Título de la nota 06/01/2021

Clase 72 6 Enero 2021

$$\mu = \bar{v}\,dp \qquad \mu = RT\ln f$$

Ideal Real

$$RT\ln f = \bar{v}\,dp \qquad \text{agregar } \frac{RT}{P}$$

$$RT\ln f = \left(\bar{v} + \frac{RT}{P} - \frac{RT}{P}\right)dp$$

$$RT\ln f = \left(\bar{v} - \frac{RT}{P}\right)dp + \frac{RT}{P}\,dp$$

$$RT\ln f = \left(\bar{V} - \frac{RT}{P}\right)dp + \frac{RT}{P}\int_{p_1}^{p_2} dp \qquad p_1 = 1\,atm$$

$$RT\ln f = \left(\bar{V} - \frac{RT}{P}\right)dp + RT\ln p$$

$$RT\ln f - RT\ln p = \left(\bar{V} - \frac{RT}{P}\right)dp$$

$$RT\ln\left(\frac{f}{P}\right) = \left(\bar{V} - \frac{RT}{P}\right)dp$$

$$\Phi = \frac{f}{P}$$

$$RT \ln \Phi = \left(\bar{V} - \frac{RT}{P}\right) dp$$

$$\bar{V} = \frac{ZRT}{P} \qquad Z = \frac{P\bar{V}}{RT}$$

$$RT \ln \Phi = \left(\frac{ZRT}{P} - \frac{RT}{P}\right) dp$$

$$RT \ln \Phi = RT \left(\frac{Z-1}{P}\right) dp$$

$$\ln \Phi = \left(\frac{Z-1}{P}\right) \int_{P_1}^{P_2} dp$$

$$\Phi = e^{\left[\left(\frac{z-1}{P} \right) \int_{P_1}^{P_2} dP \right]}$$

$$z = f(P) \qquad \Phi = f(P)$$

$$f = f(P)$$

A 100°C se ha determinado una ec. virial hasta el 3er coeficiente en un intervalo de presión de 1 a 60 atm y se obtienen los siguientes términos.

$$B = -242.5 \ cm^3/mol$$

$$C = 25{,}200 \ cm^6/mol^2$$

Calcular el $\overline{W}$ de compresión cuando la presión inicial es de 1 atm y la final de 40 atm

1) Convertir B y C a B' y C'

$$Z = 1 + B'(T)p + C'(T)p^2$$

$$B' = \frac{B}{RT} \qquad C' = \frac{C - B^2}{R^2T^2}$$

$$B' = \frac{(-242.5\ cm^3/mol)\left(\frac{1\ L}{10^3\ cm^3}\right)}{\left(\frac{0.082\ atm\ L}{mol\ K}\right)(373.15\ K)} = -7.9253 \times 10^{-3}\ atm^{-1}$$

$$c' = \frac{\left[\left(25{,}200\ \text{cm}^6/\text{mol}^2\right) - \left(-242.5\ \text{cm}^3/\text{mol}\right)^2\right]\left(\frac{1\ \text{L}^2}{10^6\ \text{cm}^6}\right)}{\left(\frac{0.082\ \text{atm L}}{\text{mol K}}\right)^2 \left(373.15\ \text{K}\right)^2}$$

$$c' = -3.5894 \times 10^{-5}\ \text{atm}^{-2}$$

2) $$Z = 1 - 7.9252 \times 10^{-3}\ \text{atm}^{-1} P - 3.5894 \times 10^{-5}\ \text{atm}^{-2} P^2$$

$$\bar{W} = p\, d\bar{V} \qquad Z = \frac{P\bar{V}}{RT}$$

$$\frac{p\bar{V}}{RT} = 1 - 7.9252\times10^{-3}p - 3.5894\times10^{-5}p^2$$

$$\bar{V} = \left[\frac{1 - 7.9252\times10^{-3}p - 3.5894\times10^{-5}p^2}{p}\right]RT$$

$$\bar{V} = \left[\frac{1}{p} - 7.9252\times10^{-3} - 3.5894\times10^{-5}p\right]RT$$

$$\bar{W} = p\,d\bar{V}$$

$$d\bar{V} = \left(\frac{\partial \bar{V}}{\partial p}\right)_T dp$$

$$\left(\frac{\partial \bar{V}}{\partial p}\right)_T = -\frac{1}{p^2} - 3.5894\times10^{-5} = d\bar{V}$$

$$\left(\frac{\partial \bar{v}}{\partial p}\right)_T = -\frac{1}{p^2} - 3.5894\times10^{-5} = d\bar{v}$$

$$d\bar{v} = \left[-\frac{1}{p^2} - 3.5894\times10^{-5}\right] RT\, dp$$

$$\bar{w} = p\, d\bar{v}$$

$$\bar{w} = p\left[-\frac{1}{p^2} - 3.5894\times10^{-5}\right] RT\, dp$$

$$\bar{w} = \left[-\frac{1}{p} - 3.5894\times10^{-5} p\right] RT\, dp$$

$$\bar{W} = \left[-\frac{1}{p} - 3.5894\times10^{-5}\, p\right] RT\, dp$$

$$\bar{W} = RT\left[-\int_{p_1}^{p_2}\frac{dp}{p} - 3.5894\times10^{-5}\,atm^{-2}\int_{p_1}^{p_2} p\, dp\right]$$

$$\bar{W} = RT\left[-\ln\frac{p_2}{p_1} - \frac{3.5894\times10^{-5}\,atm^{-2}}{2}\left(p_2^2-p_1^2\right)\right]$$

$$\frac{J}{mol} = \left(\frac{atm\,L}{mol\,K}\right)(K)\left[-\ln\frac{atm}{atm} - atm^{-2}\left(atm^2\right)\right]$$

$$\left(\frac{atm\,L}{mol}\right)\left(\frac{1.01325\times10^{5}\, N/m^2}{atm}\right)\left(\frac{1\, m^3}{10^3\, L}\right) = J/mol.$$

$$\bar{W} = \left(\frac{0.082\, atm\, L}{mol\, K}\right)(373.15\, K)\left[-\ln\frac{40\, atm}{1\, atm} - \frac{3.5894\times10^{-5}\, atm^{-2}}{2}\left(40^2\, atm^2 - 1^2\, atm^2\right)\right]$$

$$\bar{W} = \left(-\frac{113.7515\, atm\, L}{mol}\right)\left(\frac{1.01325\times10^{5}\, N/m^2}{atm}\right)\left(\frac{1\, m^3}{10^3\, L}\right)$$

$$= -11525.8735\ J/mol.$$

$$\bar{W} = RT\ln\frac{P_1}{P_2} = RT\ln\frac{\bar{V}_2}{\bar{V}_1}$$

$$\bar{W} = -RT\ln\frac{P_2}{P_1} \quad \text{ideal} \quad =$$

$$\bar{W}_{ideal} = RT \ln \frac{P1}{P2}$$

$$= \left(\frac{8.314\ J}{mol\ K}\right)\left(373.15\ K\right) \ln \frac{1\ atm}{40\ atm}$$

$$= -11442.2653\ J/mol$$