$$\epsilon - \frac{\partial L}{\partial m} = -\epsilon_{\rm grav} \equiv \frac{{\rm D}q}{{\rm D}t}$$

$$\frac{{\rm D}e}{{\rm D}t} + P\frac{\rm D}{{\rm D}t}\left(\frac{1}{\rho}\right) \qquad T\frac{{\rm D}s}{{\rm D}t} + \sum_i \frac{\partial e}{\partial Y_i}\frac{{\rm D}Y_i}{{\rm D}t}$$

$$\frac{{\rm D}e}{{\rm D}t} + P\frac{\partial}{\partial m}(v\mathcal{A}) \qquad \frac{{\rm D}e}{{\rm D}t} - \frac{P}{\rho}\frac{{\rm D}\ln\rho}{{\rm D}t}$$

$$c_V T\frac{{\rm D}\ln T}{{\rm D}t} + \left(\rho\frac{\partial e}{\partial \rho} - \frac{P}{\rho}\right)\frac{{\rm D}\ln\rho}{{\rm D}t}$$

$$c_P T\left[(1-\nabla_{\rm ad}\chi_T)\frac{{\rm D}\ln T}{{\rm D}t} - \nabla_{\rm ad}\chi_\rho\frac{{\rm D}\ln\rho}{{\rm D}t}\right]$$

Thermodynamic Laws

Mathematical Identities

Physical Assumptions