

$$U = TS - pV + \mu N \rightarrow dU = TdS - pdV + \mu dN$$

$$U = S \frac{\partial U}{\partial S} + V \frac{\partial U}{\partial V} + N \frac{\partial U}{\partial N}$$

$$\theta_{ig} = 273.16 \cdot \lim_{p_3 \rightarrow 0} \frac{p}{p_3} \rightarrow 273.16 \cdot \frac{p}{p_3}$$

Coefficient de compressibilitat:

$$k_T \equiv -\frac{1}{V} \frac{\partial V}{\partial p} \rightarrow k_T = \frac{\partial \ln V}{\partial T}$$

Coefficient de dilatació tèrmica:

$$\alpha \equiv \frac{1}{V} \frac{\partial V}{\partial p} \rightarrow \alpha = \frac{\partial \ln V}{\partial T}$$

$$\frac{\partial \alpha}{\partial p} = -\frac{\partial k_T}{\partial T} \rightarrow \Delta p = \frac{\alpha}{k_T} \Delta T$$

$$dV = V\alpha dT - V k_T dp \quad W_{A \rightarrow B} = \int_A^B -pdV$$

$$Q = mC_e \Delta T = W = mg\Delta h \quad 1cal = 4.19J$$

$$dU = dW + dQ \rightarrow dU = -pdV + dQ$$

$$H = U + pV; R = C_p - C_v; \frac{C_p}{C_v} = \gamma$$

$$\gamma \equiv \text{coeficient adiabàtic}; C_p = C_v + R$$

$$C_p = C_v + \left[ \frac{\partial U}{\partial V} + p \right] \left( \frac{\partial V}{\partial T} \right)$$

$$TV^{\frac{R}{C_v}} = TV^{\frac{C_v - C_p}{C_v}} = TV^{\gamma - 1}$$

$$q = \frac{\text{calor}}{\text{àrea} \cdot \text{temps}} = -\lambda \cdot \vec{\nabla} T \quad \text{Fourier}$$

$$q = \epsilon \sigma T^4 \quad \text{Llei de Stefan-Boltzmann}$$

$\sigma \equiv$  constant de Stefan-Boltzmann

$\epsilon \equiv$  emissivitat

$$1r \text{ principi} \rightarrow Q_1 = Q_2 + W$$

Rendiment:

$$\eta = \frac{W}{Q_1} = \frac{Q_1 - Q_2}{Q_1} = 1 - \frac{Q_2}{Q_1} = 1 - \frac{T_2}{T_1}$$

$$\eta_{refrigerador} \equiv \frac{Q_2}{W}; \eta_{bomba} \equiv \frac{Q_1}{W}$$

$$k \equiv \text{constant de Boltzmann} \equiv \frac{R}{N_A}$$

$$G = U + pV - TS$$

$$\Delta G = \Delta U + p\Delta V - T\Delta S$$

$$\Delta H = \Delta U + p\Delta V$$

$$C_v = \frac{\partial U}{\partial T} \quad pV = RTn \quad \text{gas ideal}$$

Gas real Van der Waals

$$\left( p + a \frac{n^2}{v^2} \right) (v - nb) = RT$$

$$F = U - TS \rightarrow dF = dU - TdS - SdT - pdV + \mu dN$$

$$dF = -SdT - pdV + \mu dN$$

$$S = -\frac{\partial F}{\partial T}; p = -\frac{\partial F}{\partial V}; \mu = \frac{\partial F}{\partial N}$$

$$G = U - TS + pV$$

$$dG = dU - TdS + Vdp + pdV$$

$$dG = -SdT + Vdp + \mu dN$$

$$S = -\frac{\partial G}{\partial T}; V = \frac{\partial G}{\partial p}; \mu = \frac{\partial G}{\partial N}$$

$$dQ = dU + pdV = \left( \frac{\partial U}{\partial T} \right) dT + \left[ \frac{\partial U}{\partial V} + p \right] dV$$

$$C_v = \frac{\partial U}{\partial T}$$

$$C_p = \frac{\partial U}{\partial T} + \left[ \left( \frac{\partial U}{\partial V} \right) + p \right] \left( \frac{\partial V}{\partial T} \right)$$

$$C_p - C_v = \left[ \frac{\partial U}{\partial V} + p \right] \frac{\partial V}{\partial T} = T \frac{\partial p}{\partial T} \frac{\partial V}{\partial T} = *$$

$$\frac{\partial V}{\partial T} = V\alpha; \frac{\partial V}{\partial p} = -V k_T$$

$$C_p = \frac{\partial H}{\partial T} = T \frac{\partial S}{\partial T}; \gamma = \frac{C_p}{C_v} = \frac{5/2 R}{3/2 R} = 5/3$$

