Physics

Giacomo

March 22, 2025

Early Kinematics

SDR and Galilean relativity

Late Kinematics

Special Relativity

Thermodynamics

"It's no use going back to yesterday, because I was a different person then."
— Alice, Alice in Wonderland

The zeroth law of thermodynamics

Macrostates and Microstates

A Macrostate is a macroscopic description of a system using the 4 main thermodynamic variables pressure (p), temperature (T), volume (V), and number of particles (N). These variables are averages e.g the pressure of a gas is the average force per unit area exerted by particles, temperature reflects the average kinetic energy of particles. A Microstate is a complete, detailed description of every particle in the system, including their positions and momenta. MICROSTATES WILL NOT BE COVERED.

The zeroth law

"If A, B and C are different thermodynamical systems and A is in thermodynamical equilibrium with B, and B is in thermodynamical

equilibrium with, then A is in the themodynamical equilibrium with C"

The first law

"The internal energy of an isolated system is conserved under any thermodynamical change"

The second law
Under any thermodynamical change:

$$\Delta U = Q + W$$

And in differential form using inexact derivatives

$$dU = đQ + đW$$

-This will be explained further on.

Work

Work is energy being transferred between one system. Due to this it cannot be tied to a thermodynamical process, and therefore is a function of path. A system doesn't store work, therefore it cant be measured in the exact differential equation at the start or end of a reaction. This is why it is represented in a inexact differential written as đX, which allows us to show work transforming over time.

Work can be defined as:

$$dW = \vec{F} \times \vec{dh} \tag{1}$$

For the first law of thermodynamics, W $>$ 0 if work is done on the system, such as compression and W $<$ 0 work done by the system, usually expansion.

Heat

Internal Energy

PRESSURE QUESTION:::::: NOT FINISHED
if force and displacement are in the same direction

$$dW = Fdh$$

Force in terms of pressure is determined by:

$$F = p_{surr} \times A$$

Where A is the relevant surface area
To represent the change in volume

$$dV = A \times dh \Longrightarrow dh = \frac{dV}{A}$$

Now when we substitute F and dh into