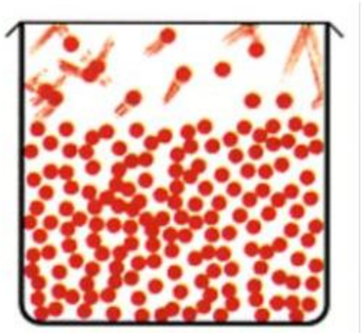
LIQUIDI

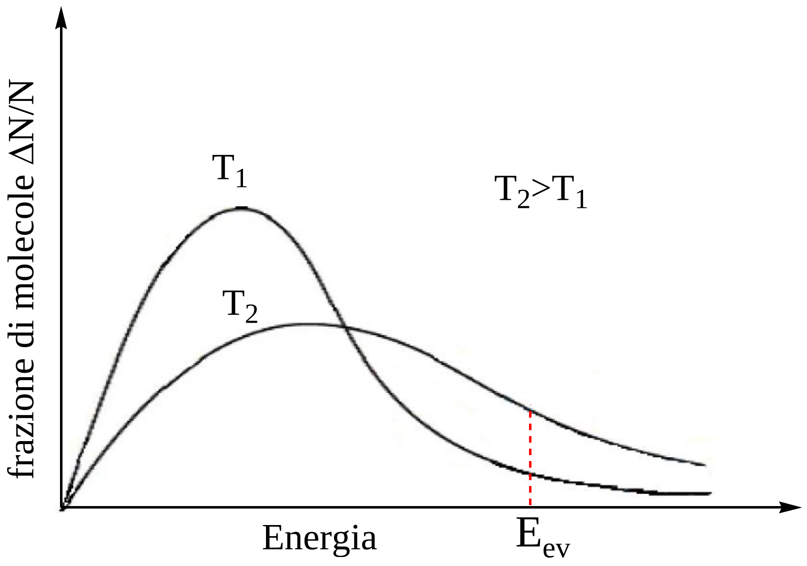
Volume liquidi < Volume gas
- Molecole libere di muoversi
- Forze intermolecolari $\neq 0$

