

# Stuff for Monday, May 14, 2012

- PS #13 due up front.

T1, T2 and T3 stuff:

- Specific heat  $c$ :  $dU = mc dT$  or  $c \equiv \frac{1}{m} \frac{dU}{dT}$
- Ideal gas law:  $PV = Nk_B T$  with  $k_B = 1.38 \times 10^{-23}$  J/K
- Temperature and energy:

$$K_{\text{avg}} = \frac{1}{2} [mv^2]_{\text{avg}} = \frac{3}{2} k_B T \implies v_{\text{rms}} \equiv \sqrt{[v^2]_{\text{avg}}} = \sqrt{\frac{3k_B T}{m}}$$

- Thermal energy of a gas:  $U = \frac{f}{2} Nk_B T$ 
  - Near room  $T$ ,  $f \approx 3$  (monatomic gas),  $f \approx 5$  (diatomic gas), and  $f > 6$  (polyatomic gas)
  - $f$  is called the number of molecular “degrees of freedom”
- Gas processes: heat is energy flow from  $\Delta T$ 
  - First Law:  $\Delta U = Q + W$
  - Expansion or compression work:  $dW = -P dV$
  - Adiabatic:  $TV^{\gamma-1} = \text{const.}$        $PV^\gamma = \text{const.}$        $\gamma = 1 + 2/f$