agenda
- test-taking tips
- review lecture
- problems
- open questions

- TD is the macroscopic science of systems at equilibrium: predict their behaviour.
- Equilibrium: maximize S or minimize U, G... balance of energy (bonds, vibs, etc), entropy (available states), and T (ustate sampling) matters.
* Know how to classify system (every exam!): isolated / closed / open / adiabatic

First Law: $\Delta U = q + w$ → overall process calcs. (real processes can't convert $q \to w$ 100%)

$dU = dq + dw = TdS - PdV + \ldots$ heat into or work done on system: $q, w > 0$

work: $dw = Fdx$ (intensive × extensive) eg., $-PdV$; (TdS) (dq); $H(VdB)$; μdn

Gases: $dw = -\int P dV$ isobaric $= -P\Delta V$ isochoric $= 0$ iso-T, rev $= -\int \frac{nRT}{V} dV$

Entropy, 2nd Law: $\Delta S^{univ} \geq (=) 0$ for spontaneous (reversible) process. $dS = \frac{dq_{rev}}{T}$ $C \equiv \frac{dq_{rev}}{dT}$

$$dS_{(P)} = \int n \frac{C_P}{T} dT \qquad \Delta S^{tr} = \frac{\Delta H^{tr}}{T^{tr}}$$

← main eqs we have used.

$\int nC_P dT = \Delta H = q_P$

$\int nC_V dT = \Delta U = q_V$

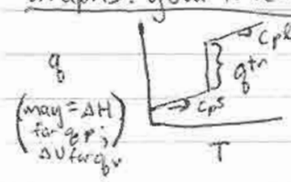
fyi: $dS_V = \int n \frac{C_V}{T} dT$

dS_T = convert dT to dP or dV from ideal gas law.

} TD property calcs.

$dS = \frac{dU}{T} + \frac{PdV}{T} + \ldots$ } equil. condition calcs. for equil. properties. using constraints (e.g., $dU_A = -dU_B$)

Graphs: your friends!



ΔS vs. T is similar but slope $= \frac{C_P}{T}$

- higher slope = higher C_P
- Know how to show supercooling / heating: can draw cycles for H, S - because state functions.
- V vs. T gives α for slope.
- phase fractions: linear transformations.

Misc.

concept: reversible processes (at equil., no dissipation) allow calcs. for real processes at same initial final states (for all state functions).

PDF: $dH = \left(\frac{\partial H}{\partial S}\right)_P dS + \left(\frac{\partial H}{\partial P}\right)_S dP = TdS + VdP = dH(S, P)$ → natural variables.

$U = U(S,V)$; $G = G(T,P)$; $F = F(T,V)$

problems: - we went over PS3 #3, #6 on the board.
- I recommended: PS3 #4; Q2003 (like PS3 #6, but check part e.)!); Q2004 (should be straightforward).