- Volume proprio, non forma propria

- Ordine a corto raggio
- Disordine a lungo raggio

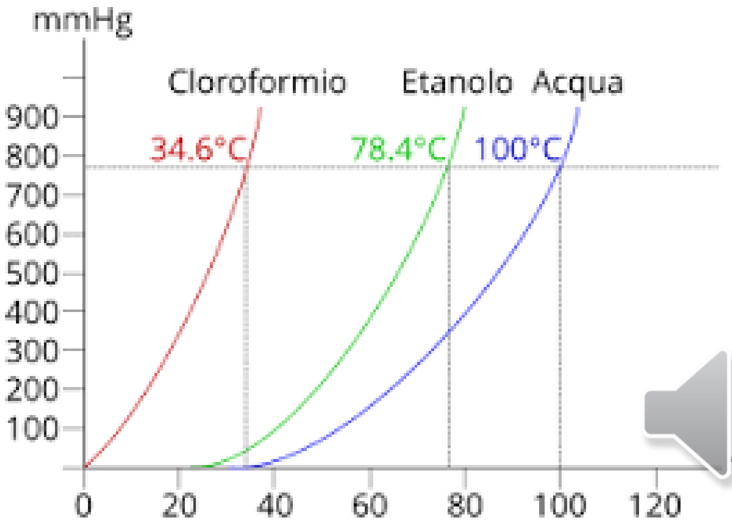
- Poco comprimibili
- Isotropia





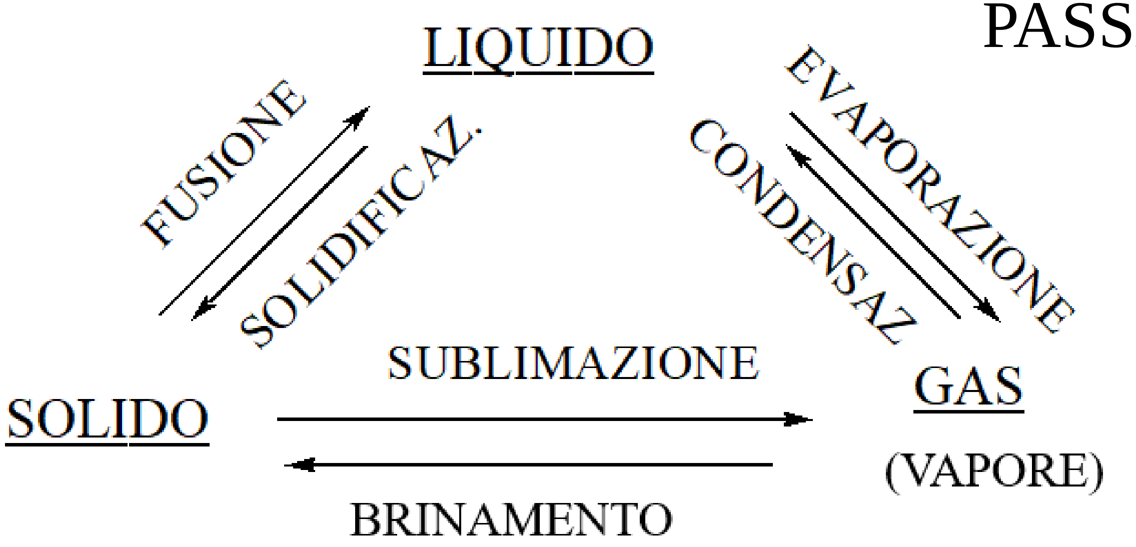
Tensione di vapore

$$P = P^\circ e^{-\frac{\Delta H_{ev}}{RT}}$$



Liquido-vapore → evaporazione
ΔHev → entalpia
(calore latente) di evaporazione

PASSAGGI DI STATO

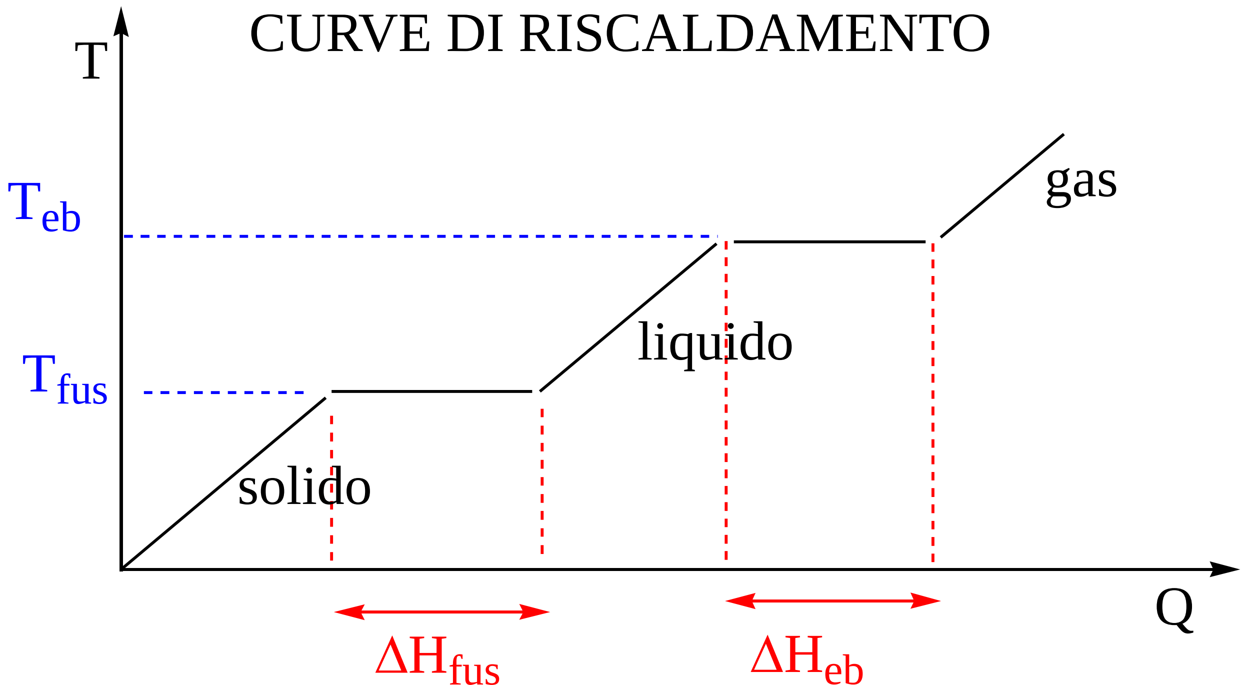


$\Delta H sol = - \Delta H fus$

$\Delta H cond = - \Delta H ev$

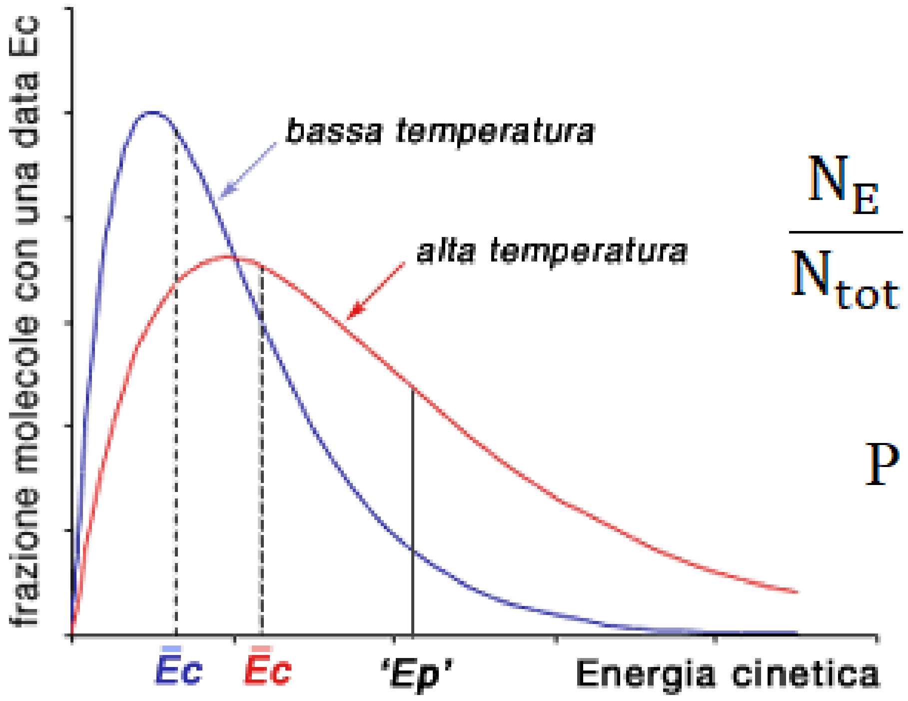
$\Delta H sub = \Delta H fus + \Delta H ev$

CURVE DI RISCALDAMENTO



