P: ISSN NO.: 2394-0344 RNI No.UPBIL/2016/67980 VOL-4* ISSUE-2* (Part-2) May- 2019
E: ISSN NO.: 2455-0817 Remarking An Analisation

# Thermodynamics : Implications of Its Four Laws

**Abstract**

There are four laws of thermodynamics. These laws explains as how quantities like temperature, energy and entropy work under various circumstances in a system.

**Keywords:** Quantities, Energy, Temperature, Perpetual Motion, Entropy.

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**Introduction**

The first law describes that when energy passes, through various objects systems the internal nature of energy automatically is changed. Their process is called as conservation of energy. The system's internal energy changes in accord with the law of conservation of energy. No machine can work without producing energy. Because when it works naturally it produces energy.

The Second law of thermodynamics says that in the natural process of thermodynamic the total sum of the process of interact of thermodynamic systems usually increases. With the continuous running converts thermal energy into mechanical work.

Third law of thermodynamics defines that a running machine the system moves to a constant value. Finally temperature approaches absolute zero. There are the exceptions of non-crystalline solids where the entropy of a system machine at absolute zero is found close to zero.

Thermodynamics is a branch of physics which helps to laws in physics and other natural sciences.

**First Law of Thermodynamics**

The first law of thermodynamics may be defined ways such as :

There is a increase in internal energy in a closed system which is equal to the total energy added to the system. Further when energy enter the system is supplied as heat and if that energy leaves the closed system ultimately, the heat is termed as positive and the work as negative. The below equation clarifies that

$$\Delta U_{system} = Q - W$$

In the process of action of thermodynamic cycle in a closed system, when returns to its original state, the heat $Q_{in}$ is supplied to the closed system in one stage of the cycle, minus the heat $Q_{out}$ removed from it in another stage of the cycle, plus the work done added to the system $W_{in}$ equals the work that leaves the system $W_{out}$.

$$\Delta U_{system\ (full\ cycle)} = 0$$

As to explain a full cycle. The below equation works like this.

$$Q = Q_{in} - Q_{out} + W_{in} - W_{out} = W_{net}$$

**The Rule of Conservation of Energy Thermodynamics**

The first law of thermodynamics states that energy can be neither created nor destroyed. But, energy can change forms, and it can flow from one place to another. But law of conservation of energy states that the total energy of an isolated system does not change.

**Objectives of the Study**

1. Highlight four laws of thermodynamics.
2. To study impact of laws of thermodynamics.
3. The importance of thermodynamics in the field of scientific research.

**Relation between Internal Energy and Temperature**

When a system contains a fixed temperature then its gross energy has three separate composed distinguishable components. If for example when a system is in motion as a whole, its contains which is exhibited as an external imposed field is called as gravity kinetic energy. The other component is called potential energy. The third ones internal energy, which is called as fundamental quantity of thermodynamics. The concept of internal energy is different how the first law of thermodynamics from others like this -

$E_{total} = KE_{system} + PE_{system} + U_{system}$

We can say that the internal energy of a substance is the sum of the diverse kinetic energies its constituent atoms. The substance's internal energy is called as microscopic energy (U), and are accounted for by macroscopic thermodynamic property. In fact the kinetic energies of microscopic motions increases as the system's temperature increases.

The process of transferring energy in or from a system is described by its macroscopic mechanical forces supported by various and around factors in surroundings, outside the system. For examples an externally driven shaft induces a stirrer within the system. Likewise an externally imposed electric field that polarizes the material of the system. So it can be said that in all system working, some of the work is dissipated by internal friction or viscosity. The total work done in a system is a result of its overall kinetic energy, from potential energy, and from internal energy.

For example, if a machine (not a part of the system) lifts something upwards, some energy is transferred from the machine to the system. So resulting into increase of system's energy. The energy when increased from the system is shown as an increase in the system's gravitational potential energy. For example Naturally when work added to the system it increases the Potential Energy of the system:

$$W = \Delta PE_{system}$$

The energy added in the system in the form of work may be divided as to kinetic, potential or internal energy forms. For example

$$W = \Delta KE_{system} + \Delta PE_{system} + \Delta U_{system}$$

The process of energy transfer natural process in moving energy either to or from a system. Heat is generated as a colder system.

For example in case the which system has rigid walls energy cannot be transferred into or out from the system.

According to second law of thermodynamics the natural processes is inversible. In many cases, there is a common tendency of natural processes to more towards spatial homogeneity of matter and energy. The rise in temperature is an example that

The second law is used in a wide variety of processes which are reversible and irreversible. All natural of thermodynamics processes are irreversible. No doubt reversible processes are more useful and convenient theoretical fiction. But they do not occur in nature.

**The third law of thermodynamics explains like this**

The entropy of a perfect crystal of any pure substance approaches zero as the temperature approaches absolute zero.

When a system has zero temperature resulting into the minimum thermal energy produced. For example when the perfect crystal has only one state with minimum energy.

The other example of third law of thermodynamics applies to a system like a glass which may that may have more than one minimum microscopically distinct energy.

**Conclusion**

All the laws of thermodynamics exhibit different explanation of internal energy generated from a system. All the three laws have practical use in terms of further researches in physics.

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