Al-Mustaqbal University
College of Science
Department of Medical Physics

جامعة المستقبل
AL MUSTAQBAL UNIVERSITY

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Lecture (2)

Thermodynamic Process

Second stage

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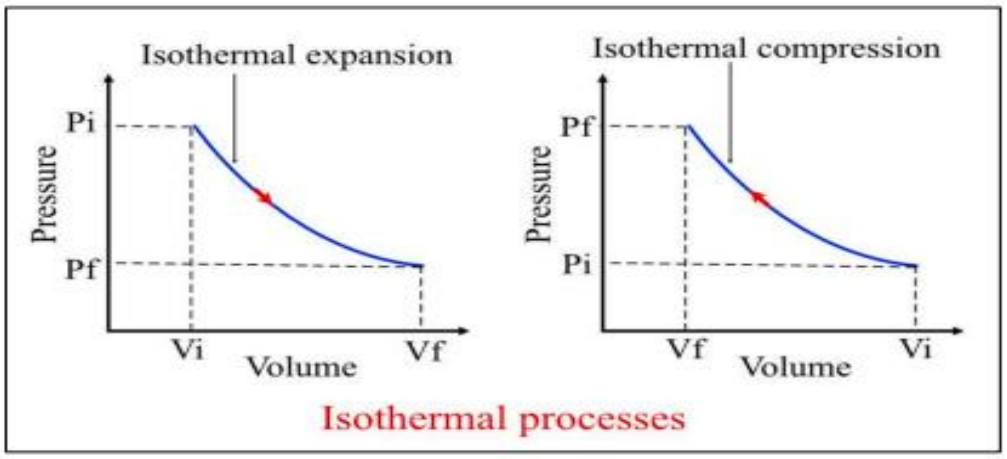
Thermodynamic processes:

It is the process of moving a system from one state of equilibrium (Vi , Pi , Ti) to another state of equilibrium (Vf , Pf , Tf) over a period of time .That means the change in the thermodynamic properties of the system. when any of the properties of the system variables change then the system state also changes. Example: If the pressure exerted on a confined invading entity increased, then it would This is accompanied by a change in other properties such as volume, density, and temperature ... and when it stabilizes ,These properties bring the system to a new equilibrium state. It can be during the thermodynamic process Install one or more system properties and let the rest of the properties change to take new values, For example, there are processes during which the size of the system remains constant and others are under pressure , constant temperature and so on , these process summarized in the following:

1-Isothermal Process: It is the process that occurs to an entity without changing its temperature or is a process where temperature remains constant.

T1=T2 and ΔT=T2-T1=0

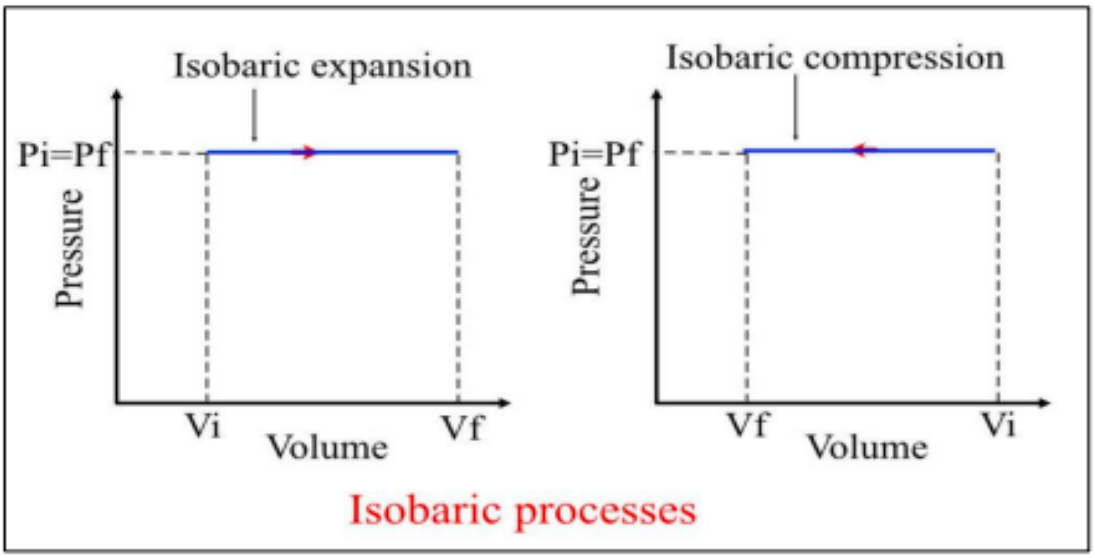
In such processes, the system envelope must be a good conductor of heat so allows heat to enter or exit the system when the temperature of the system decreases or increases during the process. The advantage of these processes is that they occur slowly. The direction of the arrows indicates whether the process is expansion or compression. In the process you want to throw, the direction of the arrow down means expansion, since the volume increases, while the direction of the arrow up means compression, since the volume decreases, as show in figure below.