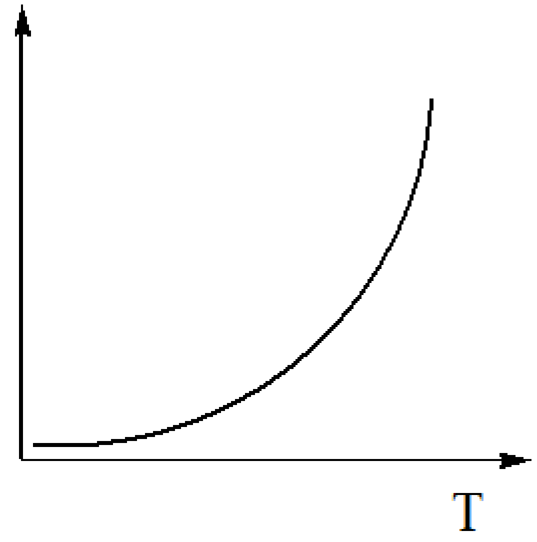
Liquido-vapore → evaporazione

ΔH_{ev} → entalpia (calore latente) di evaporazione



$$\frac{N_E}{N_{tot}} = e^{-\frac{E}{kT}} = e^{-\frac{E_{mol}}{RT}}$$

$$P = P_0 \cdot e^{-\frac{\Delta H_{ev}}{RT}}$$



Solido-vapore → sublimazione

ΔH_{sub} → entalpia (calore latente) di sublimazione

$$P = P_0 \cdot e^{-\frac{\Delta H_{sub}}{RT}}$$

$G = H - TS \qquad H = E + PV \qquad \Rightarrow G = E + PV - TS$

$dG = dE + PdV + VdP - TdS - SdT$

$E = Q - W \Rightarrow dE = \delta Q - \delta W = TdS - PdV \qquad \Rightarrow dE - TdS + PdV = 0$

