## PROPERTIES OF SYSTEMS

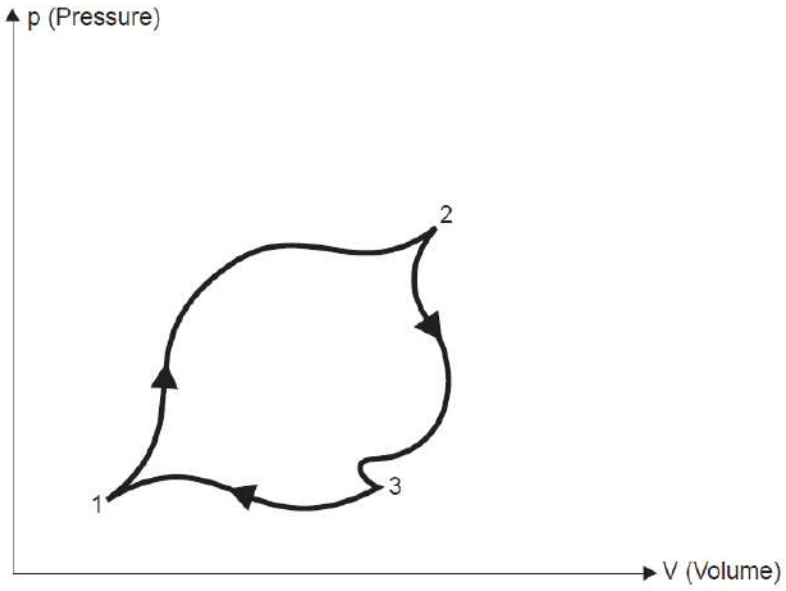
A property of a system is a characteristic of the system which depends upon its state, but not upon how the state is reached. There are two sorts of property :

1. **Intensive properties.** These properties *do not depend on the mass of the system*. *Examples* : Temperature and pressure.

2. **Extensive properties.** These properties *depend on the mass of the system*. *Example* : Volume. Extensive properties are often divided by mass associated with them to obtain the intensive properties. For example, if the volume of a system of mass $m$ is $V$, then the specific volume of matter within the system is $\frac{V}{m} = v$ which is an intensive property.

## CYCLE

*Any process or series of processes whose end states are identical is termed* a **cycle**. The processes through which the system has passed can be shown on a state diagram, but a complete section of the path requires in addition a statement of the heat and work crossing the boundary of the system. Fig. shows such a cycle in which a system commencing at condition '1' changes in pressure and volume through a path 123 and returns to its initial condition '1'.




Cycle of operations.

## POINT FUNCTION

*When two properties locate a point on the graph (co-ordinate axes) then those properties are called as* **point function.**

*Examples*. Pressure, temperature, volume etc.

$$\int_1^2 dV = V_2 - V_1 \text{ (an } \textit{exact differential}\text{)}.$$

## PATH FUNCTION

There are certain quantities which cannot be located on a graph by a *point* but are given by the *area* or so, on that graph. In that case, the area on the graph, pertaining to the particular process, *is a function of the path of the process.* Such quantities are called **path functions.**

*Examples*. Heat, work etc.

Heat and work are *inexact differentials*. Their change cannot be written as difference between their end states.

Thus $\int_1^2 \delta Q \neq Q_2 - Q_1$ and is shown as ${}_1Q_2$ or $Q_{1-2}$

Similarly $\int_1^2 \delta W \neq W_2 - W_1$, and is shown as ${}_1W_2$ or $W_{1-2}$

**Note.** The operator $\delta$ is used to denote inexact differentials and operator $d$ is used to denote exact differentials.