FIRST LAW OF THERMODYNAMICS

PIAT

FIRST LAW OF THERMODYNAMICS

- Need to relate HEAT (Q), WORK (W) and Total Energy (E) each other during the thermodynamic process

- Need to study the relationship among the various forms of energy and energy interactions

- First Law states energy can be neither created nor destroyed during a process, it can only change forms

- It is also known as the conservation of energy principle

- First Law emerged in 1850 out of the works of William Rankine, Rudolph Clausius & Lord Kelven and invented by Julius Robert Mayer

- It implies every bit of energy should be accounted for during the process

FIRST LAW OF THERMODYNAMICS

- Total Energy of universe remains constant
- e. g. light bulbs transform electrical energy into light energy, and gas stoves transform chemical energy from natural gas into heat energy.
- The net heat energy supplied to the system is equal to sum of change in internal energy of the system and work done by the system.
- Consequence of the first law is the existence & definition of the property Total Energy E

FIRST LAW OF THERMODYNAMICS

- **Energy Balance**

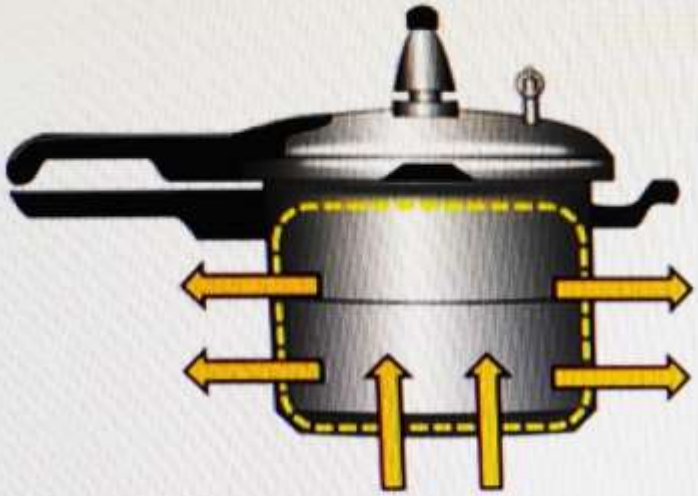
- **The net change (increase or decrease) in the total energy of the system during a process is equal to the difference between the total energy entering and the total energy leaving the system during the process**

- **(Total Energy entering the system) – (Total energy leaving the system) = (Change in the total energy of the system)**

- **$E_{in} - E_{out} = \Delta E_{sys}$**

- **It is applicable to any kind of system undergoing any kind of process**

FIRST LAW OF THERMODYNAMICS



$E_{in} = 7000\ J$

Que: By what amount the system energy is increased?

