



Department of Air Conditioning and
Refrigeration Engineering Technology



Class: 2nd

Subject: Thermodynamics

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Fundamental Concept and Definitions

تعريف ومفاهيم اساسية

1- What is Thermodynamics?

is the science that studies the conversion of energy from one form to another.

Its name came from Greek words

thermo (**heat**: warm or hot) which is related to temperature and dynamics (**power**) applied to motion.

i.e. the term of thermodynamics is descriptive of the early efforts to convert heat into power (**'heat motion'**).



2-Thermodynamic System

Collection of matter within prescribed and identifiable boundaries.

A system may be either an **open**, or a **closed**,

3-Surroundings

Everything fall outside of the system called surroundings, which may be have direct behavior on the system because exchanges energy with it, thus may be affected by changes within the system. The surroundings themselves may form another system.

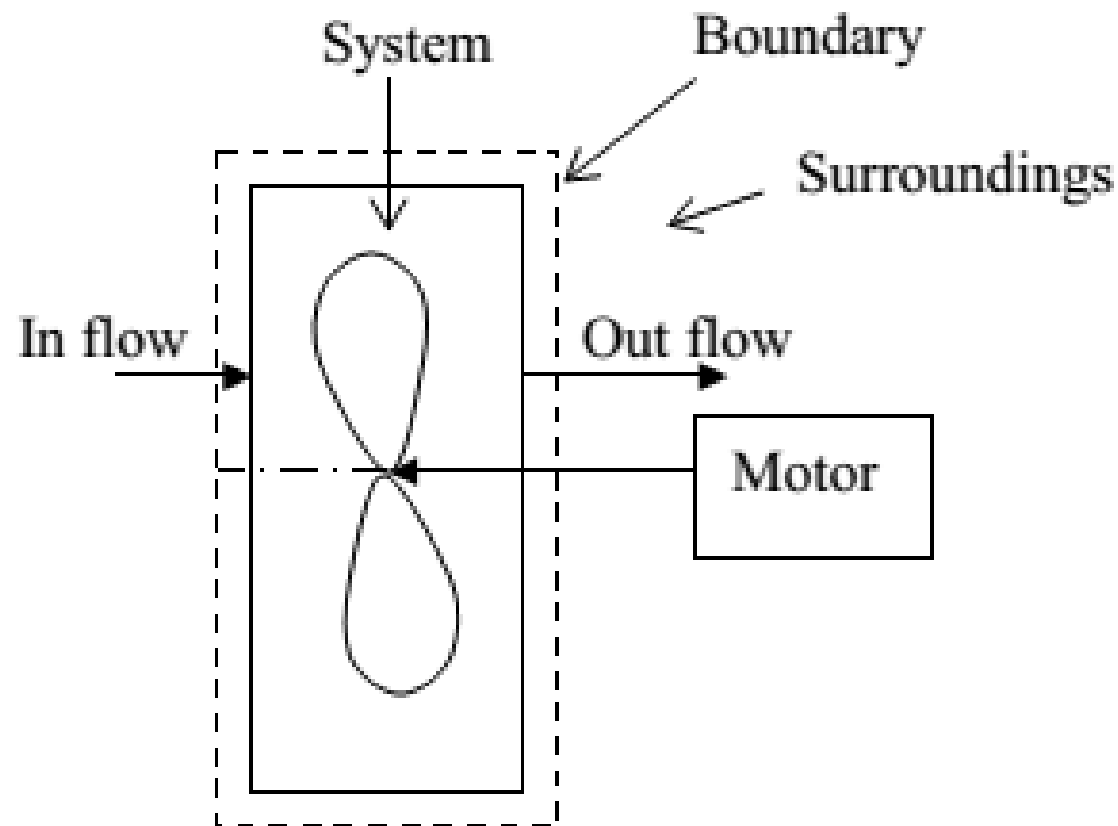
كل مايقع خارج حدود النظام يعرف بالمحيط والذي له تأثير مباشر في سلوك النظام لانه يتبادل الطاقة معه وبالتالي قد يتأثر بالتغيرات الحاصلة داخل النظام. وربما قد يشكل المحيطه نفسه نظاما

اخر



4- Boundary

A physical real surface such as cylinder walls and piston or imaginary surface such as smoke in the air, or compression or expansion amount of gas.



