

Thermodynamica 1

1^{ste} hoofdwet

gesloten systeem	algemeen	$1 \rightarrow 2 \quad Q_{12} = U_2 - U_1 + W_{12}$
	reversibel	$dQ = dU + pdV$
open systeem	warmte	$Q_{12} = W_i + m \left[h_2 - h_1 + \frac{\vec{V}_2^2 - \vec{V}_1^2}{2} + g(z_2 - z_1) \right]$

ideaal gas

$$pV = mRT$$

$$dU = mc_v(T)dT \quad c_p(T) - c_v(T) = R \quad k = \frac{c_p(T)}{c_v(T)}$$

$$dH = mc_p(T)dT \quad h = u + pv$$

deelprocessen 1→2

isochoor proces	$W_{12} = 0$	$Q_{12} = m(u_2 - u_1)$
isobaar proces	$W_{12} = -m(u_2 - u_1) + Q_{12}$	
reversibel	$W_{12} = p(V_2 - V_1)$	$Q_{12} = m(h_2 - h_1)$
adiabatisch proces	$W_{12} = -m(u_2 - u_1)$	$Q_{12} = 0$
reversibel	$\frac{p_1}{p_2} = \frac{p_{r1}}{p_{r2}}$	$\frac{v_1}{v_2} = \frac{v_{r1}}{v_{r2}}$
isotherm proces	$W_{12} = -m(u_2 - u_1) + Q_{12}$	
reversibel	$W_{12} = m \int_1^2 pdv$	$Q_{12} = mT(s_2 - s_1)$
ideaal gas	$W_{12} = mRT \ln \frac{v_2}{v_1} = Q_{12}$	
polytroom proces	$pV^n = \text{constant}$	
reversibel	$W_{12} = -\frac{p_2 V_2 - p_1 V_1}{n-1}$	$Q_{12} = m(u_2 - u_1) + W_{12}$
ideaal gas	$W_{12} = -mR \frac{T_2 - T_1}{n-1}$	$Q_{12} = m(u_2 - u_1) + W_{12}$

vereenvoudigingen voor ideaal gas, als bovendien $c_p = \text{constant}$, $c_v = \text{constant}$

$$m(u_2 - u_1) = mc_v(T_2 - T_1) \quad m(h_2 - h_1) = mc_p(T_2 - T_1)$$

Poisson relaties *adiabatisch* proces:

$$pV^k = \text{constant} \quad TV^{(k-1)} = \text{constant} \quad T \frac{k-1}{p} = \text{constant}$$