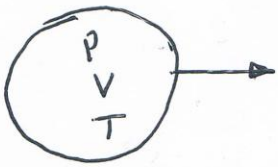
Fondemental of Thermodynamics Chapter 1

Thermodynamics deal with the study of the impacts of heat on material.
and catogarized in two parts:

1. Sample study: deal with on exterenal structure and measured properties such as (temperature, pressure and volume).



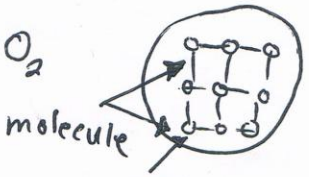
sample or parcel

Sample

2. microscopic study: deal with crystal structure and the atomic structure, molecule structure.

C O_2 → CO_2

كربون جزيء أوكسجين



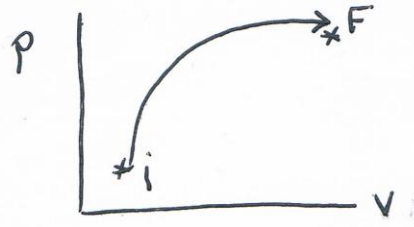
and we can say that the thermodynamic deal with the tow parts sample and microscopic.

Definitions

1. Thermodynamic system: is a tiny sample of material taken in order to study such as a droplet of blood in order to analysed it in the labrotary.
   and the thermodynamic systems have two types:
   (A) Simple system: contain one system
   (b) Complicated system: = two or more.

Note: every think outside the thermodynamic system called the environment.

2. Thermodynamic ~~system~~ processes: means the change in pressure, volume or temperature or two of each where the system transfere from the intial case to final case



*Typs of Themodynamic process:

1. Isothermal process (T constant): this process done with constant temperature.

2. Isobaric process (P constant): this process done with constant pressure.

3. Adiabatic process: this process done with constant heat amount change and not temperature.

* temperature: is the measure of the heat of the system or environment

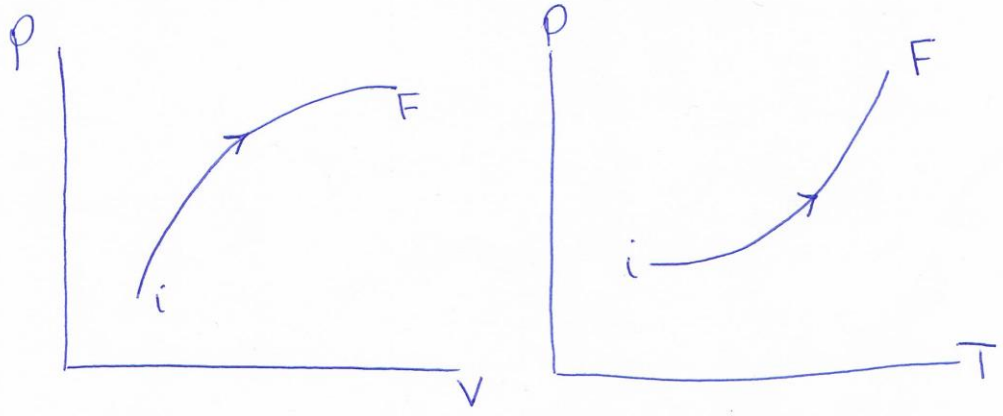
* heat amount: is the amount of the energy in the system or environment.

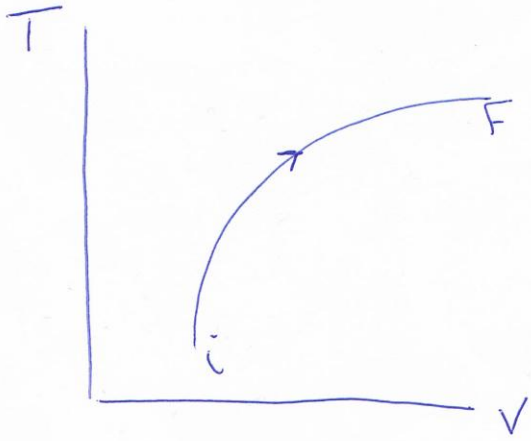
Thermodynamic path : is a diagram.

represents the coordinate of the thermodynamic

wich includes the temperature (T), pressure (p)

and volume (V).





