BE-381/BE-382 Thermodynamic Definitions (v. 1.1)
(see textbook sections 2-1 – 2-5)

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System: quantity of matter or region in space chosen for a study.
Surroundings: mass or region outside the system.
Boundary: the real or imaginary surface separating the system from the surroundings.
Universe: the sum of the system and its surroundings.

Closed System:

- A fixed amount of mass, none of which may cross the system boundary.
- Its volume can change.
- Energy may enter or leave it.
- Isolated System: a closed system in which energy may not cross the boundary.

Open System:

- Generally defined by a fixed space (called the *control volume*).
- Both mass and energy may cross the boundaries.
- Boundaries may be real or imaginary.
- Boundaries may move.

Property: Any measurable characteristic of a system.

Intensive Property: Any property that is independent of the mass of a system.

- Usually denoted using lowercase symbols.
- Examples: temperature (T), pressure (P), density (ρ), specific volume (v), specific enthalpy (h).

Extensive Property: Any property whose value depends on the mass of a system.

- Usually denoted using uppercase symbols.
- Examples: mass (m), volume (V), total enthalpy (H)
- S*pecific* properties are intensive, corresponding to extensive properties divided by mass.

To determine if a property is intensive or extensive:

1. Divide the system in half
2. Properties whose values are the same as the original system are intensive
3. Properties whose values have halved in each half are extensive

Continuum: Treatment of a system in which we assume that properties are definable at every point and continuous functions; disregarding things going on at the molecular scale.

Density: Mass per unit volume.

Specific volume: Volume per unit mass (more commonly used in thermodynamics than density).

Specific gravity: The ratio of density of a substance to density of water (usually) at the same temperature.

State: The condition of a system, as fully described by a set of properties.

Equilibrium: A state in which there are no unbalanced driving "forces" within a system.

- **Thermal equilibrium**: No temperature differences.
- **Mechanical equilibrium:** No unbalanced pressures (doesn't have to be uniform).
- **Phase equilibrium**: No tendency for mass of each phase to change.
- **Chemical equilibrium**: No tendency for chemical reactions to occur.
- **Thermodynamic equilibrium**: Combination of all relevant equilibriums.

State Postulate: The state of a simple single component, compressible system is completely specified by any two independent, intensive properties.

- "simple compressible system" implies lack external force fields.
- "independent properties" are those that can be varied while the others remains constant.

Process: A change that a system undergoes from one equilibrium state to another.
Path: The series of states through which a system goes during a process.
Quasi-static process: A process that proceeds sufficiently slowly such that the system is approximately at equilibrium throughout.
Process diagram: Graphical relationship between two or more thermodynamic properties during a process, such as T, P, or V (see Fig. 2-15).
Isothermal process: A process in which temperature is constant.
Isobaric process: A process in which pressure is constant.
Cycle: A process with identical final and initial states.
Steady: No changes with time.
Uniform: No changes with location.
Steady-flow process: A process during which a fluid flows through a control volume steadily.