Thermodynamic Laws

**0th**: **“If two systems are in thermal equilibrium with a third system, they are in thermal equilibrium with each other”** Introduces the thermodynamic intensive variable of temperature (*T*)

**1st**: **“When energy passes, as work, as heat, or with matter, into or out from a system, the system's internal energy changes in accord with the law of conservation of energy”** Conservation and conversion of energy: Defines extensive thermodynamic state variable of internal energy (*U*)

**2nd**: **“In a natural thermodynamic process, the sum of the entropies of the interacting thermodynamic systems increases”** Defines the extensive thermodynamic state variable of entropy (*S*)

**3rd**: **“The entropy of a system approaches a constant value as the temperature approaches absolute zero”** For systems in internal equilibrium, sets the zero of entropy at minimum in temperature (0K) and at the minimum in internal energy.

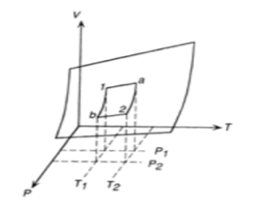
Mathematical Transforms

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State Functions



Processes: Constraints

Heat Capacity (*C*) - ratio of thermal energy added to or withdrawn from a system (of fixed composition) to the resultant change in the temperature of the system