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

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

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

Coeficient de compressibilitat:

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

Coeficient de dilatació tèrmica:

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

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

$$\boxed{dV = V\alpha dT - Vk_T dp} \quad \boxed{W_{A\to B} = \int_A^B -pdV}$$

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

$$\boxed{dU = dW + dQ} \rightarrow dU = -pdV + dQ$$

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

$\gamma \equiv$ coeficient adiabátic; $\boxed{C_p = C_V + R}$

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

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

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

$\boxed{q = \varepsilon \sigma T^4}$ Llei de Stefan-Boltzmann

$\sigma \equiv$ constant de Stefan-Boltzmann

$\varepsilon \equiv$ emissivitat

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

Rendiment:

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

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

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

$$\boxed{G = U + pV - TS}$$

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

$$\boxed{\Delta H = \Delta U + p\Delta V}$$

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

Gas real Van der Waals

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

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

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

$$G = U - TS + pV$$
$$dG = dU - TdS + Vdp + pdV$$
$$dG = -SdT + Vdp + \mu dN$$

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

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

$$\boxed{\begin{aligned} C_V &= \frac{\partial U}{\partial T} \\ C_p &= \frac{\partial U}{\partial T} + \left[\left(\frac{\partial U}{\partial T}\right) + p\right]\left(\frac{\partial V}{\partial T}\right)\end{aligned}}$$

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$B = l =$calor latent

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

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

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

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

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

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

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

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

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

$$\boxed{x_A + x_B = 1}$$

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

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

$$p_A = p y_A \qquad \boxed{y_A + y_B = 1}$$

$$p_B = p y_B$$

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

$$x_B = \frac{n_B}{n_A + n_B} \rightarrow x_J = \frac{n_J}{\sum n_J} \ \#$$

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

$$\boxed{\Pi = cRT}$$

$\Pi \equiv$ pressió osmòtica

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

$T \equiv$ temperatura

$M \equiv$ molaritat

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

$$H_2 + Cl_2 \,\Omega\, 2HCl$$

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

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

$$W = \int H dM$$

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

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