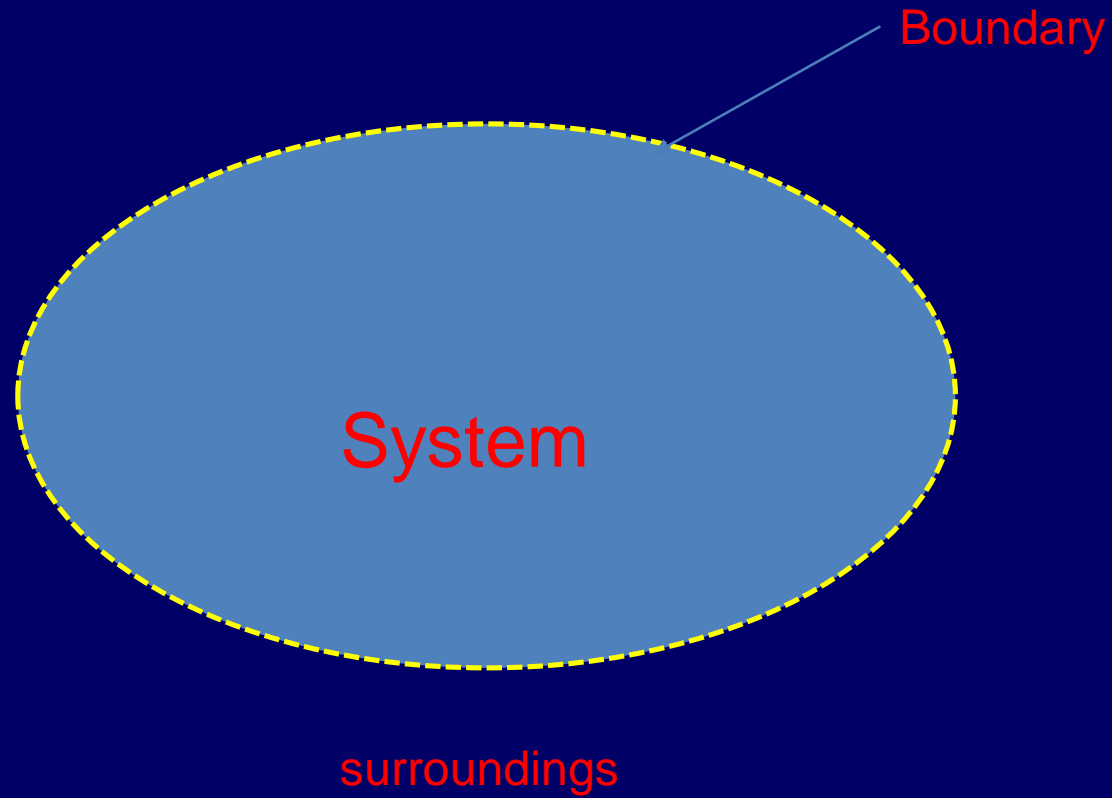


# THERMODYNAMIC SYSTEM

# System



# Thermodynamic System

- It is defined as a quantity of matter or a region in space upon which attention is concentrated in the analysis of a problem
- Everything external to the system is surroundings or the environment
- The real or imaginary surface that separates the system from its surroundings is called the Boundary
  - Boundary can be fixed or movable
  - Boundary is Shared by both the system & surroundings
  - Boundary has zero thickness
  - It can neither contain any mass nor occupy any volume in space

# Classes of Systems

- Closed System (Control Mass or Just A System)
  - It is a system of fixed mass
  - No mass transfer across system boundary
  - There may be energy transfer into or out of system
  - Volume of fixed system does not have to be fixed
  - e. g. Cylinder bounded by piston

# Special Case of Closed System

- Isolated System

- It is a Special case of Closed System

- It is a system in which there is no interaction or communication between the system and the surroundings

- It is of Fixed mass and Energy

- There is no mass or energy transfer into or out of system

- e.g. Universe can be considered as an isolated system, Thermos Flask and Ice Box

# Classes of System

- Open System (Control Volume)
  - It is a properly selected region in space
  - It usually encloses a device which involves mass flow
  - Flow through these devices studied by selecting a region in the device as control volume
  - e. g. A Water Heater, Car Radiator, a turbine and compressor

# Open System

- Open System (Control Volume)
  - System has selected region (Fixed Volume) called control volume
  - Boundary of an open system is fixed
  - It is one in which matter crosses the boundary of the system
  - There may be energy transfer (Heat & work) into or out of system of a control volume
  - Boundaries of a control volume are called control surface (real or Imaginary)

