Entropy Calculation

\[ \Delta S = \int \frac{\delta Q_{\text{rev}}}{T} \]

Statement of 2nd law: \[ \Delta S_{\text{sys}} + \Delta S_{\text{surrounding}} \geq 0 \]

Calculating \( \Delta S_{\text{sys}} \):
If process is reversible \[ \rightarrow \]

If process is irreversible \[ \rightarrow \]

But in any case, since \( \Delta S \) is a state function: \[ \Delta S = \]

If “surrounding” is at constant temperature (a heat reservoir), then \( \Delta S_{\text{surrounding}} \) is calculated as:

\[ \Delta S_{\text{surrounding}} = \]

(see page 165 of textbook).

Maxwell’s Equations

EOS gives us \( f(P,V,T) = 0 \) and \( Cp = f(T) \) \( \rightarrow \) we need only 2 variables to figure out the rest.

Main use: Getting rid of \( \left( \frac{\partial S}{\partial ...} \right)_{...} \) and \( \left( \frac{\partial ...}{\partial S} \right)_{...} \)

Example Problem:
Gas A goes from state 1 \((T_1, V_1)\) to \((T_2, V_2)\). Give the expression for the change in enthalpy \( H \).
The Use of 2\textsuperscript{nd} Law

2\textsuperscript{nd} Law is often used to answer questions of this nature:
1) Is this possible?
2) What is the (maximum/minimum) (heat / work) possible?

Example Problem:

There is no net heat or work interaction with the surrounding.
Assume air is an ideal gas with $C_p = 3.5R$ (constant). Is the process drawn above feasible?

To think about: If we were to change the pressure of the air coming in (keeping everything else the same), what is the lowest pressure possible?