

Ques:- What is thermodynamics. State the first law of thermodynamics and discuss its physical significance & limitation.

Ans:- Thermodynamics :-

It is the science that discusses the relation of heat to mechanical work. It establishes the equivalence between the work done and the heat produced. The principles of thermodynamics are very general and give the relation of heat to other forms of energy eg. electrical, light etc

Mechanical Equivalent of heat :-

Whenever work is transformed into heat and heat into work, the quantity of work is mechanically equivalent to the quantity of heat.

$$W \propto H$$

$$W = JH$$

where J = constant known as Joule's mechanical equivalent of heat. The value of J is 4.186 Joules/calorie or 4.186×10^7 ergs per calorie. In S.I system both W and H are measured in Joules. Therefore, in this system $J=1$ and therefore $W=H$

First law of thermodynamics :-

Whenever heat is imparted to a body a part of it is used to increase its internal energy, i.e. to raise its temperature and the rest is doing external work. If dQ is the heat energy absorbed by a system, du the increase in internal energy and dW the external work done by it, then provided all the quantities are measured in units of work.

$$\therefore dQ = du + dW$$

This is known as the first law of thermodynamics

Differential form of first law of thermodynamics :-

$$\therefore dQ = du + dW$$

This is the differential form of the first law of thermodynamics. If the pressure remain constant at P and change in volume dV takes place, then

$$dW = P \cdot dV$$

$$\therefore dQ = du + P dV$$