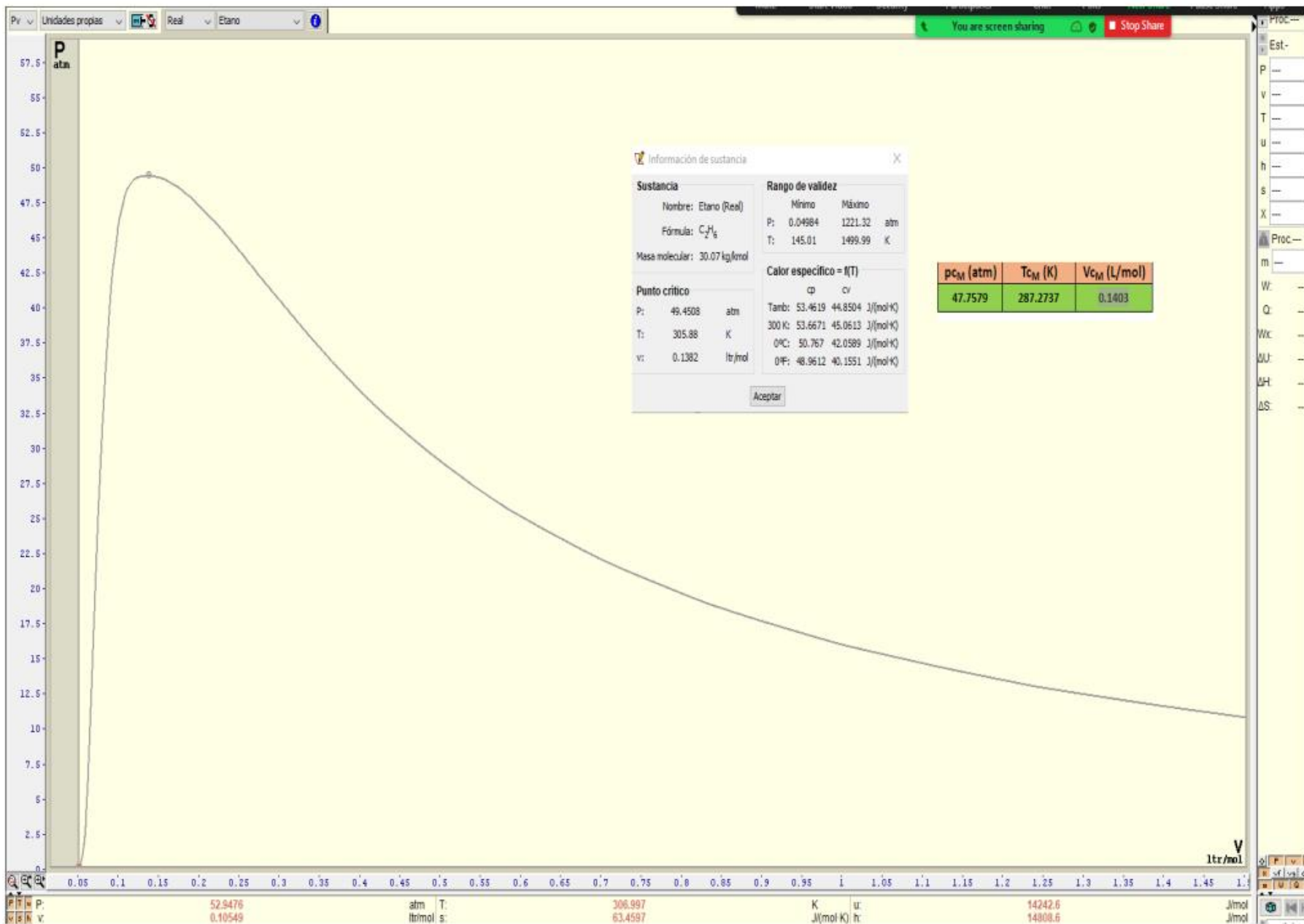
$$= (0.1579)(190.6 \text{ K}) + (0.8421)(305.4 \text{ K})$$