5- Independent and Dependent properties

Temperature (T), Pressure (P), Volume (V)

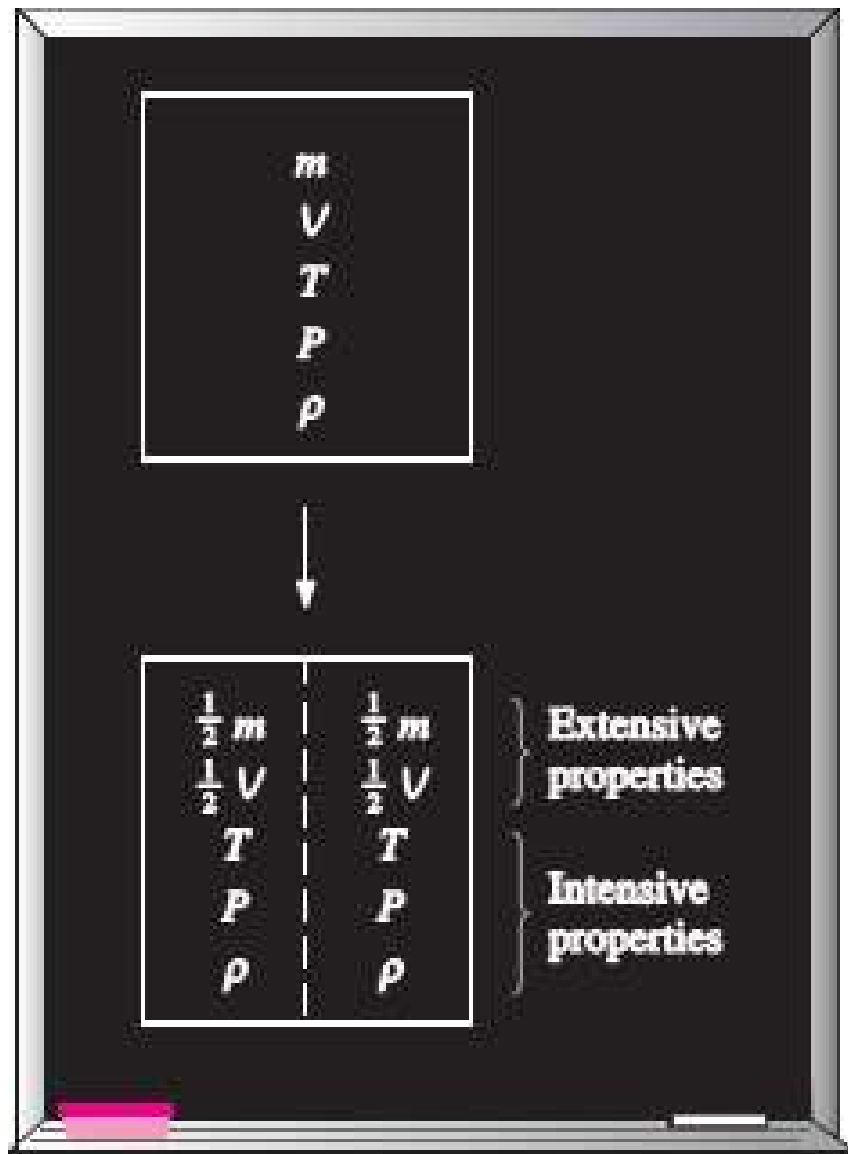
Internal energy (U), Enthalpy (H), Entropy (S)

7- Intensive and Extensive Properties

Intensive properties are those that are independent of the mass of a system, such as temperature, pressure, and density.

Extensive properties are those whose values depend on the size or extent of the system. Examples of extensive properties include (volume, internal energy, enthalpy and entropy).





