Lecture Notes Dated: Aug 11, 2012

Introduction

Thermodynamics is mainly an empirical science based upon assumptions whose validity has been established experimentally. The treatment of problem in thermodynamics is done totally on the basis of such assumptions. Just as in classical mechanics we begin with very few numbers of laws, like the Newton's law of motion which are based on experience, and deduce other results from them.So in thermodynamics we infer the existence of certain fundamental laws from experimental evidence and then draw our conclusions from these fundamental laws.

Thermodynamical results are generally highly accurate and therefore the scince of thermodynamics have an important place in the area of modern physics.

Zeroth Law of Thermodynamics

Imagine two systems A and B, separated from each other by an adiabatic wall but each in contact simultaneously with a third system C through a diathermic wall (if exchange of heat occurs through a *boundary* it is called ***diathermic*** and the system will be in thermal contact with its surroundings), the whole assembly of systems being surrounded by an adiabatic wall (A surface which prevents thermal interaction is known as adiabatic and the system is said to be thermally isolated) as shown in Figure 1 (a).

Figure 1 *The zeroth law of thermodynamics.*

Experiments shows that the two systems will come to thermal equilibrium with the third system. No further change will occur if the adiabatic wall separating A and B is then replaced by a diathermic wall, as well as if the diathermic wall separating C from both A and B is also replaced by an adiabatic wall (Figure 1 (b)). If, instead of allowing both systems A and B to come to equilibrium with C at the same time, we first establish equilibrium between A and C and later establish equilibrium between B and C; then when A and B are brought into communication through a diathermic wall, they will be found to be in thermal equilibrium with each other.

These experimental facts may then be stated in the following transitive relation; *Two systems in thermal equilibrium with a third are in thermal equilibrium with each other.*

As suggested by *Ralph fowler*, this postulate of transitive thermal equilibrium has been numbered ***the zeroth law of thermodynamics***, which establishes the basis for the *concept of temperature*.