$$\frac{\partial p}{\partial T} = -\frac{(\partial V / \partial T)}{(\partial V / \partial p)} = \frac{V\alpha}{k_T} \quad \alpha = \frac{1}{T}; k_T = \frac{1}{p}$$

$$* = T \frac{\partial p}{\partial T} \frac{\partial V}{\partial T} = T \frac{\alpha}{k_T} V\alpha = \frac{TV\alpha^2}{k_T}$$

$$C_p - C_v = \frac{TV\alpha^2}{k_T} = \frac{TV T^{-2}}{1/p} = \frac{Vp}{T} = Rn$$

$$\Delta G = \Delta H - T\Delta S \quad \Delta S = \int \frac{dQ_R}{T}$$

$$\frac{\partial^2 U}{\partial T^2} > 0 \text{ estable tèrmicament}$$

$$\frac{\partial^2 U}{\partial V^2} > 0 \text{ estable mecànicament}$$

$$\frac{\partial^2 U}{\partial N^2} > 0 \text{ estable materialment}$$

$$\frac{dp}{dT} = \frac{l}{T\Delta V} \rightarrow \frac{dp}{dT} = \frac{l}{TRT/p}$$

$$\frac{dp}{dT} = \frac{lp}{T^2 R} \rightarrow \frac{dp}{p} = l \frac{dT}{T^2 R} \rightarrow \ln p \Big|_{p_1}^{p_2} = - \frac{l}{R} \frac{1}{T} \Big|_{T_1}^{T_2}$$

$$p = cte - \frac{l}{RT}$$

$$\ln p_A = A_1 - B_1 \frac{1}{T_1}$$

$$\ln p_B = A_2 - B_2 \frac{1}{T_2}$$

$$-\frac{l}{RT} = -B_1 \frac{1}{T_1} \rightarrow l_1 = RB_1$$

$$-\frac{l}{RT} = -B_2 \frac{1}{T_2} \rightarrow l_2 = RB_2$$

$$B = l = \text{calor latent}$$

$$l_{\text{fusió}} + l_{\text{vaporització}} = l_{\text{sublimació}}$$

$$l_{\text{fusió}} = l_{\text{sublimació}} - l_{\text{vaporització}}$$

$$\Delta S = \frac{\Delta H}{T} = \frac{l}{T}$$

$$\left( \Pi + \frac{3}{\Phi^2} \right) (3\Phi - 1) = 8\Theta$$

$$p_c = \frac{a}{27b^2} \rightarrow \Pi = \frac{p}{p_c} = \frac{27b^2 p}{a}$$

$$V_c = 3b \rightarrow \Phi = \frac{V}{V_c} = \frac{V}{3b}$$

$$T_c = \frac{8a}{27bR} \rightarrow \Theta = \frac{T}{T_c} = \frac{27bRT}{8a}$$

$$\mu_{JK} = \frac{\partial T}{\partial p} \text{ Coeficient Joule-Kelvin}$$

$$p = p_A + p_B = p_A^0 x_A + p_B^0 x_B$$

$$x_A + x_B = 1$$

$$p_A = p_A^0 x_A \rightarrow x_A = \frac{p_A}{p_A^0} \#$$

$$p_B = p_B^0 x_B \rightarrow x_B = \frac{p_B}{p_B^0} \#$$

$$p_A = p y_A \quad y_A + y_B = 1$$

$$p_B = p y_B$$

$$x_A = \frac{n_A}{n_A + n_B} \rightarrow x_i = \frac{n_i}{\sum n_i} \#$$

$$x_B = \frac{n_B}{n_A + n_B} \rightarrow x_j = \frac{n_j}{\sum n_j} \#$$

$$\Delta T_{\text{ebullició}}^2 = \frac{RT_{\text{ebullició}}^2}{l_{\text{vaporització}}} x_2$$

$$\Pi = cRT$$

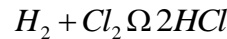
$\Pi \equiv$  pressió osmòtica

$$c \equiv \text{concentració} = \frac{\text{mols solut}}{\text{volum}}$$

$T \equiv$  temperatura

$M \equiv$  molaritat

$$\ln x_N(T) = \frac{l_f^N}{R} \left( \frac{1}{T} - \frac{1}{T_f^N} \right)$$



$$k_p = \frac{P_{HCl}^2}{P_{H_2} P_{Cl_2}} = e^{-\frac{\Delta G}{RT}}$$

$$\ln \left[ \frac{k_p(T_2)}{k_p(T_1)} \right] = -\frac{\Delta H}{R} \left( \frac{1}{T_2} - \frac{1}{T_1} \right)$$

$$W = \int H dM$$

$$m = \frac{M}{V} \rightarrow M = mV \rightarrow dM = V dm$$

$$\text{Llei de Curie: } m = \frac{C}{T} H$$