Lecture 1

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February 27, 2023

AN: hoepfully this goes better than the first half of the course.

1 Thermal Physics

These are systems with many particles, to the order of 10^{23}. Hence, we approximate that as infinitely many particles. We want to learn the "universal behaviour" which obey laws independent of microscopic detail. For example, the **Boltzmann Distribution** in 3 dimensions is

$$v^2 dv e^{-kv^2} dv$$

We have thermodynamics and statistical mechanics, where the latter is a microscopic "derivation" of the former.

Consider 5cm^3 of olive oil which can be spread over at most 2000m^2. This gives the size of molecules, which is $2.5 \times 10^{-9}\text{m}$. The number of molecules is to the order of 10^{21}.

To fully describe a system of N particles, we need the initial positions and velocities of each particle, which is $6N$ variables. This is hopeless to compute and useless to interpret.
A thermodynamic equilibrium is reached when

1. Uniformity throughout V
2. Pressure and Temperature will have constant values
3. There are no macroscopic fluxes

2 Ideal Classical Gas

These gases are formed by many classical point like particles that follow the ideal gas law in general.

$$pV = NkT$$