2-**Isobaric Process**: It is a process that occurs under constant pressure where:

P1=P2 and ΔP=P2-P1=0

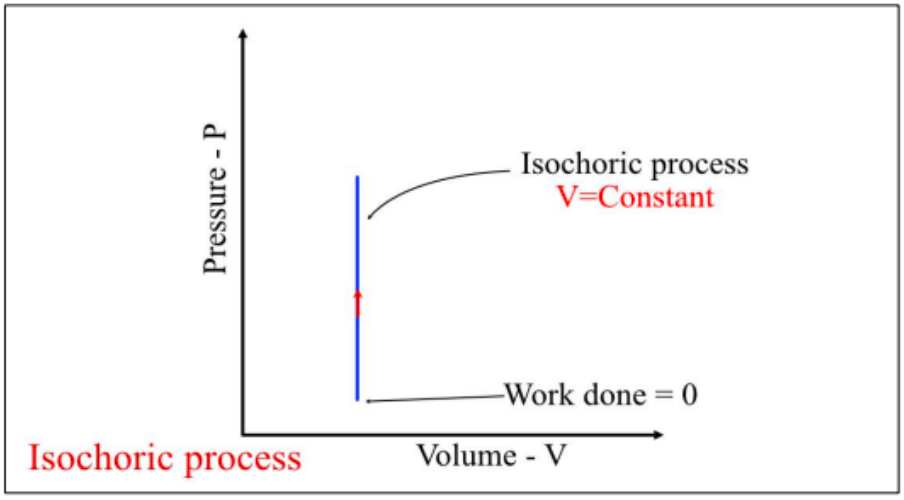
When the arrow is pointing to the right, it means expansion, as the volume is increasing. If the arrow is pointing to the left, it means compression, as the volume is decreasing ,as show if figure below



3-**Isochoric Process**: It is a process that occurs under constant volume where:

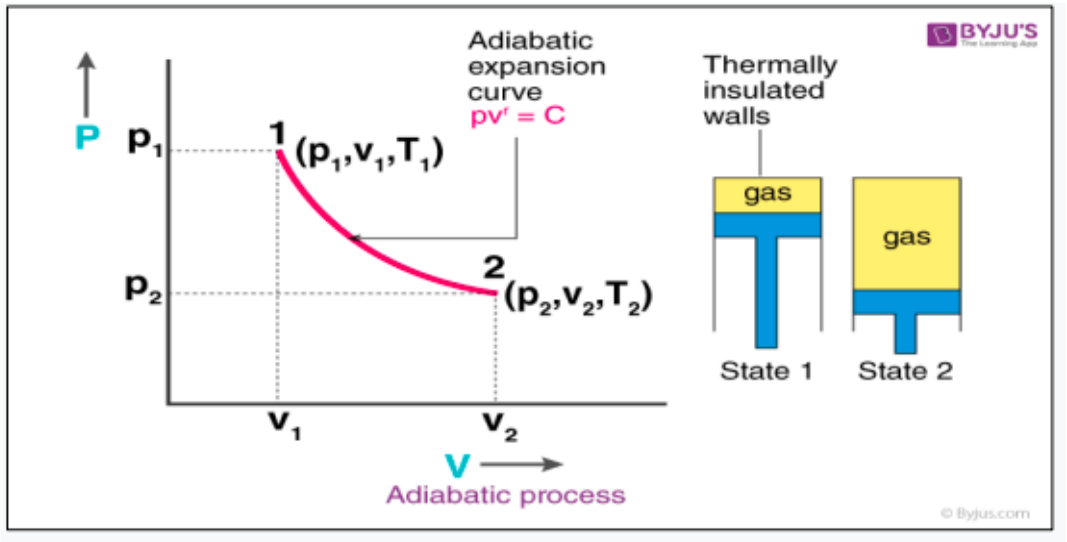
V1=V2 and ΔV=V2-V1=0

When the arrow is pointing to the right, it means expansion, as the volume is increasing. If the arrow is pointing to the left, it means compression, as the volume is decreasing ,as show if figure below.



4-**Adiabatic Process:** It is the process that occurs when pressure, volume and temperature change with a constant amount of heat. dQ=0 It takes place in an isolated system, meaning that there is no heat transfer to and from the system, or the process occurs so quickly that the system does not have enough time for heat to escape from it and to it, such as the sudden

explosion of tires and the compression and rarefaction that accompany sound waves when they pass through the air.



