1 Fundamentals of equilibrium thermodynamics

Definition 1.1. We define a *thermodynamical system* $\mathcal{S}$as a system of particles where $n \gg 1$.

Axiom 1. *Every system evolves to an equilibrium state.*

Definition 1.2. Let $\mathcal{S}$be a thermodynamical system and x a state variable of $\mathcal{S}$. We say

1. x is *extensive* if and only if it varies when dividing $\mathcal{S}$in partitions,
2. x is *intensive* if and only if it does not varies when dividing $\mathcal{S}$in partitions, and
3. x is *specific* if and only if it is the result from dividing an extensive variable by the number of particles of $\mathcal{S}$.

Definition 1.3. We define a *system* $\mathcal{S}$as the region we are studying.

Definition 1.4. We define the environment as the region different from $\mathcal{S}$that interacts with $\mathcal{S}$.

Definition 1.5. Let $\mathcal{S}$be a system. We define the universe as the system formed by the system and its environment.

Definition 1.6. Let $\mathcal{S}$be a system. We say

1. $\mathcal{S}$is *closed* if and only if

Proposition 1.1. *Let $\mathcal{S}$be a system. If $\mathcal{S}$is isolated, the it coincides with the universe.*

Definition 1.7. Let $\mathcal{S}_1, \ldots, \mathcal{S}_r$ be r thermodynamical systems tha interact between them. Then, we call the union of $\mathcal{S}_1, \ldots, \mathcal{S}_r$ as a *system* $\mathcal{S}$and every $\mathcal{S}_i$ a *subsystem of* $\mathcal{S}$.