

Hello,

I've been going back over things I've done, and realized I had several clarification questions I seem to be confused about what seem to be some simple thermo concepts--

1. Throughout the pset1, I have seen the relations between $pV^\gamma = \text{constant}$, or VT^c where $c = cv/R$, etc. Where are these relations from? I know the derivation for them and that makes sense, but are these strictly for adiabatic reversible processes?

These relations were derived in class and during recitation and correspond to the adiabatic expansion of an ideal gas. Consider the generalized equation to calculate the change in internal energy for an ideal gas:

$$dU = nC_vdT = dQ - PdV$$

Combining the first and second laws:

$$dU = nC_vdT = TdS - PdV$$

Using $PV = nRT$,

$$dV = (nR/P) dT - (nRT/P) dP$$

$$C_vdT = TdS - RdT + RTdP/P$$

$$dS = C_pdT/T - RdP/P$$

If the process is adiabatic, $dS=0$ and we have

$$\ln(T_2/T_1) = \ln((P_1/P_2)^{R/C_p})$$

2. Is there any good way to think about drawing the p vs. V diagrams. I seem to get all confused as soon as I'm supposed to draw a diagram about a temperature process on a p vs V diagram, particularly when parts are adiabatic, isothermal, isobaric, etc I have been trying problem after problem, but I always seem to draw the whole diagram wrong, or not even know how to approach it.

a) An Isobaric process should be a horizontal line in a P-V diagram.

b) An isothermal process, should satisfy the condition $PV = \text{constant}$

c) An adiabatic process, should satisfy the relation above.

3. For a rev. adiabatic, things I know are $dQ = 0$, $dS = 0$, therefore, $delU = w$, so I would assume $delU = -pdV$, but in pset1 2.5, this $w = nc_vdT$. Any help with why this is the case?

This is just the first law. Since there is no heat, the work performed by/on the system is just the change in internal energy. Since this is an ideal gas, the internal energy is determined by C_vdT ...