

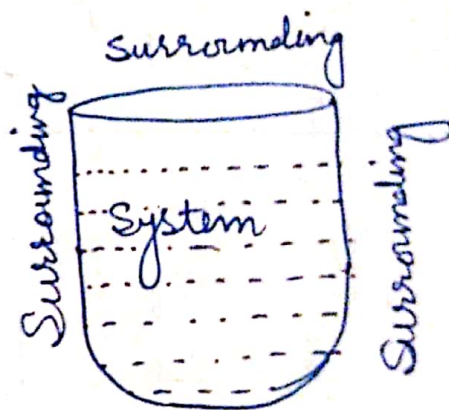
System and Surrounding

System: A specified part of the Universe which is under observation is called the system.

Homogeneous system: A system is called homogeneous if physical properties and chemical proper composition are identical throughout the system.

Heterogeneous system: A system is said to be heterogeneous if it consists of parts (or phases) each of which has different physical and chemical properties.

Surrounding: The remaining portion of the universe which is not a part of the system is called the surroundings. In other words, surroundings include everything other than the system. The system and the surroundings together constitute the universe.



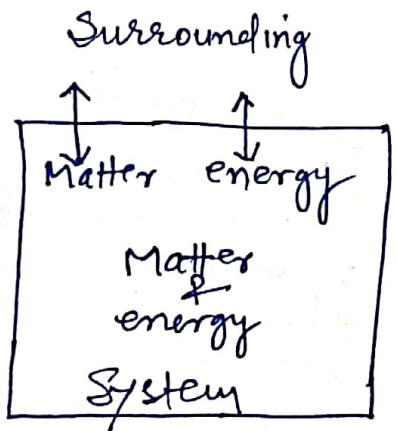
Types of systems: Sys may be classified into three types depending on the movement of matter and energy in or out of the system.

Open system: A system which can exchange ~~energy~~ ~~matter~~ matter as well as energy with the surrounding is called open system. For ex. Hot coffee

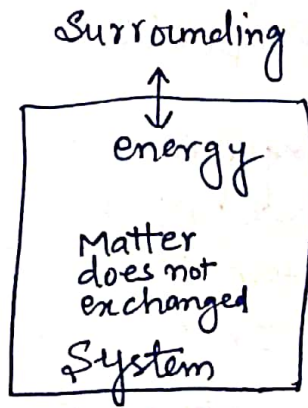
open flask is open system as it can gain or lose matter as well as energy.

closed system: A system which can exchange energy but not matter with its surrounding is called closed system. Hot coffee in a stainless flask is an example of closed system because energy can be gained or lost but not matter.

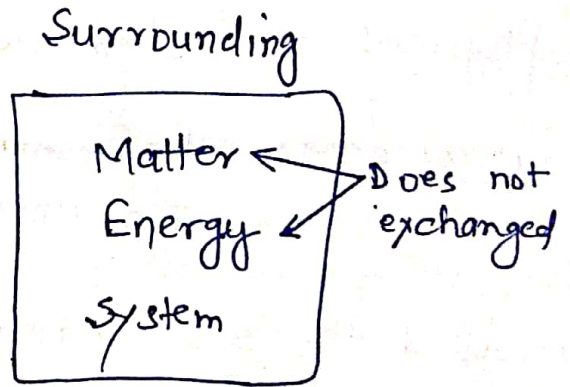
Isolated system: A system which can neither exchange matter nor energy with the surrounding is called an isolated system. For example, hot coffee in a corked thermos flask is an example of isolated system, because it can neither gain or lose energy nor gain or lose matter.



Open System
Exchanges matter & energy



Closed System
Exchanges matter & energy



Isolated System
No exchange of matter & energy

Review of laws of thermodynamics

Law of Conservation of energy: First law of

thermodynamics: It states that energy can neither be created nor destroyed although it can be converted from one form into another.

Mathematical Expression for the first law of thermodynamics

Let us consider a general case in which change of state is brought both by doing work and by transfer of heat.

The internal energy of a system can be changed in two ways:

① By allowing heat to flow into the system or out of the system.

② By doing work on the system or by the system.

Let us consider a system whose internal energy is U_1 . Now, if the system absorbs q amount of heat, then the internal energy of the system increases and becomes

$$U_1 + q.$$

If the work w is done on the system then its internal energy further increases and becomes U_2 . Thus,

$$U_2 = U_1 + q + w$$

$$U_2 - U_1 = q + w$$

$$\Delta U = q + w$$

$$\left[\begin{array}{l} \text{change in} \\ \text{internal} \\ \text{energy} \end{array} \right] = \left[\begin{array}{l} \text{Heat added} \\ \text{to the system} \end{array} \right] + \left[\begin{array}{l} \text{Work done on} \\ \text{the system} \end{array} \right]$$

The above relationship is a mathematical statement of first law of thermodynamics.