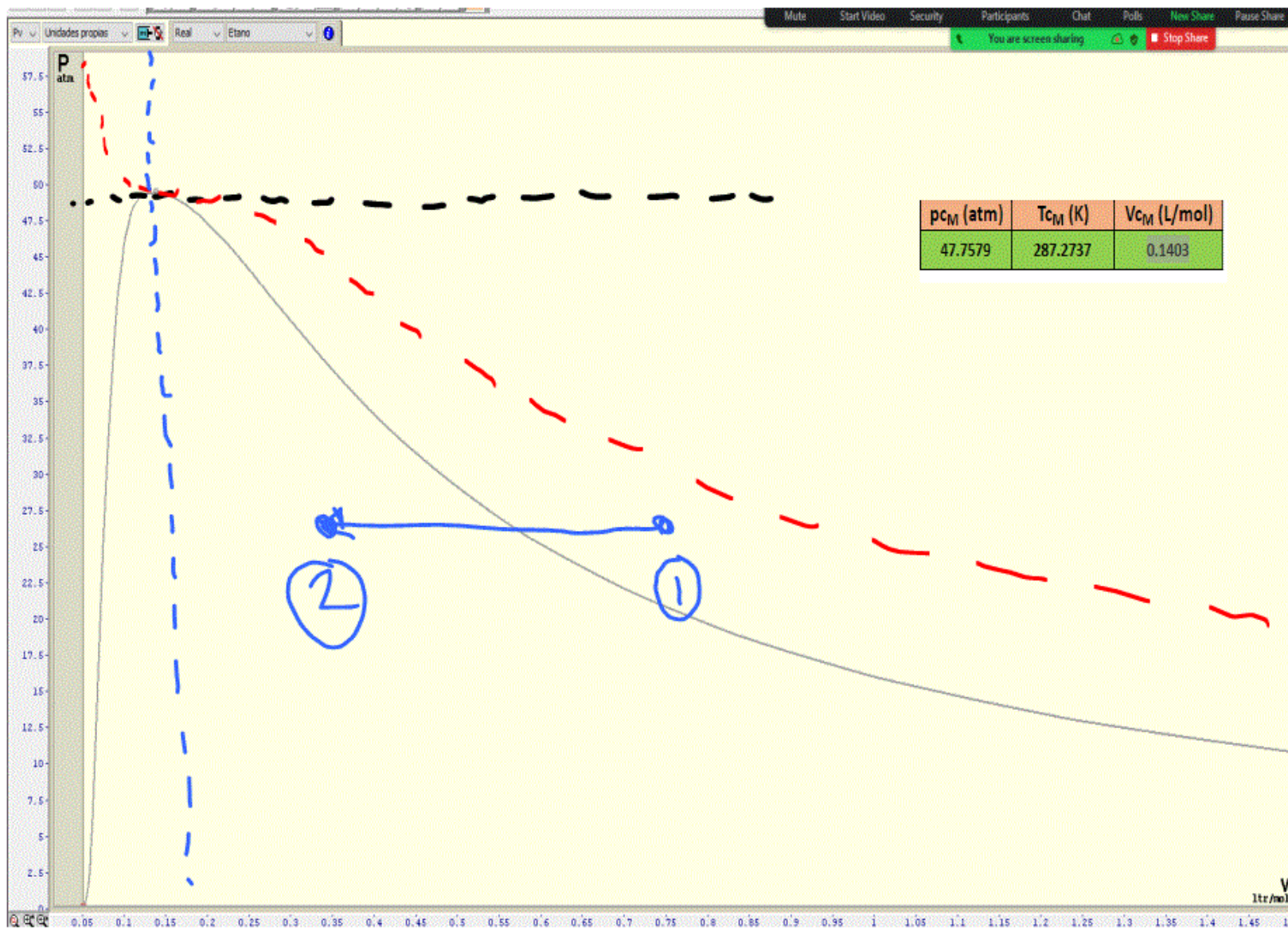
$$= 287.27 \text{ K}$$

$$\bar{V}_{CM} = \sum_{i=1}^n \bar{V}_{Ci}$$

$$= y_{Met} V_{CMet} + y_{Etano} V_{Cetano}$$

$$= 0.1403 \text{ L/mol.}$$







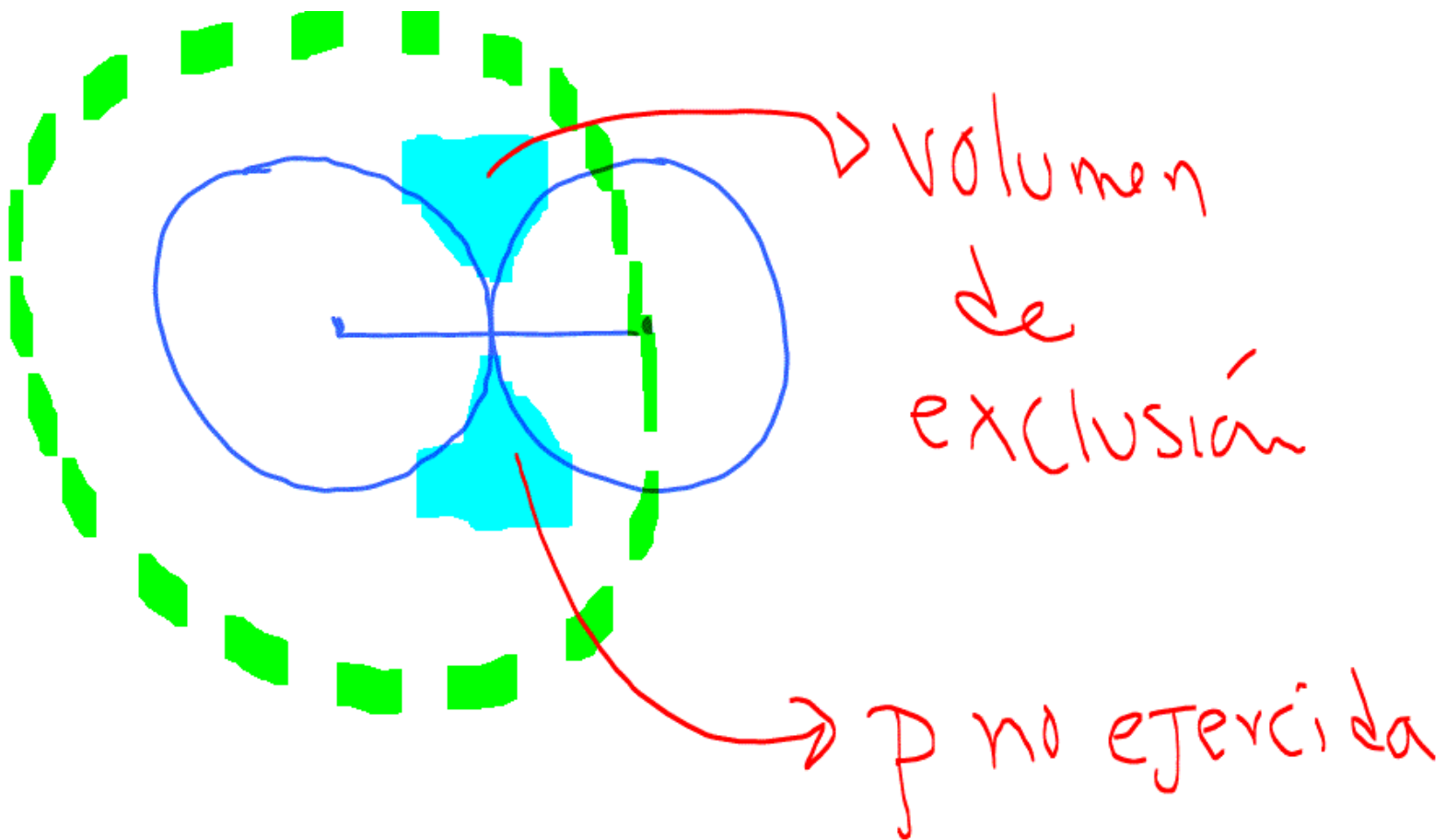
Desviación idealidad

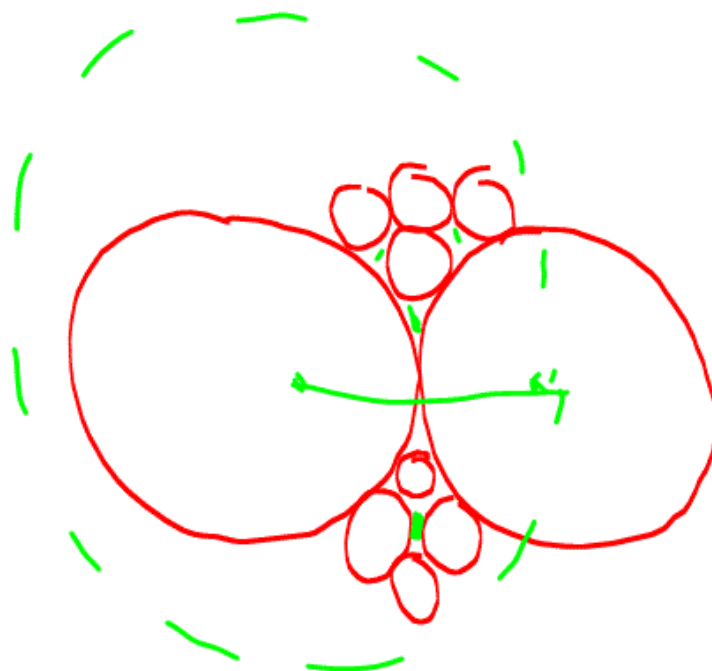
$$P = \frac{nRT}{V}$$

$$T \rightarrow 0$$

$$V \rightarrow 0$$

$$P \rightarrow 0$$





$$V_{\text{exclusión}} = \frac{4}{3} \pi r^3 \quad 2 \text{ moléculas}$$

$$= \frac{2}{3} \pi r^3 \quad 1 \text{ molécula}$$

$$V_{ex} = \frac{2}{3} \pi v^3 N$$

$\approx b$
(L/mol)

