

1 Basic Thermodynamics

1.1 Ideal Gas Equation

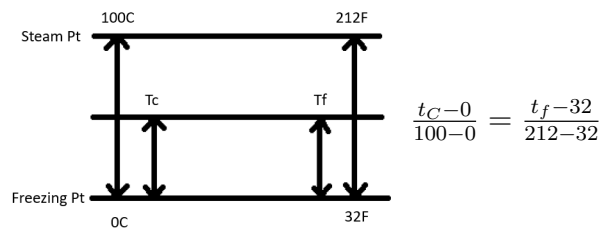
Ideal Gas Equation : $PV = mRT = n\bar{R}T$

$$R = \frac{\bar{R}}{M}$$

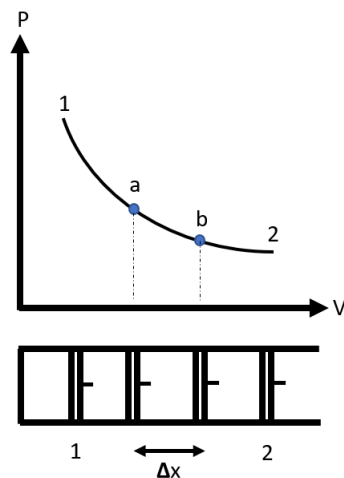
\bar{R} = Universal Gas Constant

M = Molecular mass

1.2 Temperature Scale conversion



2 Fixed Mass Energy analysis



$$\begin{aligned} \text{Work}(W) &= \text{Force}(F) * \text{distance}(\partial x) \\ &= PA\partial x \\ &= P\partial v \\ &= PdV \end{aligned}$$

$$W = \int PdV$$

The above work is called Non-flow work or closed system work or boundary work

2.1 Work formulae for various processes

Constant Volume work : $W = \int PdV = 0$

Constant Pressure work : $W = \int_1^2 PdV = \boxed{P(V_2 - V_1)}$

Constant Temperature work :

$$W = \int PdV \quad (1)$$

For Ideal gas, $PV = mRT$. Here $m\mathbf{R}\mathbf{T}$ is constant since T is constant in Isothermal process and m and \mathbf{R} are already constants.

$$PV = C \quad (2)$$

$$\Rightarrow P = \frac{C}{V} \text{ or } V = \frac{C}{P}. \text{ Use } P = \frac{C}{V} \text{ in (1)}$$

$$\Rightarrow W = \int_1^2 \frac{C}{V} dV = \boxed{C \ln \frac{V_2}{V_1}}$$

$$\text{From (2), } \frac{V_2}{V_1} = \frac{P_1}{P_2} \Rightarrow \boxed{W = C \frac{P_1}{P_2}}$$