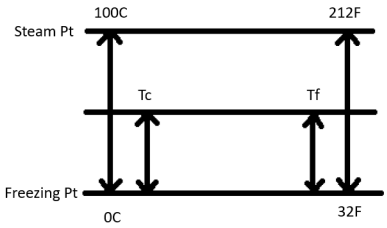
1 Basic Thermodynamics

1.1 Ideal Gas Equation

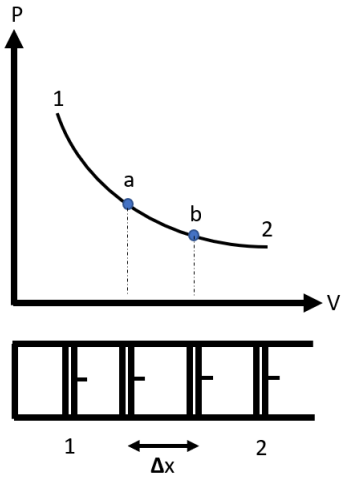
$$Ideal\ Gas\ Equation : PV = mRT = n\bar{R}T$$
$$R = \frac{\bar{R}}{M}$$
$$\bar{R} = Universal\ Gas\ Constant$$
$$M = Molecular\ mass$$

1.2 Temperature Scale conversion



$$\frac{t_C - 0}{100 - 0} = \frac{t_f - 32}{212 - 32}$$

2 Fixed Mass Energy analysis



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

$$\boxed{W = \int PdV}$$

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 :

$$W = \int PdV \tag{1}$$

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

$$PV = C \tag{2}$$

$\implies P = \dfrac{C}{V}$ *or* $V = \dfrac{C}{P}$. *Use* $P = \dfrac{C}{V}$ *in* (1)

$\implies W = \int_1^2 \dfrac{C}{V}\, dV = \boxed{C \ln \dfrac{V_2}{V_1}}$

From (2), $\dfrac{V_2}{V_1} = \dfrac{P_1}{P_2} \implies \boxed{W = C\dfrac{P_1}{P_2}}$