Ideal gases and Work Done

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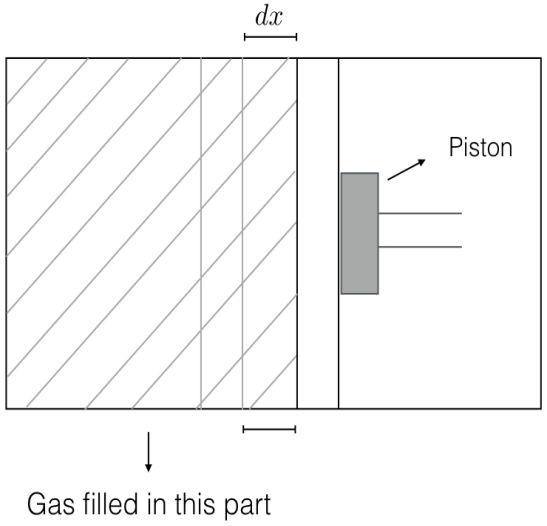
November 16, 2016

From Newtonian mechanics, we know that $W = -\int F \cdot dx$ and that *Pressure is force per unit area* that is $P = F/A$. Let's see if we can use that concepts in case of gases.

Consider the following figures. The shaded region is filled with the gas and this gas is exerting a pressure inside the chamber. This figure shows that the gas has expanded so that the piston has been displaced by an amount dx. Let's assume that the gas is held at constant pressure. We are interested



in calculating the work done by the gas. Thus the work done by the gas would be

The pressure exerted would be force per unit area. So, the force would be

$F = PA$. This would make the work

Recall that $Adx = dV$, where dV = change in the volume of the gas. Then, the above expression can be written as

Thus, *Work Done = area under the curve of a PV curve.*
Now we can write work as a product of pressure and volume, *i.e.*,

$$W = PV$$

This would make any change in the work done as

$$dW = PdV + VdP$$

Depending on what is the constant parameter, we can find out the work done by the system.