T-S1. Ideal Gas Transformations

Transformation	**P_f**	**V_f**	**T_f**	**ΔU**	**Q**	**W**	**ΔS**
Isobaric	P_0	V_f	$\frac{V_f}{V_0}T_0$	$\frac{d}{2}P_0\left(V_f - V_0\right)$	$\frac{d+2}{2}P_0\left(V_f - V_0\right)$	$P_0\left(V_f - V_0\right)$	$\frac{d+2}{2}Nk\ln\left(\frac{V_f}{V_0}\right)$
Isochoric	P_f	V_0	$\frac{P_f}{P_0}T_0$	$\frac{d}{2}V_0\left(P_f - P_0\right)$	$\frac{d}{2}V_0\left(P_f - P_0\right)$	0	$\frac{d}{2}Nk\ln\left(\frac{P_f}{P_0}\right)$
Isothermal	$\frac{V_0}{V_f}P_0$	V_f	T_0	0	$P_0V_0\ln\left(\frac{V_f}{V_0}\right)$	$P_0V_0\ln\left(\frac{V_f}{V_0}\right)$	$Nk\ln\left(\frac{V_f}{V_0}\right)$
Adiabatic	$\left(\frac{T_f}{T_0}\right)^{d+2/2}P_0$	$\left(\frac{T_0}{T_f}\right)^{d/2}V_0$	T_f	$\frac{d}{2}Nk\left(T_f - T_0\right)$	0	$-\frac{d}{2}Nk\left(T_f - T_0\right)$	0

Formulas Used:

$$\gamma = \frac{d+2}{d} \qquad PV = NkT \qquad PV^{\gamma} = \text{const.}\ \text{(for adiabatic transformations)}$$

$$\Delta U = Q - W \qquad U = \frac{d}{2}NkT \qquad W = \int P\,dV$$

$$\Delta S = \int \frac{dQ}{T} \ \text{(for reversible transformations)}$$