Chemical Thermodynamics
Joule-Thompson Expansion

- Joule-Thompson expansion depends on non-ideal characteristics of gases.
- Compare \( \text{NH}_3 \) and He in a Joule-Thompson expansion for \( P_1 = 100 \text{ bar} \) to \( P_2 = 1 \text{ bar} \) at an initial temperature of 260 K.
Joule-Thompson Expansion

- Continue comparison between NH$_3$ and He.
Joule-Thompson Expansion

- Difference between NH$_3$ and He due to differences in intermolecular forces.
Joule-Thompson Expansion

- Continuously repeating a Joule-Thompson expansion is the basis for a refrigerator
Ideal coolant

- Look at intermolecular forces to determine an ideal refrigerant.
Most chemistry done at constant pressure (so $C_p$ is typically tabulated) but most equations involve $C_v$.

- Convert between $C_p$ and $C_v$. 
$C_p/C_v$

- Relationship between $C_p$ and $C_v$ dependent on equation of state.
- For an ideal gas:
For a solid block of iron:

\[
\frac{C_p}{C_v}
\]