Boundaries can be real or imaginary. In case of real boundaries, they can be

- rigid /movable: rigid boundary means work done is zero
- permeable / impermeable: matter can exchange through impermeable boundary
- diathermic/adiabatic: thermal exchange is possible through diathermic boundary

Thermodynamic Equilibrium: Thermodynamics equilibrium occurs if and only if:

- the macroscopic properties of the system don't change with time
- the properties don't change if system is moved from the surroundings.

The second statement is necessary for non-isolated systems.

Internal Energy:

Internal energy is the energy molecules store inside them. This is the sum of energy due to molecular motion and molecular interaction.

Work:

Work is the form of energy which is measurable and observable. By convention, work is considered as positive if work is done on the system by the surroundings and is negative if work is done by the system.

Heat:

Heat is considered as positive if heat is added to the system as the system gains energy and considered as negative if heat is released from the system.

First law of thermodynamics:

The energy of an isolated system is constant. This law is basically conservation of energy. It relates the state variable with path variables. Mathematically, $\Delta U = q + w$

Reversible Process:

A process or change is said to be reversible, if a change is brought out in such a way that the process could, at any moment, be reversed by an infinitesimal change. In reality, no such process exist which is truly reversible in nature.

Types of processes:

1. isobaric process: constant pressure process
2. isochoric process: volume is constant
3. isothermal process: constant temperature process
4. adiabatic process: no heat transfer

Enthalpy:

Enthalpy is another state variable. For isochoric process, W=0. Hence, $\Delta U = q_v$

For isobaric process, $\Delta U = q_p + w$;

$q_p = \Delta U + P\Delta V = \Delta(U + PV) = \Delta H$ where ΔH is the change in enthalpy, it is mathematically equal to the value of heat absorbed at constant pressure.