

Lecture 2: Some motivation



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PART 1: Define basic quantities for describing the macroscopic state of a substance.

PART 2: Mathematically modeling behavior of gases with the "Ideal gas law"

PART 3: How heat impacts substances and their



Macroscopic State V_a

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Macroscopic State Variables

Temperature (T): How hot is the substance?

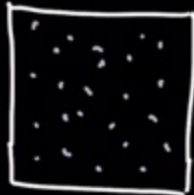
Volume (v): How much space does it take up?

Pressure (p): How hard the substance pushes per unit area.

Particle number (N): How many particles?

Number of mo^l

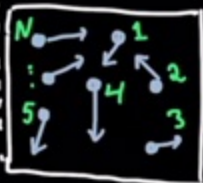
Defining volume (v)



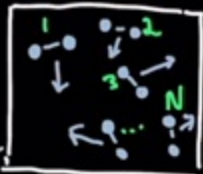
Measuring amounts of a substance



one atom per particle



two atoms per particle



N = number of particles (atoms or molecules)
usually a huge #.

$$N_A = \text{Avogadro's number} = 6.02 \times 10^{23} \text{ mol}^{-1}$$

$$n = \frac{N}{N_A} =$$

Example: Bottle of water.



1L of water

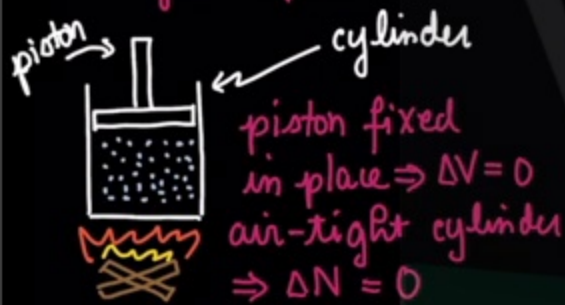
$$\begin{aligned} \text{Mass} = M &= (\text{density})(\text{volume}) \\ &= (1 \text{ g/l}) \end{aligned}$$

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Mathematically modeling gases

are the state variables P, V, n, T related?

Thought experiment ①



$\Rightarrow \Delta E_{th}$

Increased temperature

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