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Course 565/665 Lecture Number ______ Date 3/13/03

Lecturer Dr. Silvia Cavagnero Note Taker Lena Ho

{Exam B357 at 4:30pm}

d = total differential
derivatives of functions of 1 variable only.
$\frac{df}{dx}$: $f = f(x)$

∂: partial derivatives of functions that depend on more than 1 independent variable $\left(\frac{\partial f}{\partial x}\right)_y$: $f\ f(x,y)$

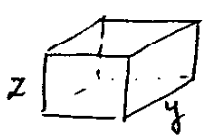
δ : Total differentials of functions that are not state functions
$dU = \delta w + \delta q$

Δ : used for finite, macroscopic differences
$f(x_1),\ f(x_2)$ $\Delta f = f(x_2) - f(x_1)$

* Internal Energy of an Ideal gas depends only on temperature.
Ideal gas: No potential energy, no intermolecular interactions
Only kinetic energy
From kinetic energy of gases,

$$pV = \frac{1}{3} n M c^2 \qquad c = \sqrt{c^2} = \sqrt{\langle v^2 \rangle} = \sqrt{\langle v_x \rangle^2 + \langle v_y^2 \rangle + \langle v_z^2 \rangle}$$

$$= \frac{1}{3} n M \left(\langle v_x \rangle^2 + \langle v_y^2 \rangle + \langle v_z^2 \rangle \right)$$



$$PV = nRT$$

$$c = \sqrt{\frac{3RT}{M}}$$

For an ideal monoatomic gas, $U = E_{kinetic} + \cancel{V} \equiv 0$ (potential energy) no mutual interactions between particles.

$$E_{kinetic} = N_0 \frac{1}{2} m c^2$$

$$= \frac{3}{2} RT \quad \text{(only a function of T)} \quad U \Rightarrow U(T)$$

$$\left(\frac{\partial U}{\partial V}\right) = 0$$

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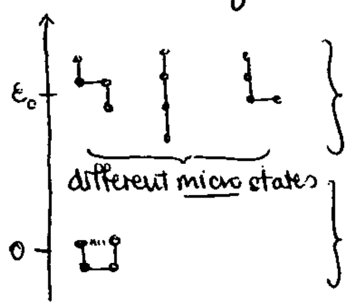
{Chapter 10} Boltzmann Distribution Law.

will bring together chapters 6 ⇒ Smax, Boltz. Law

chapters 6-9 ⇒ different thermodynamic function.

We will bring microscopic and macroscopic worlds together.

→ Recall Polymer collapse example



first excited state (⇒ macrostate) (a collection of several microstates w/ same energy)

ground state

$\varepsilon = 0$: 1 microstate (one single molecule with a defined value of the property of interest)

$\varepsilon = \varepsilon_0$: 4 microstates, 1 macrostate

In general, $E_{Tot} = E_{\substack{internal \\ Total}} + E_{\substack{interaction \\ Total}}$

Interactions at the single molecule level

interactions between different particles.

$E_{internal, total} = E_{rotational} + E_{vibrational} + E_{conformational}$

$E_{interaction, total} = \sum_i \varepsilon_{ij}$ with $i \neq j$

Interaction between i and j

Notation : E_j = energy of a generic system.

ε_j = energy of a simplified system where $E_{interaction, total} = 0$