Ans: (7000-2000) = 5000 J

$E_{out} = 2000\ J$

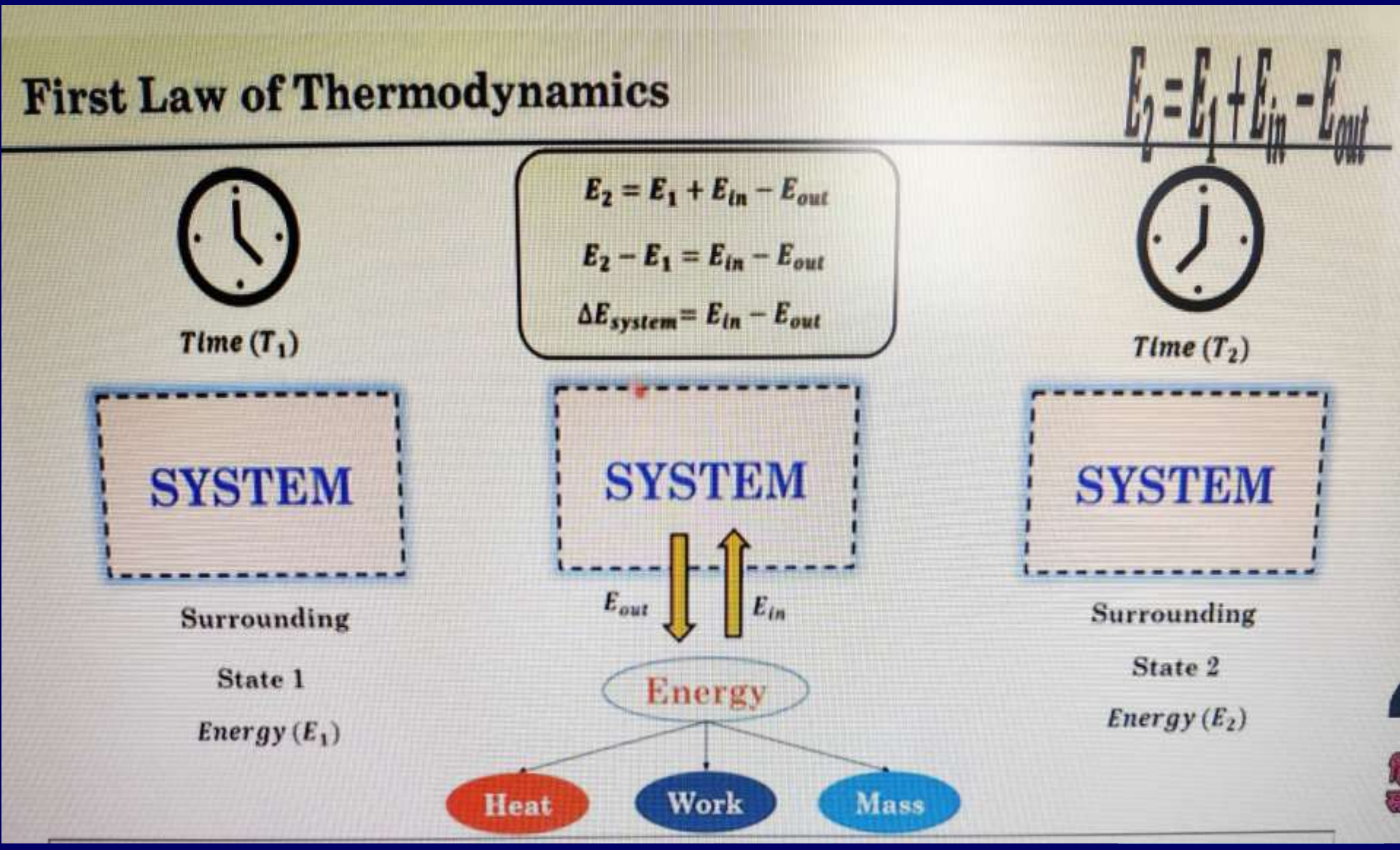
10 minutes

Conservation of Energy → First Law of Thermodynamics

"Energy can be neither created nor destroyed during a process; it can only Change forms."

PIAT

FIRST LAW OF THERMODYNAMICS



FIRST LAW OF THERMODYNAMICS

$$\Delta E_{system} = E_{in} - E_{out}$$

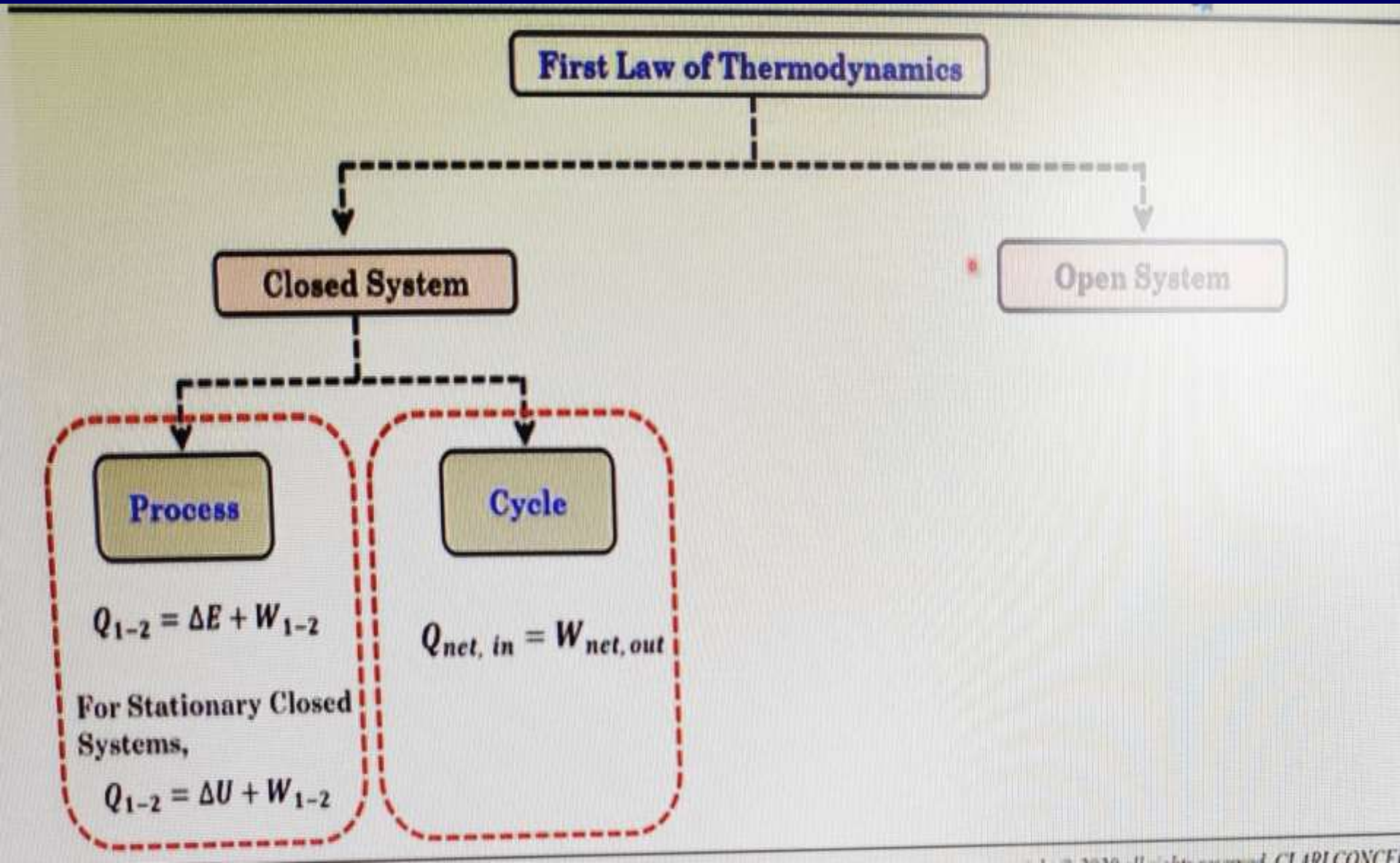
⟹ Generalized Mathematical Form for First Law of Thermodynamics

Change in Total Energy of the System(ΔE) = Total Energy Entering the System (E_{in}) − Total Energy Leaving the System (E_{out})

" The net change in the total energy of the system during a process is equal to the difference between the total energy entering and the total energy leaving the system during that process."

This is applicable to any kind of system and also applicable to any kind of Process.

FIRST LAW OF THERMODYNAMICS



JAI HIND

PIAT