

Indicator diagram:- A graphical representation of the state of a system with the help of two thermodynamic variables is called indicator diagram of the system.

If the thermodynamic variables are pressure (P) and volume (V) then the graph between P and V is called P - V diagram. It is shown in figure (i) & (ii).

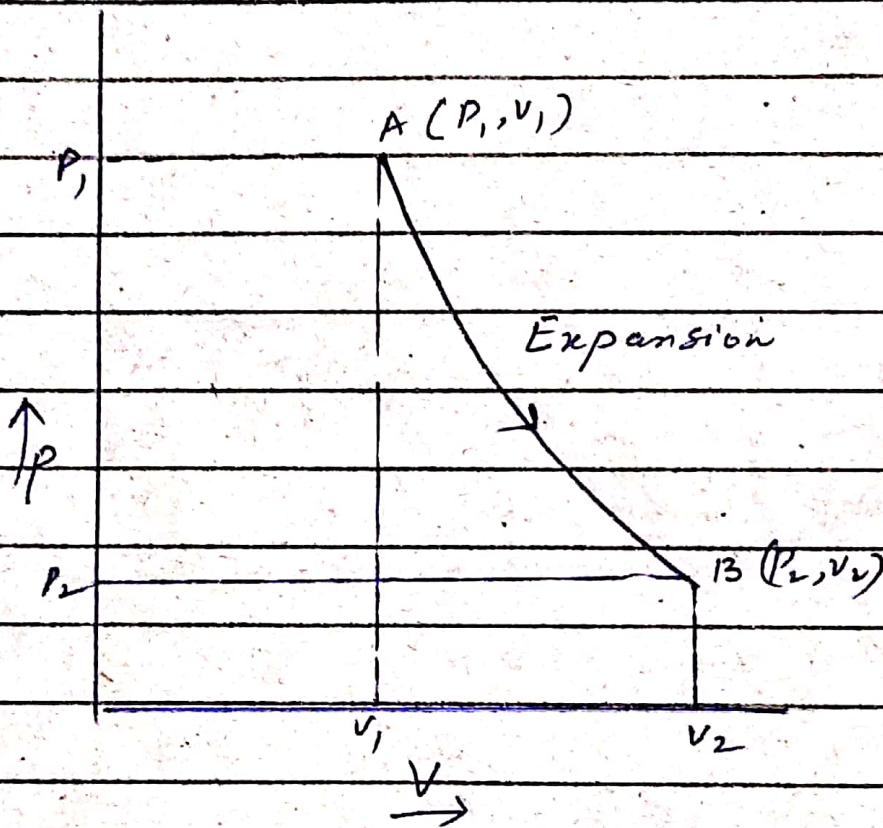
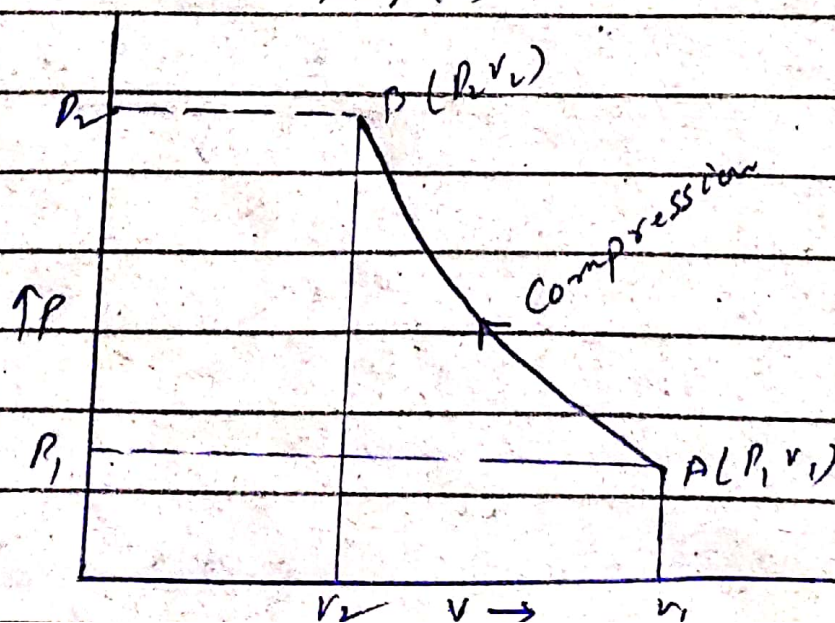
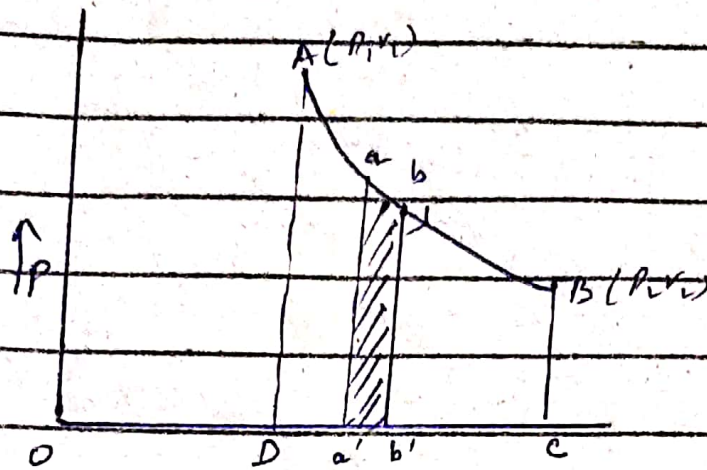


Fig (i)



Importance of P-v diagram, Work done during thermodynamic process by a system or on the system can be calculated by using P-v diagram and which is numerically equal to the area under P-v diagram. Shown in figure.



Let a thermodynamic system goes through a thermodynamic expansion shown by the above P-v diagram.

Let a and b be the two points on the P-v diagram where P, v are the values at point a and P and $v+dv$ be the values corresponding for the point b. So that $aa' = bb' = P$, the const pressure on the system, and $a'b' = dv = \text{increase in volume}$.

Now small work done

$$dW = P dv = aa' \times a'b' \\ = \text{area of the strip } abb'a'$$

\therefore Total work done by the gas during expansion from state A to B can be calculated by adding the area of all strips formed between AB and ~~AB~~ under P-v diagram.

$$W = \text{area } ABCD$$

Thus, work done by a system is numerically equal to the area under P-v diagram.