December 3

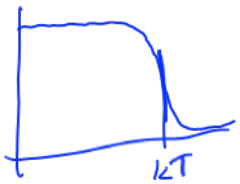
PUSH YOUR COMPUTERS TO THE CENTER OF THE TABLE AND DON'T SPILL!!!!!!

Boltzmann Distribution $e^{-\frac{E}{kT}}$

Prob of finding energy E in a system in contact with large reservoir is proportional to

$$\Omega(E)\, e^{-E/kT}$$

- $\Omega(E)$: # of states with energy E
- k: Boltzmann's const
- T: temp



In ideal gas $\left(e^{-K_{trans}/kT}\right)\left(e^{-E_{vib}/kT}\right)\left(e^{-E_{rot}/kT}\right)\left(e^{-M_{gg}/kT}\right)$

Ponderable: A nitrogen molecule gets bumped off a desk at room temperature. How high does it go if it does not hit any other molecules? (i.e., "typical" height when $k\,T = m\,g\,y$)

$$y = \frac{kT}{mg}$$

(room temp)

$$= \frac{(1.38\times10^{-23}\,J/K)(300K)}{\left(\frac{0.029\,kg/mol}{6\times10^{23}\,atoms/mol}\right)\left(9.8\,m/s^2\right)} = 8.7\,km$$

Ponderable: A marble is on the desk with $M = 10$ g. What is the typical height of the marble? (i.e., $M g y = k T$)

$$y = \frac{(1.38 \times 10^{-23}\ \text{J/K})(300\ \text{K})}{(0.01\ \text{kg})(9.8\ \text{m/s}^2)} = 4 \times 10^{-20}\ \text{m}$$

Ponderable: Approximately what fraction of the sea-level air density is found at the top of Mount Everest, a height of 8848 meters above sea level?

$$\rho = \rho_{\text{sea level}}\, e^{-E/kT}$$

$$\frac{\rho}{\rho_{\text{sea level}}} = e^{-mgy/kT}$$

(mostly N_2 in the exponent; $T \approx 300\,K$)

$$= \exp\left[-\frac{0.028}{6\times10^{-23}} \times 9.8 \times 8848 \Big/ 300 \times 1.38e{-23}\right]$$

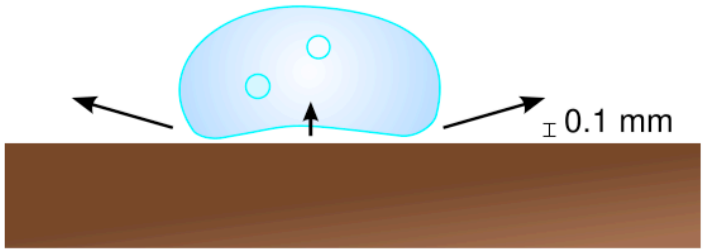
$$\approx 0.35$$

Post Diagnostic

Ice cream!

Liquid Nitrogen: Boiling point 77K

Leidenfrost Effect



For those who are going into the regular section of 0175 next semester:

We covered very similar material to 0174 this semester. The main thing we did not do is waves (will do next semester).

<u>If you go to the regular section of 0175, review waves in Halliday and Resnick (the text for regular section)</u>

Survey on Web Assign (please consider doing)

Final Info:

Friday, Dec 12, 2:00-3:50 here in Thaw 210

Bring calculator

Covers Chapters 1-11

Review Friday in class

Practice Exam on Web Page (under Test Information link)