5-Cyclic Process: It is the process by which the system goes through a number of processes and then returns to its initial state .This system is said to have gone through a complete Cycle. And in periodic processes it absorbs .The system usually has heat in each cycle and performs work on the ocean, and in the case of cycles Large The resulting workload was large and could be employed and utilized as well as machinery Steam, internal combustion machines .

6- A reversible process :is a process in which the thermodynamic coordinates are homogeneous when the process is performed. It is a process in which after its completion, the system can be returned to the same conditions as when the process was performed without any effect on the environment, or it is a process that occurs in the opposite direction, taking the same path without changing the external influences. Here, we have listed a few examples of Reversible Processes:

• extension of springs.

• slow adiabatic compression or expansion of gases.

• electrolysis (with no resistance in the electrolyte).

• the frictionless motion of solids.

• slow isothermal compression or expansion of gases.

7-Irreversible Process :

It is the process in which the events are inhomogeneous when the process is performed and is a one-way process that cannot be reversed without leaving permanent changes ocean. All natural processes that occur on their own are reversible processes, such as the heat that is transferred from a hot body to a cold body, and the wind that is it blows from the high pressure area to the low pressure area and the objects fall from top to bottom.

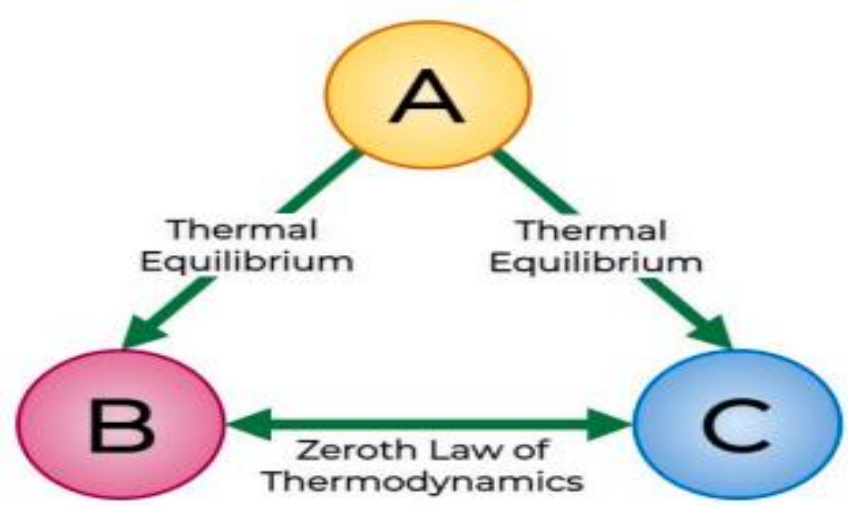
This process is characterized by

1-irreversibility.

2- passes from initial to final state in one step, that is, it is done very quickly.

The Zero Law of Thermodynamic

This law states that (if two A and B are isolated adiabatic systems and each is in thermal equilibrium with a third system C, this is due to that two systems in thermal equilibrium with each other as shown in Figure below, This is a basic law of thermal equilibrium.



Applications of the Zeroth Law of Thermodynamics

The zeroth law of thermodynamics is seen in many everyday situations.

• The thermometer may be the most well-known example of the zeroth law in action. For example, say the thermostat in your bedroom reads 67 degrees Fahrenheit. This means that the thermostat is in thermal equilibrium with your bedroom. However, because of the zeroth law of the thermodynamics, you can assume that both the room and other objects in the room (say, a clock hanging in the wall) are also at 67 degrees Fahrenheit.

• Similar to the above example, if you take a glass of ice water and a glass of hot water and place them on the kitchen countertop for a few hours, they will eventually reach thermal equilibrium with the room, with all 3 reaching the same temperature.

• If you place a package of meat in your freezer and leave it overnight, you assume that the meat has reached the same temperature as the freezer and the other items in the freezer.

1. What does an isothermal process involve? A- Change in temperature B- Constant pressure C- Constant volume D- No heat exchange E- Constant temperature

2. In which process does the volume remain constant? A- Isothermal process. B- Adiabatic process. C- Isochoric process. D- Cyclic process. E- Reversible process.

3. Which thermodynamic process occurs with no heat transfer? A- Isothermal process. B- Adiabatic process. C- Cyclic process. D- Isobaric process. E- Irreversible process

4. What is characteristic of an irreversible process? A- It can be reversed without leaving any permanent changes. B-It occurs slowly and is in equilibrium at every stage. C- It passes from the initial to final state in one step. D- It is done under constant temperature. E- It involves heat exchange with the surroundings.