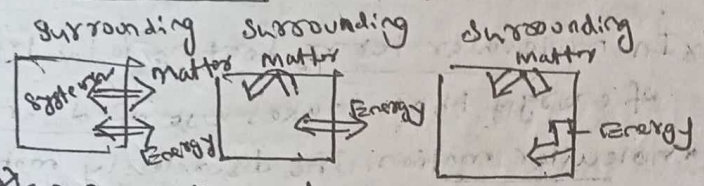
Thermodynamics is the study of the transformations of energy

System The part of the world in which we have a special interest. It may be a reaction vessel, an engine, an electrochemical cell, a biological cell.

Surroundings It comprise of the region outside the system & are where we make our measurements.

Types of system :- (a) Open (b) closed & (c) isolated system.



(a) Open (b) closed (c) Isolated

Fig:- (a) An open system can exchange matter and energy with its surroundings; (b) A closed system can exchange energy but cannot exchange matter (c) An isolated system can exchange neither energy nor matter with its surroundings.

Work, heat and energy Work is motion against an opposing force

* An example of doing work is the expansion of a gas that pushes out a piston and raises a weight.
* A chemical reaction that drives an electric current through a resistance also does work, because the same current could be driven through a motor and used to raise weight.

Energy :- The energy of a system is its capacity to do work.

* When work is done on an otherwise isolated system (by compressing a gas or winding a spring), the capacity of the system to do work increased, ie energy of the system is increased.

* When the system does work (when the piston moves out or the spring unwinds), the energy of the system is reduced and it can do less work than before.

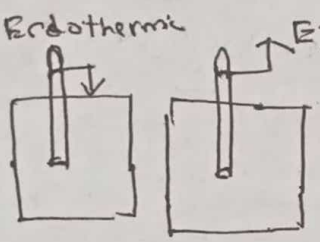
Heat :- When the energy of a system changes as a result of a temperature difference between the system and its surrounding we say that energy has been transfered as heat.

Example:- When a heater is immersed in a beaker of water (the system), the capacity of the system to do work increases because hot water can be used to do more work than the same amount of cold water.

An exothermic process is a process that releases energy as heat into its surroundings. All combustion reactions are exothermic. An endothermic process is a process in which energy is acquired from its surroundings as heat.

An example of an endothermic process is the vapourization of water.

* In an exothermic process energy is transfored as heat to the surroundings. In an endothermic process energy is transforted as heat from the surroundings into the system.



*In molecular terms, heating is the transfer of energy that makes use of disorderly molecular motion. The disorderly motion of molecules is called thermal motion.

* Work is the transfer of energy that makes use of organized motion.

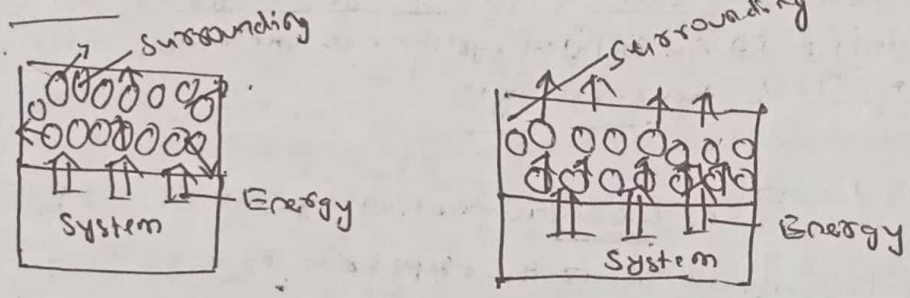


Fig (a) When energy is transferred to the surroundings as heat, the transfer stimulates random motion of the atoms in the surroundings. Transfer of energy from the surroundings to the system makes use of random motion (thermal motion) in the surroundings.

(b) When a system does work, it stimulates orderly motion in the surroundings. For instance, the atoms shown here may be part of a weight that is being raised. The ordered motion of the atoms in a falling weight does work on the system.

Internal energy, U : In thermodynamics, the total energy of a system is called its internal energy. The internal energy is the total kinetic and potential energy of the molecules in the system. The change in internal energy ΔU, when a system changes from an initial state 'i' with internal energy U_i to a final state of internal energy U_f $\boxed{\Delta U = U_f - U_i}$.

* It is a state function and depends only on the current state of the system and is independent of how that state has been prepared.

* Units = Joule (J), $1\ J = 1\ kgm^2s^{-2}$

* A Joule is quite a small unit of energy, for example, each beat of the human heart consumes about 1 J. 1 cal = 4.184 J