Equation of State:

is the equation which describes the behavior of the system by the thermodynamic coordinates (V, P, T)

Volume expansion index: (β): معامل التمدد الحجمي:
هو مقدار التغير في الحجم الى مقدار التغير في درجة الحرارة بثبوت الضغط لوحدة الحجم

$$\beta = \frac{1}{v}\left(\frac{\Delta v}{\Delta T}\right)_P$$

specific volume

Note: $v = \frac{V}{n}$ → V real volume, n number of moles

Thermodynamic compersiable K^*: الانضغاطية الثرموديناميكية
هو مقدار تغير الضغط الى مقدار تغير الحجم بثبوت درجة الحرارة

$$K^* = -\frac{1}{v}\left(\frac{\Delta P}{\Delta v}\right)_T$$

Iso thermal compersible: الانضغاطية الايزوثرمية

هو مقدار التغير بالحجم الى مقدار التغير بالضغط
بثبوت درجة الحرارة

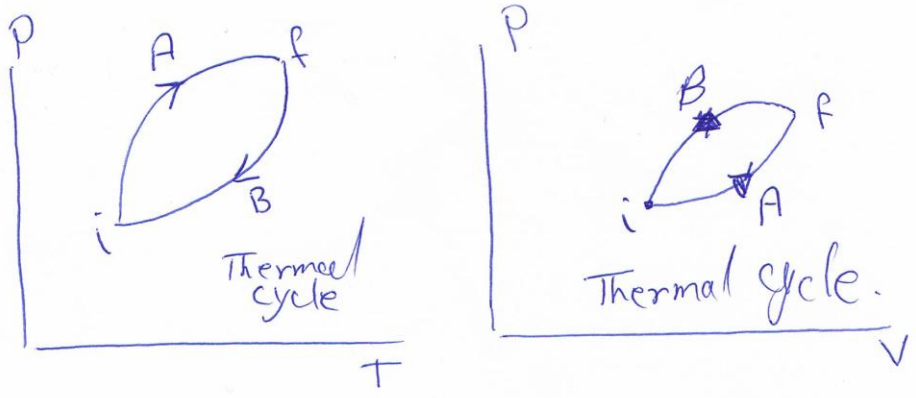
$$K = -\frac{1}{v}\left(\frac{\partial v}{\partial p}\right)_T$$

Thermodynamic Equilibrium:

The thermodynamic system will be in equilibrium state if these conditions are avaible:

1. mechanical equibirum .
2. Thermal = .
3. Chemical = .

Thermodynamic sycle: if the thermodynamic system perforne two processor more, where return in the final to its orgin location or intial state, the thermodynamic system perforne a complete thermal cycle



example: Show that "β" for ideal gas can be given by the relation

$$\beta = \frac{1}{T}$$

Solution:

$$\beta = \frac{1}{\upsilon}\left(\frac{\partial \upsilon}{\partial T}\right)_p$$

For ideal gas the equation of state

$$PV = nRT$$

$$\because \upsilon = \frac{V}{n} \Rightarrow V = \upsilon n$$

$$P\upsilon = RT$$

$$p\,d\upsilon + \upsilon\,dp = R\,dT \qquad \div dT$$

$$p\frac{d\upsilon}{dT} + \upsilon\frac{dp}{dT} = R \qquad \div \upsilon$$

$$\beta \quad \frac{P}{\vartheta}\frac{d\vartheta}{dT} + \frac{\vartheta}{\vartheta}\frac{dP}{dT} = \frac{R}{\vartheta} \qquad \frac{dP}{dT} = 0$$

$$\frac{P}{\vartheta}\left(\frac{d\vartheta}{dT}\right)_P + 0 = \frac{R}{\vartheta}$$

$P\vartheta = RT$

$$P\beta = \frac{R}{\vartheta}$$

$$\frac{\vartheta}{RT}\beta = \frac{R}{\vartheta}$$

$$\frac{RT}{\vartheta}\beta = \frac{R}{\vartheta}$$

$$\therefore \beta = \frac{1}{T}$$