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1^{a} Lei: $dU = T dS - p dV$

$U = U(S, V)$

$$dU = \frac{\partial U}{\partial S} dS + \frac{\partial U}{\partial V} dV$$

Para Entropia

$$dS = \frac{1}{T} dU + \frac{P}{T} dV$$

$S = (U, V)$

$$dS = \frac{\partial S}{\partial U} dU + \frac{\partial S}{\partial V} dV$$

GÁS IDEAL

$PV = nRT$

$U = \alpha PV = (\alpha n R) T$

SEC. 4

1. $U = \alpha PV = (n\alpha R)T$

$$dU = TdS - PdV$$

Processo adiabático $dS = 0$

$$dU = -PdV$$

$$dU = \alpha\, d(PV)$$
$$= \alpha(VdP + PdV)$$

$$\Rightarrow \alpha VdP = -PdV - \alpha PdV$$

$$\Rightarrow \alpha \frac{dP}{P} = -(1+\alpha)\frac{dV}{V}$$

$$\alpha \int_{P_0}^{P} \frac{d\tilde{P}}{\tilde{P}} = -(1+\alpha)\int_{V_0}^{V} \frac{dV}{V}$$

$$\alpha \ln(P/P_0) = -(1+\alpha)\ln(V/V_0)$$

$$\ln(P/P_0) = \ln\left(\frac{V}{V_0}\right)^{-\frac{1+\alpha}{\alpha}}$$

$$\frac{P}{P_0} = \left(\frac{V}{V_0}\right)^{-\frac{1+\alpha}{\alpha}}$$

$$P = P_0\left(\frac{V_0}{V}\right)^{\frac{1+\alpha}{\alpha}}$$

gás monoat.

$\alpha = 3/2$

$\gamma = \frac{1+\alpha}{\alpha} = 5/3$

2. $U = \alpha PV = (nR\alpha)T$

$$dS = \frac{1}{T}dU + \frac{P}{T}dV$$

(b) $S(P,V)$

$$dS = \frac{1}{T}\alpha(VdP + PdV) + \frac{P}{T}dV$$

$$T = \frac{1}{nR}PV$$

$$\Rightarrow dS = \frac{\alpha}{(nR)^{-1}}\left(\frac{dP}{P} + \frac{dV}{V}\right) + \frac{1}{(nR)^{-1}}\frac{dV}{V}$$

$$\Rightarrow \int_A^B dS = \alpha nR \int_{P_A}^{P_B} \frac{dP}{P} + nR(1+\alpha)\int_{V_A}^{V_B} \frac{dV}{V}$$

$$S_B - S_A = \alpha nR \ln(P_B/P_A) + nR(1+\alpha)\ln(V_B/V_A)$$

$S_B \to S$, $S_A \to S_0$

$$\boxed{S(P,V) = S_0 + \alpha nR \ln(P/P_0) + nR(1+\alpha)\ln(V/V_0)}$$

5. $S(U,V)$, $\boxed{PV = nRT}$

$$dS = \frac{1}{T}dU + \frac{P}{T}dV$$

$$\frac{1}{T} = \frac{\partial S}{\partial U}$$

$$\frac{1}{T} = \cancel{\frac{nR}{PV}} \quad , \quad \frac{1}{T} = f(U,V)$$

6. $$\frac{\partial}{\partial V}\left(\frac{1}{T}\right) = \frac{\partial}{\partial U}\left(\frac{P}{T}\right)$$

$$\cancel{\frac{\partial}{\partial V}\left(\frac{nR}{PV}\right) = -1\frac{nR}{P}\frac{1}{V^2}} \; ?$$

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$$\frac{P}{T} = \frac{nR}{V} \quad , \quad U = \alpha PV = \alpha nRT$$

$$\frac{1}{T} = \left(\frac{\partial S}{\partial U}\right)_V \quad , \quad \frac{P}{T} = \left(\frac{\partial S}{\partial V}\right)_U$$

$S(U,V)$