Ideal Gas Law	:	$PV = nRT = NkT$
Isothermal processes	:	$T = \text{constant} \Rightarrow (\Delta T = 0)$
Isobaric processes	:	$P = \text{constant} \Rightarrow (\Delta P = 0)$
Isovolumetric processes	:	$V = \text{constant} \Rightarrow (\Delta V = 0)$
Adiabatic process	:	$Q = \text{zero} \Rightarrow (Q = 0) \Rightarrow PV^{\gamma} = \text{constant}$
		$TV^{\gamma - 1} = \text{constant}$
Internal Energy	:	$U = nC_vT$, $\Delta U = nC_v \Delta T$
Work	:	$dW = PdV$, $W = \int PdV$
Heat	:	$Q = nC_v \Delta T$ (for constant volume) , $R = C_p - C_v$
		$Q = nC_p \Delta T$ (for constant pressure) , $\gamma = C_p / C_v$
1st Law of T.D.	:	$Q = W + \Delta U$
Entropy	:	$dS = dQ/T$, $\Delta S = \int dQ/T$

Isothermal Processes:

$T = \text{constant} \Rightarrow PV = nRT = \text{constant} \Rightarrow P_iV_i = P_fV_f$

$\Delta T = 0 \Rightarrow P\Delta V - V\Delta P = 0$

$\Delta U = 0$

$W = nRT\, ln(V_f / V_i) = P_iV_i\, ln(V_f / V_i) = P_fV_f\, ln(V_f / V_i)$

$Q = W = nRT\, ln(V_f / V_i) = P_iV_i\, ln(V_f / V_i) = P_fV_f\, ln(V_f / V_i)$

$\Delta S = \int dQ/T = Q/T = W/T = nR\, ln(V_f / V_i)$

Isobaric Process:

$P = \text{constant} \Rightarrow V/T = nRT/P = \text{constant} \Rightarrow V_i/T_i = V_f/T_f$

$\Delta P = 0 \Rightarrow P\Delta V = nR\Delta T \Rightarrow P = nR\Delta T / \Delta V$

$\Delta U = nC_v\Delta T = C_vP\Delta V / R = C_vW / R = (\gamma - 1)^{-1}W$

$W = P\Delta V = nR\Delta T = n(C_p - C_v)\Delta T = (\gamma - 1)\, nC_v\Delta T$

$Q = W + \Delta U = nC_v\Delta T + (\gamma - 1)nC_v\Delta T = \gamma nC_v\Delta T = nC_p\Delta T = \gamma P\Delta V / (\gamma - 1)$

$\Delta S = \int dQ / T = \int \gamma nC_v dT / T = \gamma nC_v\, ln\, (T_f / T_i) = nC_p\, ln\, (T_f / T_i) = nC_p\, ln\, (V_f / V_i)$

Isovolumetric Process:

$V = \text{constant} \Rightarrow P/T = nRT/V = \text{constant} \Rightarrow P_i/T_i = P_f/T_f$

$\Delta V = 0 \Rightarrow V\Delta P = nR\Delta T \Rightarrow V = nR\Delta T / \Delta P$

$\Delta U = nC_v\Delta T = C_vV\Delta P/R$

$W = 0$

$Q = \Delta U = nC_v\Delta T = C_vV\Delta P / R$

$\Delta S = \int dQ / T = \int nC_v dT / T = nC_v\, ln\, (T_f / T_i) = nC_v\, ln\, (P_f / P_i)$

Adiabatic Process:

$PV^{\gamma} = \text{constant} \Rightarrow P_iV_i^{\gamma} = P_fV_f^{\gamma} \Rightarrow VdP - \gamma PdV = 0$

$TV^{\gamma - 1} = \text{constant} \Rightarrow T_iV_i^{\gamma - 1} = T_fV_f^{\gamma - 1} \Rightarrow VdT - (\gamma - 1)TdV = 0$

$\Delta U = nC_v\Delta T = -\int PdV = \int (P_iV_i^{\gamma})dV / V^{\gamma} = (P_iV_i^{\gamma})(1 - \gamma)(V_f / V_i)^{1-\gamma}$

$W = -\Delta U = -nC_v\Delta T = (P_iV_i - P_fV_f) / (\gamma - 1) = -nR\Delta T / (\gamma - 1)$

$Q = 0$

$\Delta S = \int dQ/T = 0$ (entropy stays constant in reversible adiabatic processes, $Q = 0$)