1er principe P.V.T

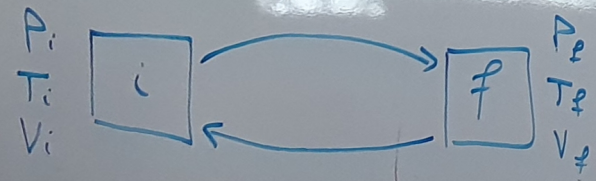
de la Thermodynamique

quantité de chaleur

$$\Delta U = Q + W$$

énergie interne — travail

- Transformation réversible :



- IsoTherme

$T = cte \Rightarrow T_f = T_i$

$\Delta T = T_f - T_i \Rightarrow \boxed{\Delta T = 0}$

$\boxed{P.V = cte} \Rightarrow P_i.V_i = P_f.V_f$

$\Delta U = n.C_v.\Delta T^{\circ} \Rightarrow \boxed{\Delta U = 0}$

$\Delta H = n.C_p.\Delta T^{\circ} \Rightarrow \boxed{\Delta H = 0}$

enthalpie

$\Delta U \overset{0}{=} Q + \omega$

$Q + \omega = 0 \Rightarrow \boxed{Q = -\omega}$

$\omega = -\int_{V_i}^{V_f} P \cdot dV$

$P \cdot V = nRT \Rightarrow P = \frac{nRT}{V}$

$\omega = -\int_{V_i}^{V_f} \frac{nRT}{V} \cdot dV$

$\omega = -nRT \int_{V_i}^{V_f} \frac{dV}{V}$

$\omega = -nRT \cdot Ln\, V \Big|_{V_i}^{V_f}$

$\boxed{\omega = -nRT\, Ln \frac{V_f}{V_i}}$

$P_i \cdot V_i = P_f \cdot V_f$

$\frac{P_i}{P_f} = \frac{V_f}{V_i}$

$\boxed{\omega = -nRT \cdot Ln \frac{P_i}{P_f}}$

• Isobare

$P = ct^s \Rightarrow \boxed{\Delta P = 0}$

$\boxed{\frac{T}{V} = ct^s}$

$\Delta U = \eta \cdot C_v \cdot \Delta T$

$\Delta H = \eta \cdot C_p \cdot \Delta T$

$\omega = -\int_{V_i}^{V_f} P \, dV = -P \int_{V_i}^{V_f} dV$

$\boxed{\omega = -P \left[V_f - V_i \right]}$

$Q = \eta \cdot C_p \, \Delta T$

$\boxed{Q = \Delta H}$

• Isochore

$V = ct^s \Rightarrow \boxed{\Delta V = 0}$

$\boxed{\frac{T}{P} = ct^s}$

$\Delta U = \eta \, C_v \cdot \Delta T$

$\Delta H = \eta \cdot C_p \cdot \Delta T$

$\omega = -\int_{V_i}^{V_f} P \, dV$

$\boxed{\omega = 0}$

$Q = \eta \cdot C_v \cdot \Delta T$

$\boxed{Q = \Delta U}$

- Adiabatique

$Q = 0$

$$\begin{cases} P \cdot V^{\gamma} = ctr \\ T \cdot V^{\gamma-1} = ctr \\ T^{\gamma} \cdot P^{1-\gamma} = ctr \end{cases}$$

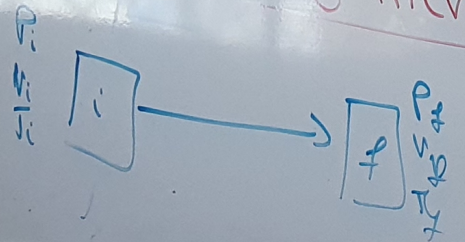
$\Delta U = n C_v \Delta T$

$\Delta H = n C_p \Delta T$

$\Delta U = W + Q^{=0}$

$\boxed{W = \Delta U}$

Transformation irréversible :



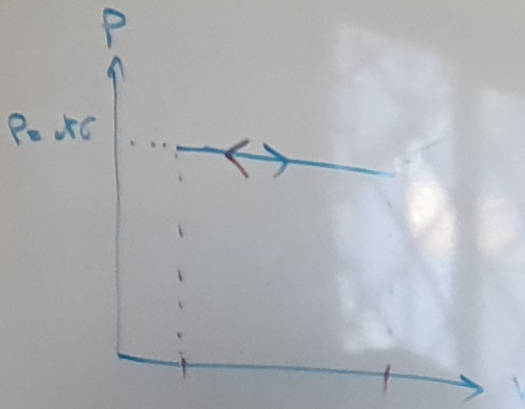
$W_{irrev} = -P_f \cdot (V_f - V_i)$

$C_v = \dfrac{R}{\gamma - 1}$ — ~~8,32~~ 8,314 / 2

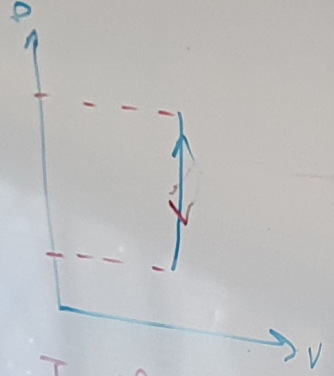
$C_p = C_v \cdot \gamma$

Diagramme de Clapeyron

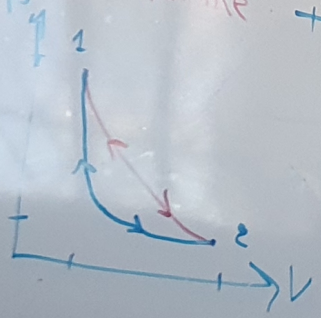
- Isobare $P = cte$



- Isochore $V = cte$



- Isotherme + Adiabatique



$$W_{irrev} = -P_f \cdot (V_f - V_i)$$

$$C_V = \frac{R}{\gamma - 1}$$

~~8,082~~ — 8,314

2

$$C_p = C_v \cdot \gamma$$