- اذا اخذنا نظام في حالة اتزان وقسمناه الى قسمين متساويين في الكتلة
- فان بعض الصفات تبقى ثابتة لكل نصف من هذا النظام كالضغط ودرجة الحرارة والكثافة فان هذه الخواص تدعى بالضمنية او المؤكده وهي لاتعتمد على كتلة النظام .
- اما الخواص التي تتنصف كالحجم والطول والمساحة والوزن والطاقة الداخلية فانها تدعى خواص غير ضمنية او غير مؤكدة وهي تعتمد على كتلة النظام



8- Internal energy (U)

is a property consisting of the combined molecular kinetic and potential energies. This property is derived from the first law of thermodynamics.

9- Enthalpy (H)

is a thermodynamic quantity equivalent to the total heat content of a system. It is equal to the internal energy of the system plus the product of pressure and volume $h = u + pv$.

10- Entropy (S)

The microscopic disorder of the system. It is an extensive equilibrium property.



Types of System

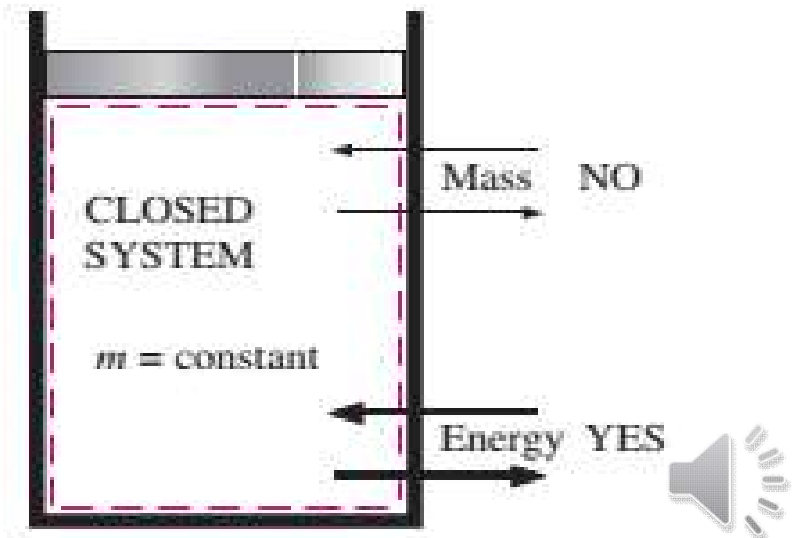
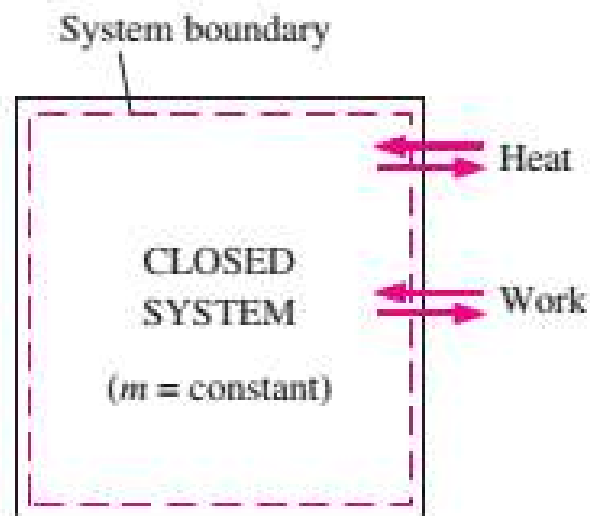
11- Isolated System

Even energy is not allowed to cross the boundary,

12- Closed System (control mass)

