Physics 161 Fall 2011 HW 2 Solutions

18.10 a) $\frac{pV}{RT} = n = \frac{21\ \text{atm} \cdot (15 \times \pi \times 4.5^2)\ \text{dl}^3}{0.082\ \frac{\text{L}\cdot\text{atm}}{\text{mol K}} \cdot (22+273)\text{K}}$ $\quad 1\ \text{dl}^3 = 1$ liter

$n = 828$ moles

b) $M_{tot} = nM = 828\ \text{moles} \times \frac{0.032\ \text{kg}}{\text{mol}} = 26.5\ \text{kg}$

18.14 a) $\frac{V_s}{V_B} = \frac{nRT_s}{nRT_B} \cdot \frac{P_B}{P_s} = \frac{(23+273)\cdot 3.5}{(4+273)\cdot 1.0} = 3.74$

b) Lungs will burst!

18.44 a) $C_V = \frac{n}{2}R$ $\quad n =$ # of places to put energy

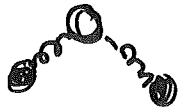
$= 3R$ for 3 translation + 3 rotation degrees of freedom

this is molar heat capacity, J/molK.
specific heat is per gram.

$c = C_V \cdot \frac{1\ \text{mol}}{M\ \text{gms}} = 3R \cdot \frac{1}{18} = 1.38\ \frac{\text{J}}{\text{gK}}$

OR $1380\ \frac{\text{J}}{\text{kg}\cdot\text{K}}$

b) $c_{true} = 2000\ \frac{\text{J}}{\text{kgK}}$. Ratio ≈ 1.5 must have ~9 places to put energy, rather than 6 ... "1½" vibrations contribute.



H_2O . could have 2 vibrations, plus in-plane & out-of-plane wagging!