Lecture 2 : Some motivation

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 Va

Macroscopic State Variables

Temperature (T): How hot is the substance?

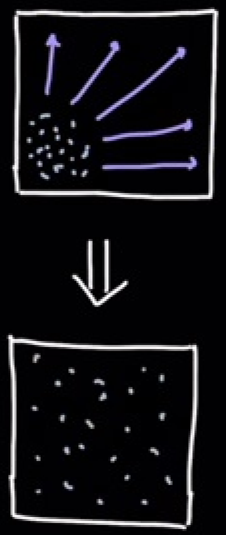
Volume (V): How much space does it take up?

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

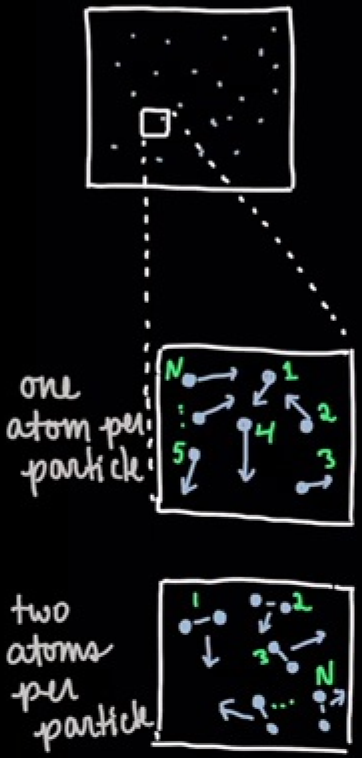
Particle number (N): How many particles?

Number of mo

Defining volume (V)



Measuring amounts of a substance



N = number of particles (atoms or molecules)

usually a huge #.

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

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

Example: Bottle of water.

1L of water

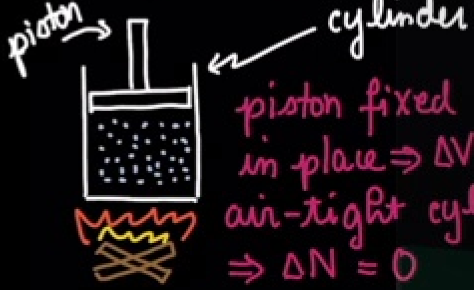
$$\text{Mass} = M = (\text{density})(\text{volume})$$

$$= (1g/$$

Mathematically modeling gases

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

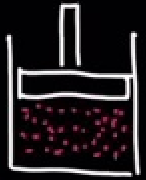
Thought experiment ①



piston fixed in place ⇒ $\Delta V = 0$

air-tight cylinder ⇒ $\Delta N = 0$

⇓



⇒ ΔE_{th}

Increased temperature