

Stuff for Tuesday, May 29, 2012

- Schedule for this week
 - PS #17 due today; PS #18 due Friday
 - 1094 Session 9 on Wednesday and quiz #9 on Friday

T6, T7, T8 stuff:

- Entropy $S = k_B \ln \Omega$, so $\Omega = e^{S/k_B}$; $\partial S / \partial U \equiv 1/T$ defines temperature
- Maxwell-Boltzmann: Probability of molecule speed v is $\propto e^{-E/k_B T} = e^{-mv^2/2k_B T}$

$$\text{Pr}(\text{speed } v \pm dv/2) = \frac{4}{\sqrt{\pi}} \left(\frac{v}{v_P} \right)^2 e^{-(v/v_P)^2} \frac{dv}{v_P} \quad \text{where} \quad v_P \equiv \left(\frac{2k_B T}{m} \right)^{1/2}$$

- Average energy of a quantum system

$$E_{\text{avg}} = \sum_n E_n \text{Pr}(E_n) = \sum_n E_n e^{-E_n/k_B T} / \sum_n e^{-E_n/k_B T}$$

- Characteristic temperature $T_\varepsilon \equiv \varepsilon/k_B$; dof's switched off if $T_\varepsilon \ll T$
- Entropy of a monatomic gas

$$\Omega(U, V, N) \approx \frac{1}{N!} \left(\frac{8mV^{2/3}bU}{3Nh^2} \right)^{3N/2} \quad S(U, V, N) = \frac{3}{2} Nk_B \ln \left(\frac{8mV^{2/3}bU}{3Nh^2} \right) - k_B \ln(N!)$$

- Entropy change: $dS = dQ/T$ with constant N , only work from quasistatic ΔV
constant T : $\Delta S = \frac{Q}{T}$ phase change: $Q = \pm mL$ specific heat: $\Delta S = mc \ln \frac{T_f}{T_i}$