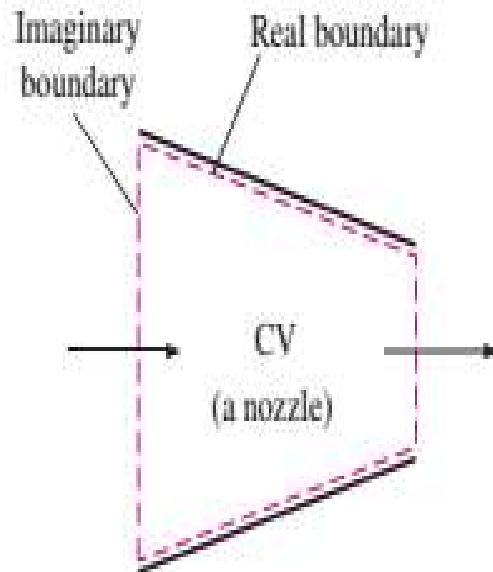
Mass transfer does not take place across the boundary.

But energy can be transfer through the system (heat or work)

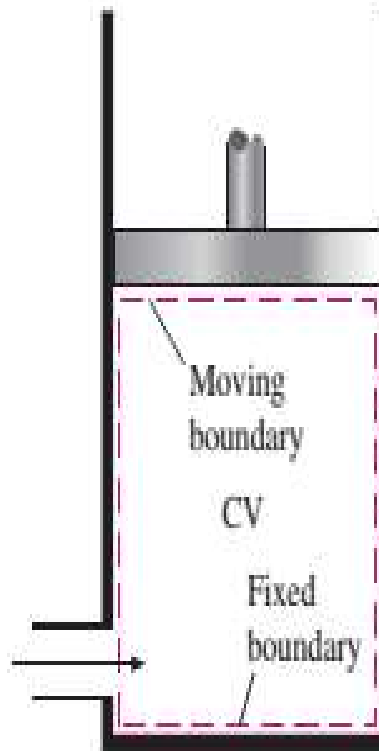


13- Open System (control volume)

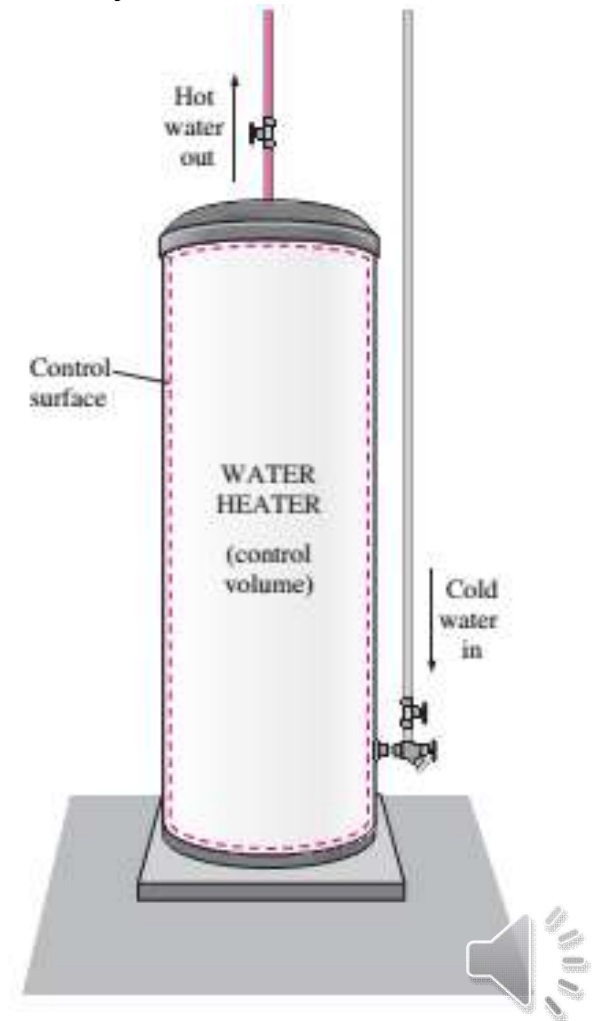
Mass heat and work are transfers across the boundary.

