

Thermodynamics

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TOPICS COVERED

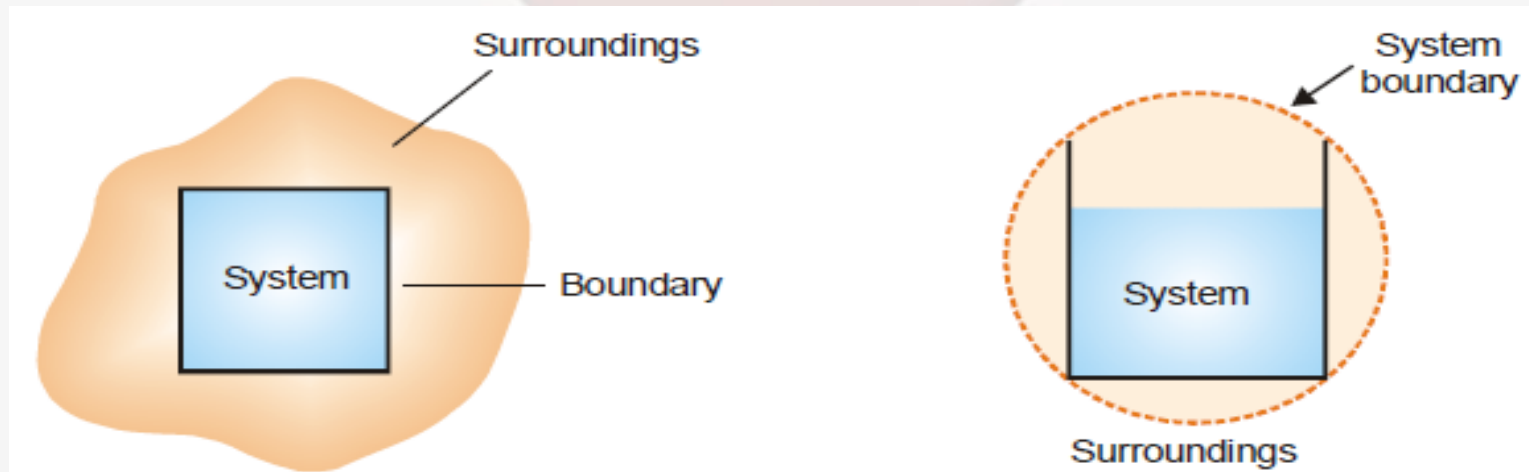
- Definition of Thermodynamics
- Basic Terminologies of Thermodynamics
 - System
 - Surroundings
 - Boundary
 - Homogenous and Heterogenous System
- Types of Thermodynamic System
- Open, Closed and Isolated System

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THERMODYNAMICS

- It is a branch of science that deals with the conversion or transformation of heat energy into other form of energy such as chemical, electrical, light energy etc.

SYSTEM, BOUNDARY, SURROUNDINGS



- **SYSTEM:** A system is that part of the universe in which thermodynamic changes has been studied.
- **SURROUNDINGS:** A surrounding is the part of the universe except system.
- **BOUNDARY:** The real or imaginary surface separating the system from the surroundings is called the boundary.

HOMOGENEOUS SYSTEMS

- ◆ When a system is uniform throughout, it is called a **Homogeneous** System. Examples: a pure single solid, liquid or gas, mixtures of gases, and true solution of a solid in a liquid.
- ◆ A homogeneous system is made of one phase only.
- ◆ A phase is defined as a homogeneous, physically distinct and mechanically separable portion of a system.

HETEROGENEOUS SYSTEMS

◆ A **heterogeneous** system is one which consists of two or more phases. In other words it is not uniform throughout. Examples: ice in contact with water, ice in contact with vapour etc. Here ice, water and vapour constitute separate phases.