$dG = \underline{dE} + \underline{PdV} + VdP - \underline{TdS} - SdT = VdP - SdT$

T=costante $\qquad dG = VdP$

Gas ideale

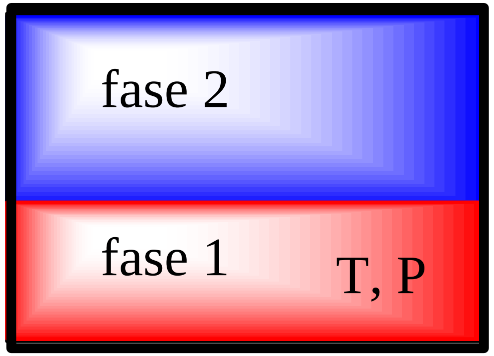
$$V = \frac{RT}{P} \Rightarrow dG = \frac{RT}{P} dP$$

$$\Delta G = G - G° = \int_{G°}^{G} dG = \int_{P°}^{P} \frac{RT}{P} dP = RT \ln \frac{P}{P°}$$

$$G = G° + RT \ln \frac{P}{P°}$$

$P° = 1{,}0$ atm $\qquad G = G° + RT\ln P$

Equazione di Clausius-Clapeyron



All'equilibrio $G_1=G_2$

Perturbazione $dG_1=dG_2$

$G_i= H_i-TS_i \Rightarrow dH_1-TdS_1-S_1dT=dH_2-TdS_2-S_2dT$

$H_i= E_i+PV_i \Rightarrow \underline{dE_1}+\underline{PdV_1}+V_1dP-\underline{TdS_1}-S_1dT=\underline{dE_2}+\underline{PdV_2}+V_2dP-\underline{TdS_2}-S_2dT$

$dE=dQ-dW=TdS-PdV \Rightarrow dE-TdS+PdV=0$

$V_1dP-S_1dT=V_2dP-S_2dT \Rightarrow (V_2-V_1)dP=(S_2-S_1)dT \Rightarrow \Delta Vdp=\Delta SdT$

$$\frac{dP}{dT}=\frac{\Delta S}{\Delta V}$$

All'equilibrio
$\Delta G=\Delta H-T\Delta S=0$

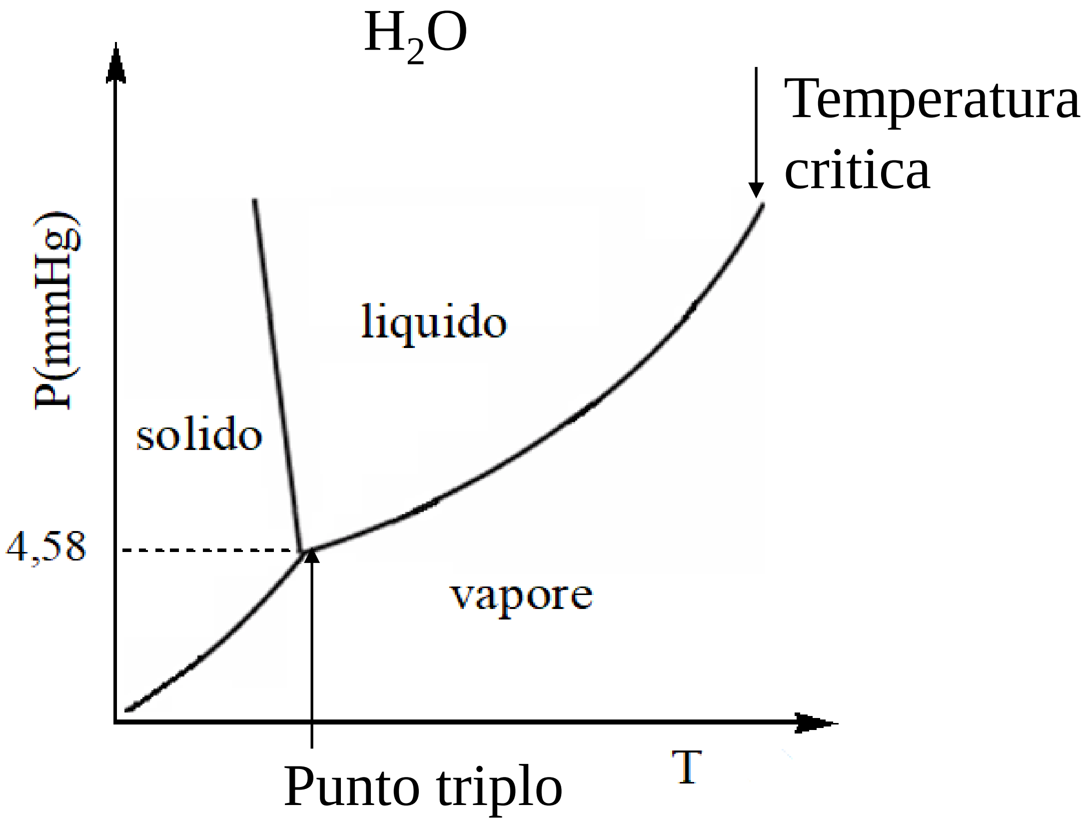
$$\Rightarrow \Delta S=\frac{\Delta H}{T} \Rightarrow \boxed{\frac{dP}{dT}=\frac{\Delta H}{T\Delta V}}$$