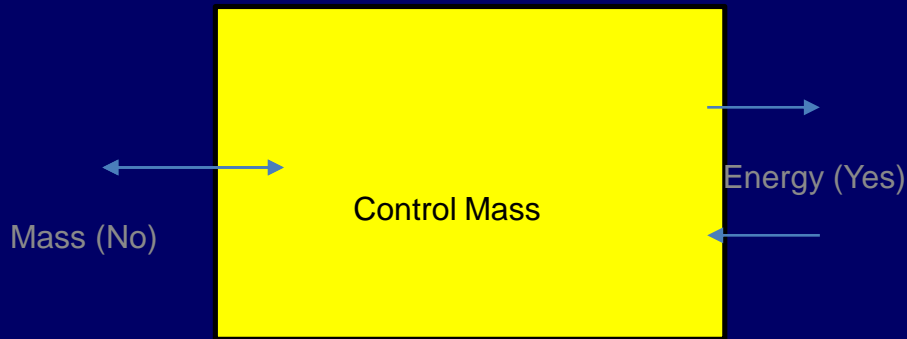
# Special Case of Open System

## An Adiabatic System

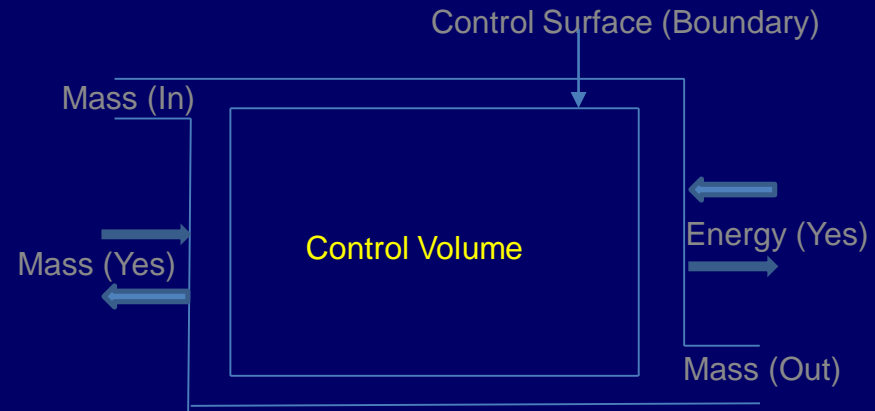
- It is a Special case of Open System
- It is a system in which mass can cross the control surfaces, but energy in the form of heat is not allow to cross the control surfaces
- However, energy in other forms can enter and leave the system
- e.g. Insulated Turbines, Throttle Valves, Water Pumps, Water Turbines, Insulated Heat Exchangers



# SYSTEMS



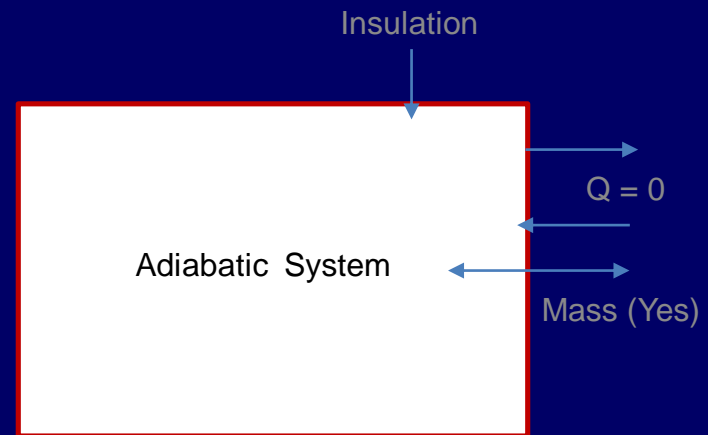
Closed System



Open System



Isolated System



Adiabatic System

# Classes of System

- Homogeneous System

- A System is called a Homogeneous System, if it consists of a single physical phase, either solid, liquid or gas phase only
- It is treated as one constituents for its analysis
- Analysis becomes simple
- e. g. Ice, Water & Steam (Three Distinct Phases), Sugar or Salt dissolved in water, air, oxygen and Nitrogen Gas

# Classes of System

- Hetrogeneous System

- When a system is a mixture of two or more than two phases of matter, it is called a Heterogeneous System

- System can not be analyses as a single constituents

- Analysis becomes slightly complex

- e. g. Mixture of Ice & Water, Mixture of Water & Steam, Dal, Rice & Water in a pressure Cooker etc.

**JAI HIND**