TYPES OF THERMODYNAMIC SYSTEMS

There are three types of thermodynamic systems depending on the nature of the boundary. If the boundary is closed or sealed, *no matter can pass through it. If the boundary is insulated, no energy (say heat) can pass through it.*

◆ Isolated system

◆ Closed System

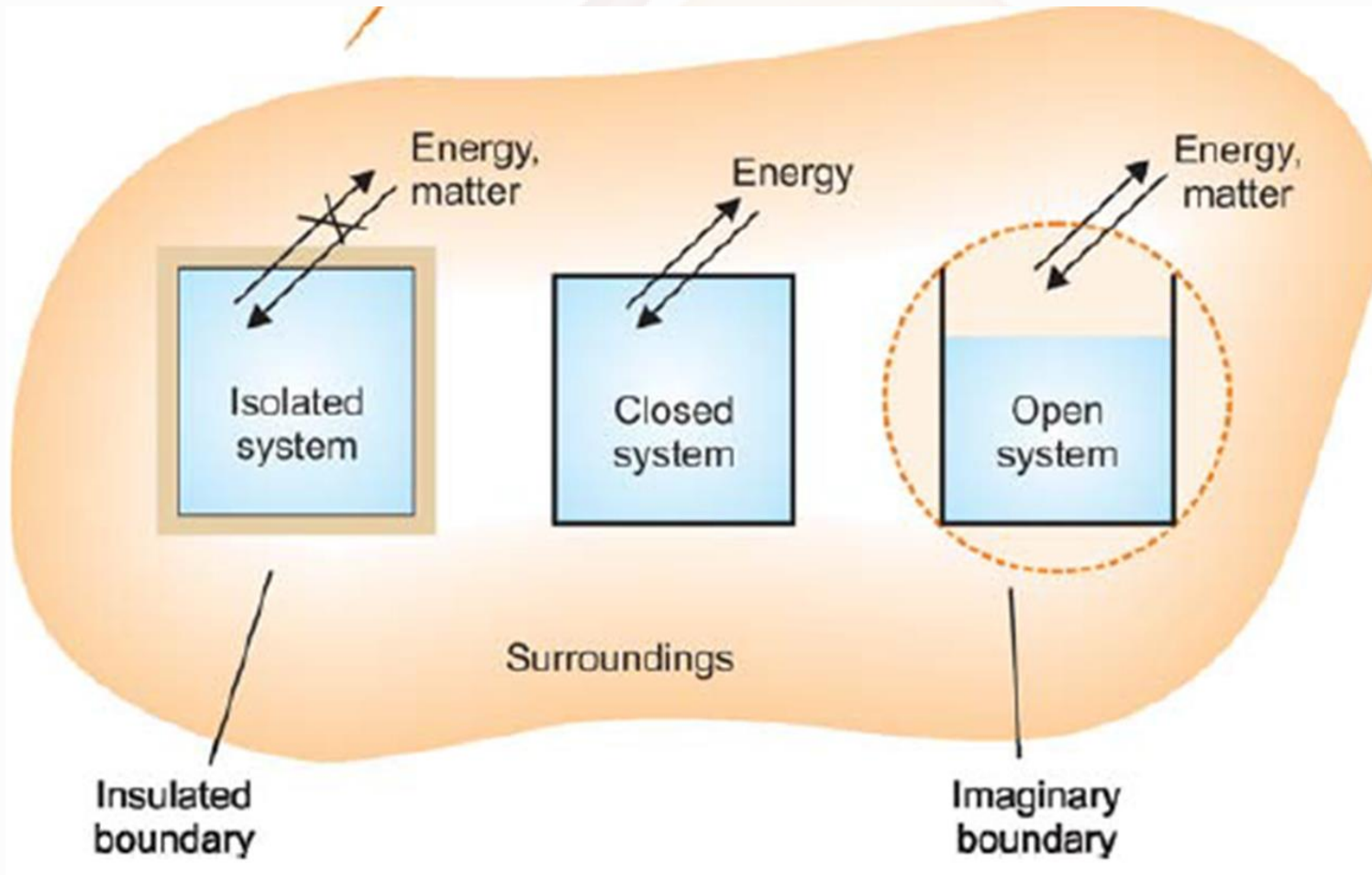
◆ Open system

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Course Code : BSCC2002

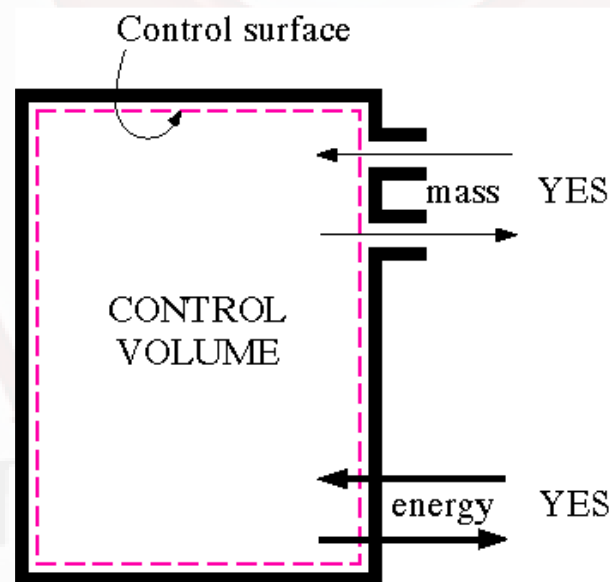
Course Name: Physical Chemistry II: Chemical Thermodynamics and its Applications



OPEN SYSTEM

In such a system the boundary is open and un-insulated. Therefore, **an open system is one which can transfer both energy and matter to from its surroundings.**

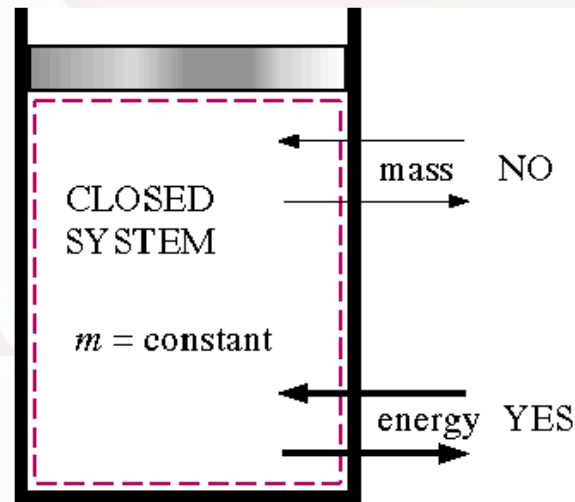
Hot water contained in a beaker placed on laboratory table is an open system. The water vapour (matter) and also heat (energy) is transferred to the surroundings through the imaginary boundary.



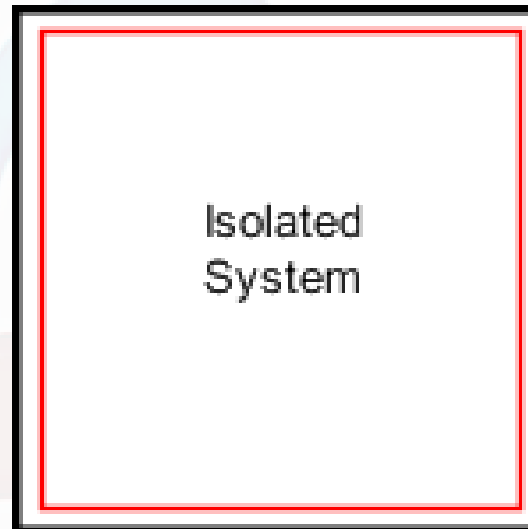
CLOSED SYSTEM

Here the boundary is sealed but not insulated. Therefore, **a closed system is one which cannot transfer matter but can transfer energy in the form of heat, work and radiation to and from its surroundings.**

A specific quantity of hot water contained in a sealed tube, is an example of a closed system. While no water vapour can escape from this system, it can transfer heat through the walls of the tube to the surroundings.



ISOLATED SYSTEM



- When the boundary is both sealed and insulated, no interaction is possible with the surroundings.
- Therefore, **an isolated system is one that can transfer neither matter nor energy to and from its surroundings.**

References

Text Books

1. Atkins, P. W. & Paula, J. de *Atkin's Physical Chemistry* 10th Ed., Oxford University Press (2014).

Reference Books

1. Castellan, G. W. *Physical Chemistry* 4th Ed. Narosa (2004).
2. Engel, T. & Reid, P. *Physical Chemistry* 3rd Ed. Pearson (2013).
3. Levine, I .N. *Physical Chemistry* 6th Ed., Tata Mc Graw Hill (2010)
4. Puri Sharma Pathania Physical Chemistry Book.

A hand holding a blue marker is shown writing the words "THANK YOU" in a large, blue, sans-serif font on a whiteboard. A horizontal blue line is drawn below the text. The background of the whiteboard is white, and there is a faint watermark of a sun and the word "UNIVERSITY" in the background.

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