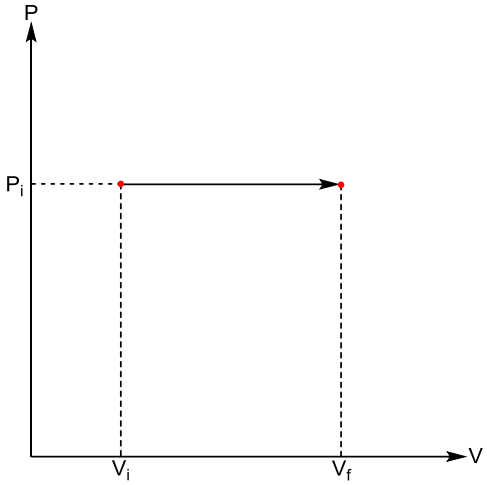
THERMODYNAMIC PROCESSES

Wardaya College – IR

I. Isobaric Process



- General Relationship

$$\frac{V_i}{T_i} = \frac{V_f}{T_f} = \text{Constant}$$

- Work

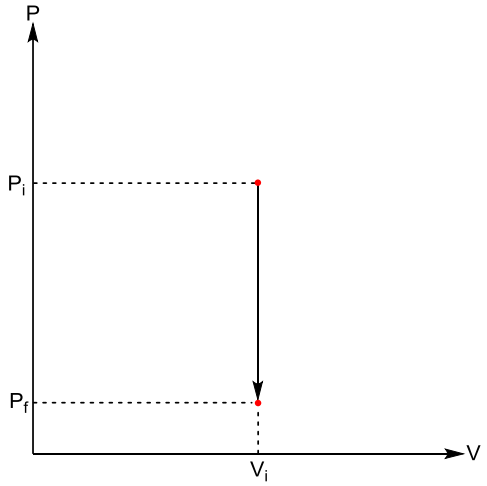
$$W_s = \int_{V_i}^{V_f} P_i \, dV = P_i \int_{V_i}^{V_f} dV = P_i(V_f - V_i)$$

- Internal Energy

$$\Delta U = \frac{f}{2} nR\Delta T = \frac{f}{2} Nk_B\Delta T = \frac{f}{2} P_i(V_f - V_i)$$

**f* is degree of freedom*

II. Isochoric Process



- General Relationship

$$\frac{P_i}{T_i} = \frac{P_f}{T_f} = \text{Constant}$$

- Work

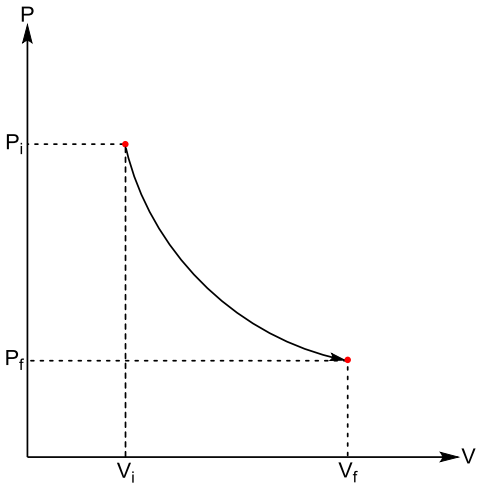
$$W_s = \int_{V_i}^{V_i} P_i \, dV = P_i \int_{V_i}^{V_i} dV = 0$$

- Internal Energy

$$\Delta U = \frac{f}{2} nR\Delta T = \frac{f}{2} Nk_B \Delta T$$

f is degree of freedom

III. Isothermal Process



- General Relationship

$$P_i V_i = P_f V_f = \text{Constant}$$

- Work

$$W_s = \int_{V_i}^{V_f} P_i \, dV = \int_{V_i}^{V_f} \frac{C}{V} dV = C \ln\left(\frac{V_f}{V_i}\right)$$

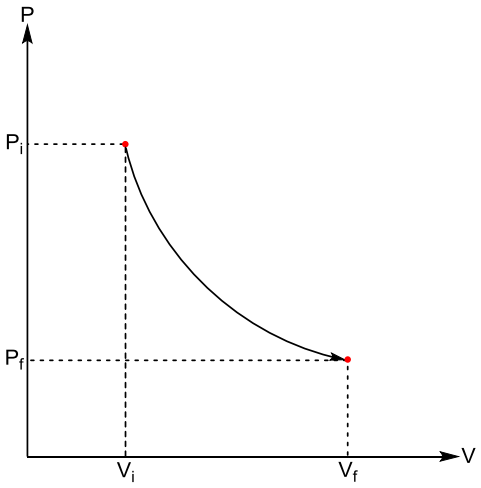
C is a constant

- Internal Energy

$$\Delta U = \frac{f}{2} nR\Delta T = \frac{f}{2} Nk_B \Delta T = 0$$

f is degree of freedom

IV. Adiabatic Process



- General Relationship

$$\frac{P_i}{P_f} = \left(\frac{V_f}{V_i}\right)^{\gamma} = \left(\frac{T_i}{T_f}\right)^{\frac{\gamma}{\gamma-1}} = \text{Constant}$$

$$\gamma = \frac{C_P}{C_V} = 1 + \frac{R}{C_V} = \frac{f+2}{f}$$

- Work

$$W_s = \int_{V_i}^{V_f} P_i \, dV = \int_{V_i}^{V_f} \frac{C}{V^{\gamma}} dV = \frac{C}{1-\gamma}\left[V_f^{1-\gamma} - V_i^{1-\gamma}\right] = \frac{P_f V_f - P_i V_i}{1-\gamma}$$

C is a constant

- Internal Energy

$$\Delta U = \frac{f}{2} nR\Delta T = \frac{f}{2} Nk_B \Delta T$$

**f* is degree of freedom*

- Heat

$$\Delta Q = 0$$