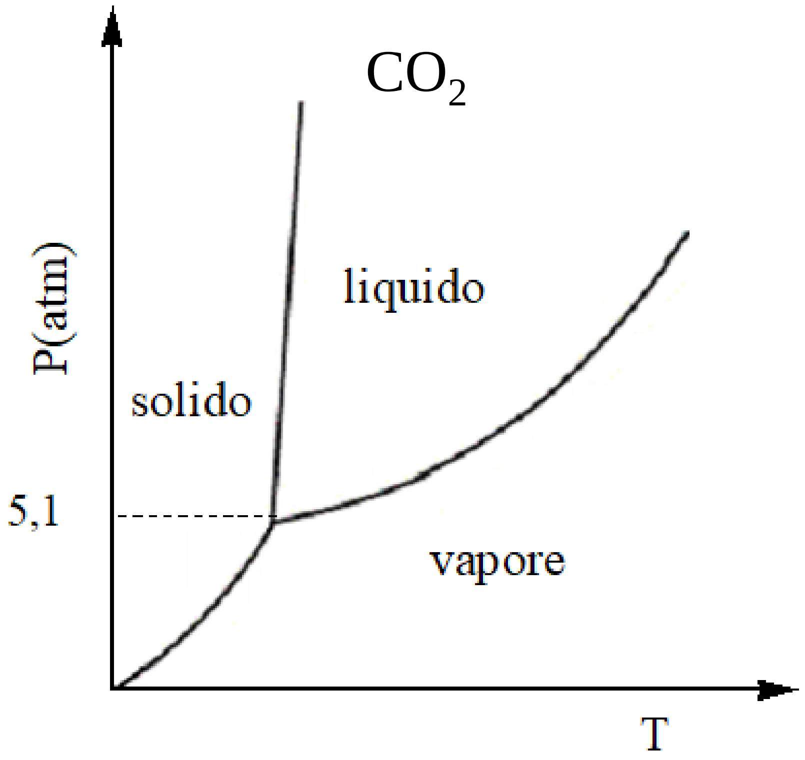
Fase 2 = gas $\Delta V=(V_2-V_1)\cong V_2= V$

$$V=\frac{RT}{P} \Rightarrow \frac{dP}{dT}=\frac{P\Delta H}{RT^2}$$

$$\frac{dP/P}{dT}=\frac{d\ln P}{dT}=\frac{\Delta H}{RT^2} \Rightarrow \ln\frac{P}{P^\circ}=-\frac{\Delta H}{RT} \Rightarrow P=P^\circ e^{-\frac{\Delta H}{RT}}$$

DIAGRAMMI DI STATO





$$\frac{dP}{dT} = \frac{\Delta H}{T\Delta V}$$

$$P = P^{\circ} e^{-\frac{\Delta H_{ev}}{RT}}$$

$$P = P^{\circ} e^{-\frac{\Delta H_{sub}}{RT}}$$