Exercise 6-7

Tuesday, 5 May 2020 12:32

$dU = TdS - PdV$

$du = Tds - Pdv$

$PV = nRT$

$\rightarrow Tds = du + Pdv$

$ds = \frac{du + Pdv}{T}$

~~ideal gas $u(T)$ $du = \left(\frac{\partial u}{\partial T}\right) dT$~~

large $dU = n c_v dT$

small $du = c_v dT$

$P = \frac{RT}{v} \Rightarrow \frac{P}{T} = \frac{R}{v}$

$s = \int \frac{1}{T} du + \int \frac{P}{T} dv$

$s = \int \frac{C_v}{T} dT + \int \frac{R}{v} dv$

$= c_p \ln(T) + R \ln(v) + s_0$

$v = \frac{RT}{P}$

$= C_v \ln\left(\frac{T}{T_0}\right) + R \ln\left(\frac{v}{v_0}\right)$

$= C_v \ln\left(\frac{T}{T_0}\right) + R \ln\left(\frac{\frac{RT}{P}}{\frac{RT_0}{P_0}}\right)$

my idea

$= C_v \ln\left(\frac{T}{T_0}\right) + R \ln\left(\frac{T P_0}{T_0 P}\right)$

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their idea... $Tds = du + Pdv = dh - d(Pv) + Pdv = dh - Pdv - vdP + Pdv = dh - vdP$

$\rightarrow dh = c_p dT$

$Pv = RT \Rightarrow \frac{v}{T} = \frac{R}{P}$

$s = \int \frac{dh}{T} - \int \frac{v}{T} dP$

$= c_p \ln(T) - R \ln(P) + s_0$

$= c_p \ln\left(\frac{T}{T_0}\right) - R \ln\left(\frac{P}{P_0}\right)$