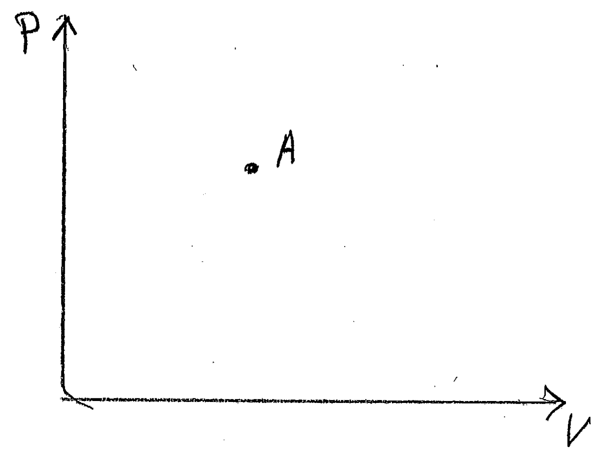
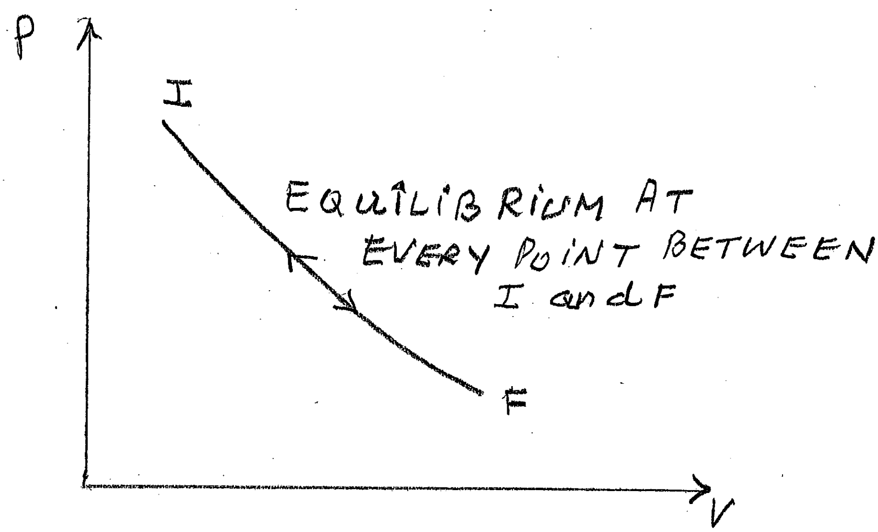
THERMODYNAMIC PROCESSES

When any one of the three parameters P, V or T varies we claim that a thermodynamic process has occurred. We need to take a deeper look at the process.

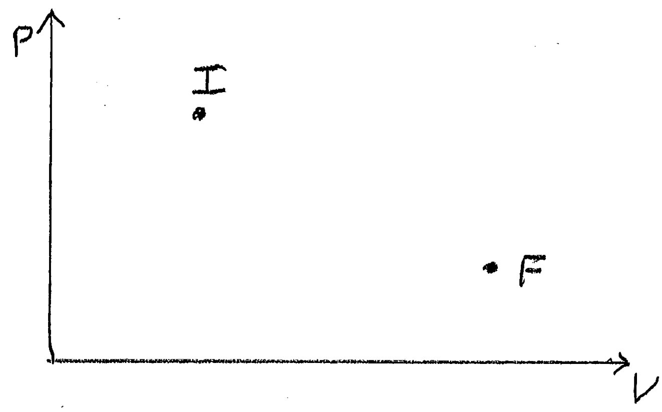
We begin by recognizing that if you wish to represent the state of a system by a point (such as A) on a P-V diagram, the system must be in equilibrium otherwise temperature is not the same every where and therefore P and V are not unique.This has the immediate implication that if you represent a thermodynamic process by a continuous line the system must in equilibrium at every point along the way from initial state I to final state F.





How can we do that? The process must be carried out infinitely slowly. For example, if I$\rightarrow$F is an adiabatic expansion you can imagine starting at I, reducing the pressure by removing one electron [mass = 9×10^{-31} kg] from the piston at a time and repeating this ever so small step to eventually reach F. Since the system is in $\equiv m$ at every point, one can stop any where and go forward or back because each step is infinitesimal. Such a process is therefore REVERSIBLE. Hence the arrow is pointing both ways in diagram above. However, such a process will take forever, so it is only an IDEAL.

In a real process which must be carried out over small time intervals we ensure equilibrium only in the initial and final states. Hence, it is represented by two points on PV diagram.



There is no information about any of the intermediate points. This is a REAL or LABORATORY process, but now we have no way of getting back to I so this process is IRREVERSIBLE.