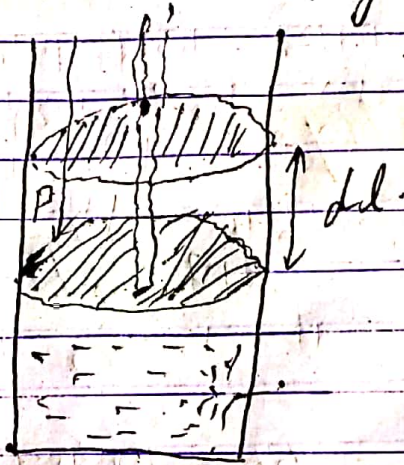


B.Sc.I, Paper - IA

Work of expansion.

Let us consider a gas is enclosed in a cylinder fitted with frictionless piston as shown in figure.



Area of cross-section of gas cylinder =  $a$  sq cm.  
The pressure on the piston of cylinder which is slightly less than the internal pressure of gas on the piston =  $p$ .

Distance travel by cylinder after expansion =  $dl$

Then force acting on the piston for expansion  
 ~~$= p \times a$  (pressure  $\times$  area)~~

$$F = p \times a \text{ (pressure } \times \text{ area)}$$

$$\Rightarrow \text{Work done on piston} = \text{Force} \times \text{displacement}$$



$$\cancel{dW} = P \times \alpha \times dt$$

$$\text{or } dW = P dV \quad \text{As } \alpha \times dt = dV$$

Integrating both side

$$\int dW = \int_{V_2}^{V_1} P dV$$

$$\text{or } W = P(V_1 - V_2)$$

$$= -P \Delta V$$

This is work done by system when pressure is constant throughout the expansion.  $\Delta V =$  change in total volume

When work done by the system i.e. work of expansion, the work done is negative.

And similarly work done on the system i.e.  $W_{\text{on}}$  is always positive.