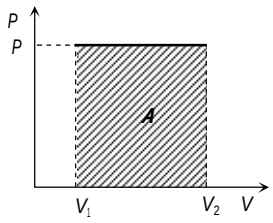
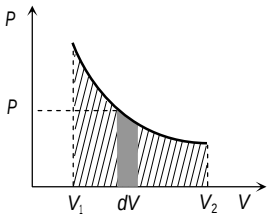
P-V Graph

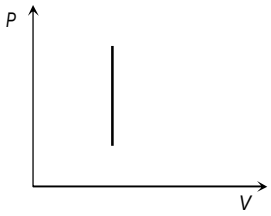
If we draw indicator diagram, the area bounded by *PV*-graph and volume axis represents the work done



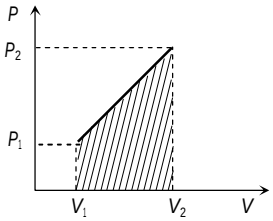
Work = Area = $P(V_2 - V_1)$



Work $= \int_{V_1}^{V_2} PdV = P(V_2 - V_1)$



Work = 0



Work = Area of the shown trapezium

$$= \frac{1}{2}(P_1 + P_2)(V_2 - V_1)$$

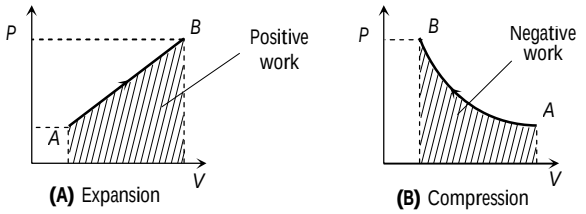
(ii) From $\Delta W = P\Delta V = P(V_f - V_i)$

If system expands against some external force then $V_f > V_i$

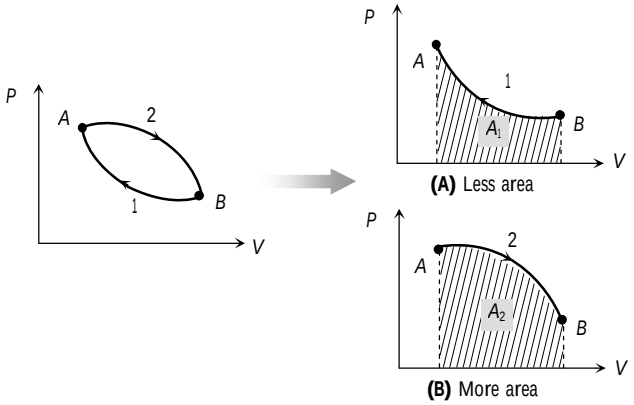
$\Rightarrow$ ΔW = positive

If system contracts because of external force then $V_f < V_i$

$\Rightarrow$ ΔW = negative

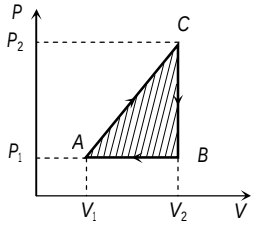


(iii) Like heat, work done is also depends upon initial and final state of the system and path adopted for the process



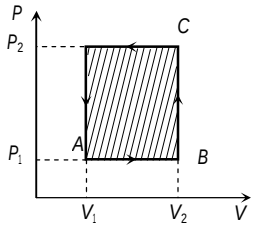
$\because A_1 < A_2 \Rightarrow W_1 < W_2$

(iv) In cyclic process, work done is equal to the area of closed curve. It is positive if the cycle is clockwise and it is negative if the cycle is anticlockwise.



Work = Area of triangle *ABC*

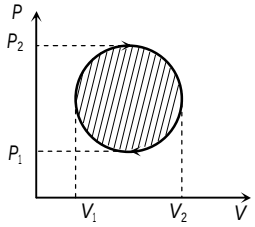
$$= \frac{1}{2} \times (V_2 - V_1) \times (P_2 - P_1)$$



Work = Area of rectangle *ABCD*

= $AB \times AD$

= $(V_2 - V_1)\ (P_2 - P_1)$



Work = $\frac{\pi}{4}(P_2 - P_1)(V_2 - V_1)$