

Récapitulatif de thermodynamique

$$\theta = T - 273,15$$

$$R = 8,314$$

$$PV = nRT \quad (GP)$$

1^{er} principe

$$dU = \underbrace{\delta W}_{=-PdV} + \delta Q$$

$$dU = TdS - PdV$$

$$dU = C_v dT \quad (GP)$$

$$dH = C_p dT \quad (GP) \quad H = U + PV$$

$$C_p - C_v = R \quad \gamma = \frac{C_p}{C_v} \quad C_x = m_\Sigma c_x = n C_{mx}$$

2^{ème} principe

$$dS = \underbrace{\delta S^r}_{=\frac{\delta Q}{T}} + \underbrace{\delta S^p}_{\substack{=0 \text{ rev} \\ >0 \text{ irrev}}}$$

$$dS = \frac{dE - \delta W}{T}$$

$$dS = C_v \frac{dT}{T} + nR \frac{dV}{V} \quad (GP)$$

$$PV^\gamma = cte \quad (dS = 0)$$

Coefficients calorimétriques et thermoélastiques

	Forces de pression		Forces de traction
Calorimétriques	$dS = \frac{C_v}{T} dT + \frac{l}{T} dV$	$dS = \frac{C_p}{T} dT + \frac{h}{T} dP$	$dS = \frac{C_f}{T} dT + \frac{h}{T} df$
Thermoélastiques	$\frac{dV}{V} = \alpha dT - \chi dP \quad \beta = \frac{1}{P} \left(\frac{\partial P}{\partial T} \right)_V \quad \alpha = P\beta\chi$		$\frac{dL}{L} = \lambda dT + \frac{1}{sE} df$

Machines thermique

$$\Delta U = W + Q_c + Q_f = 0 \quad \Delta S = S^p + \frac{Q_f}{T_f} + \frac{Q_c}{T_c} = 0$$

Fonctionnement moteur	Fonctionnement PAC/Frigo	Cycle de Carnot
Cycle de Beaux de Rochas	Cycle de Diesel	Cycle de Stirling

Systèmes ouverts

$$h = u + \frac{P}{\mu} \quad P = \mu r T \quad r = \frac{R}{M} \quad D_m = \mu S v$$

$$\frac{dM}{dt} = D_{me} - D_{ms} \quad \frac{dE}{dt} = \left(\frac{v_e^2}{2} + gz_e + h_e \right) D_{me} - \left(\frac{v_s^2}{2} + gz_s + h_s \right) D_{ms} + \mathcal{P}_u + \mathcal{P}_{th}$$

$$\frac{dS}{dt} = s_e D_{me} - s_s D_{ms} + \frac{\mathcal{P}_{th}}{T_a} + \frac{\delta S^p}{dt} \quad \frac{d\vec{p}}{dt} = \vec{v}_e D_{me} - \vec{v}_s D_{ms} + \vec{F}_{ext}$$