

SECOND LAW OF THERMODYNAMICS

Second Law vs First Law

Second Law of Thermodynamics disallows some phenomena which are consistent with First Law of Thermodynamics

For egs. Internal energy never be converted to Mechanical Energy.

Efficiency of a heat engine can never be unity

The Second Law of Thermodynamics gives a fundamental limitation to the efficiency of a heat engine and the co-efficient of performance of a refrigerator.

Second Law says that the co-efficient of performance can never be infinite.

Kelvin-Planck statement

This implies that it is impossible to build a Heat Engine that has 100% thermal efficiency

No process is possible whose sole result is the absorption of heat from a reservoir and the complete conversion of the heat into work.

Clausius statement

There are devices that can transfer heat from lower-temperature reservoirs to higher-temperature reservoirs but they have also to consume some energy.

No process is possible whose sole result is the transfer of heat from a colder object to a hotter object.

Comparison of the statements

It can be proved that the two statements above are completely equivalent.

Kelvin Planck statement explains the **heat engine** whereas the **Clausius** statement explains **heat pump**.