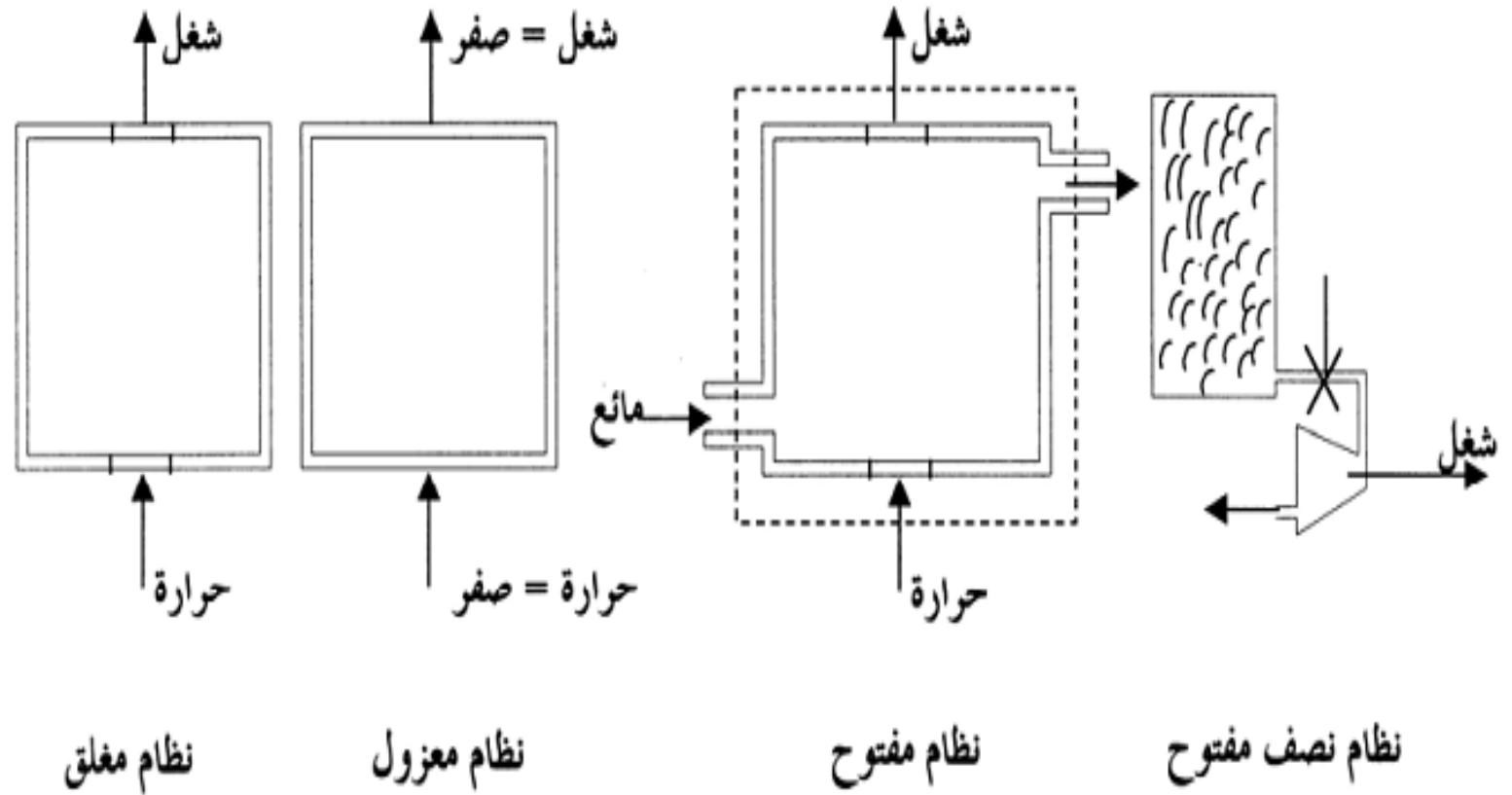


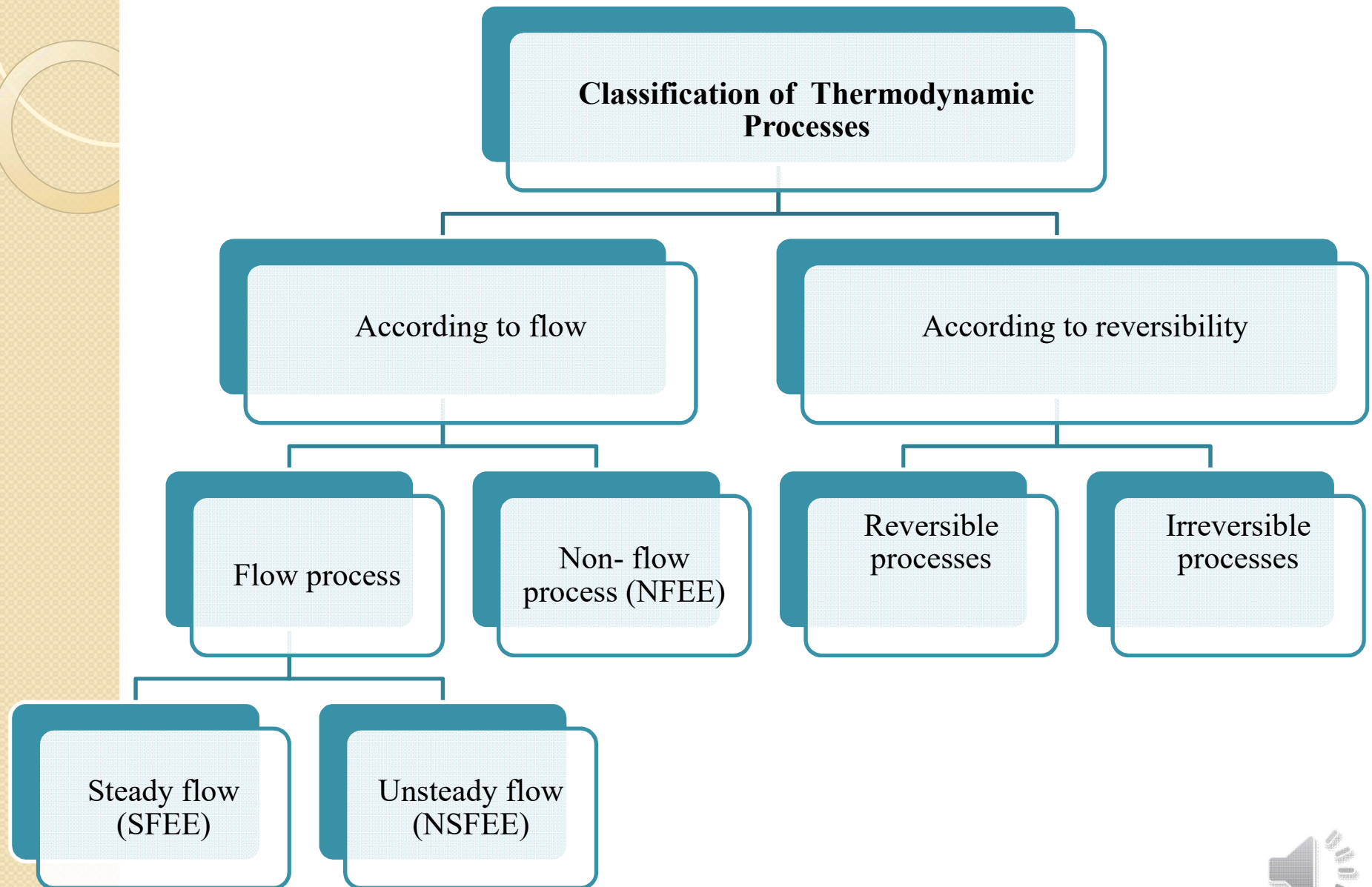
(a) A control volume with real and imaginary boundaries



(b) A control volume with fixed and moving boundaries







- **Reversibility:** When a fluid undergoes a reversible process, both the fluid and its surroundings can always be restored to their original state.
- **Irreversibility** (also called the exergy destruction or lost work),