$$p = \frac{nRT}{v}$$

$$p = \frac{nRT}{v - nb}$$

P no ejercida

$$F \propto C^2$$

$$P = \frac{F}{A}$$

$$F = a' \left(\frac{n}{v} \right)^2$$

$$P = \frac{a' n^2}{v^2 A} = \frac{a n^2}{v^2}$$

$$P = \frac{nRT}{V - nb} - \frac{an^2}{V^2}$$

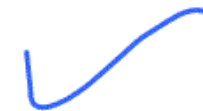
$$p = \frac{RT}{\bar{V} - b} - \frac{a}{\bar{V}^2}$$

$$b = L/mol.$$

$$p = \frac{an^2}{v^2} = atm$$

no ejercida

$$a = \frac{atm L^2}{mol^2}$$



Modelo

$$a = 3pc\bar{V}_c^{-2} \quad b = \frac{\bar{V}_c}{3}$$

a	atmL ² /mol ²	0.81629
b	L/mol	0.03002

**Independiente de volumen crítico****Modelo**

$$a = \frac{27R^2T_c^2}{64pc} \quad b = \frac{RT_c}{8pc}$$

a	atmL ² /mol ²	1.34828
b	L/mol	0.03859

Nombre	NITRÓGENO	
Masa Molar	28.013	g/mol
Temperatura Crítica	126.260	K
Presion Crítica	33.540	atm
Volumen Crítico	0.0901	L/mol
Punto ebullición	77.100	K

Modelo

$$a = 3pc\bar{V}_c^2 \quad b = \frac{\bar{V}_c}{3}$$

a	atmL ² /mol ²	0.81629
b	L/mol	0.03002

Independiente de volumen crítico

Modelo

$$a = \frac{27R^2T_c^2}{64pc} \quad b = \frac{RT_c}{8pc}$$

a	atmL ² /mol ²	1.34828
b	L/mol	0.03859

$$a = \frac{27}{64} \frac{(0.082)^2 (126.26)^2}{33.54}$$

$$= 1.348$$

	Dependiente de Vc		0.0820
Componente	a (atmL ² /mol ²)	b (L/mol)	y _i
Metano	1.3349	0.0330	0.0000
Etano	3.1673	0.0493	0.5946
Propano	5.1800	0.0677	0.4054

$$b_M = \sum_{i=1}^n b_i$$

$$= y_{et} b_{et} + y_{prop} b_{prop}$$

$$= (0.5946)(0.0493 \text{ L/mol}) + (0.4054)(0.0677 \text{ L/mol})$$

$$= 0.0567 \text{ L/mol}$$

Componente	Dependiente de Vc		0.0820
	a (atmL ² /mol ²)	b (L/mol)	y _i
Metano	1.3349	0.0330	0.0000
Etano	3.1673	0.0493	0.5946
Propano	5.1800	0.0677	0.4054

$$a_M = \sum_{i=1}^n a_i$$

$$a_i = y_i a_i^{1/2}$$

$$a_M = \left(y_{\text{etano}} a_{\text{etano}}^{1/2} + y_{\text{prop}} a_{\text{prop}}^{1/2} \right)^2$$

$$a_M = \left[(0.5946) \left(\frac{3.1673 \text{ atmL}^2}{\text{mol}^2} \right)^{1/2} + (0.4054) \left(\frac{5.1800 \text{ atmL}^2}{\text{mol}^2} \right)^{1/2} \right]^2$$

$$= 3.924 \frac{\text{atmL}^2}{\text{mol}^2}$$

$$P = \frac{nRT}{V-nb} - \frac{an^2}{V^2}$$

Pura

$$P = \frac{nRT}{V-nb_m} - \frac{a_m n^2}{V^2}$$

Mezcla

$$P = \frac{nRT}{V-nb} - \frac{an^2}{V^2}$$

$$T = ?$$

Propiedades

Obtención de a y b

Propiedades Físicoquímicas de sustancias

Nombre	PROPANO	
Masa Molar	44.097	g/mol
Temperatura Crítica	369.800	K
Presión Crítica	41.900	atm
Volumen Crítico	0.2030	L/mol
Punto ebullición	231.100	K
Punto de fusión	85.500	K
Cp (cal/mol K)	-1.009e+0	a
Cp=a+bT+cT²+dT³	7.315e-2	b
(300-2500)K	-3.789e-5	c
	7.678e-9	d

$$\bar{V} = \frac{ZL}{2.2727 \text{ mol}} = 0.88 \frac{L}{\text{mol}}$$

Propiedades

Vol real Independiente de Vc

Vol real dependiente de Vc

T y p dependiente de Vc

Obtención de Temperatura y presión comportamiento tipo Van der Waals

Introducir los valores en las celdas de color amarillo

Volumen (L)	2.0000
moles (n)	2.2727
presión (atm)	5.0000
a _M (atmL ² /mol ²)	5.1800
b _M (L/mol)	0.0677
R (atmL/molK)	0.082

T ideal (K)	53.66
T real (K)	49.53

