

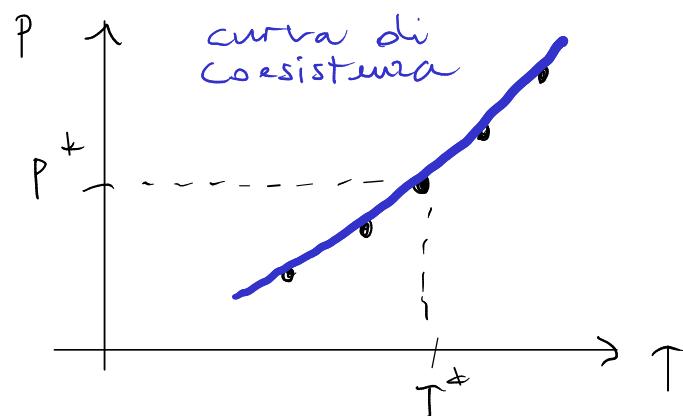
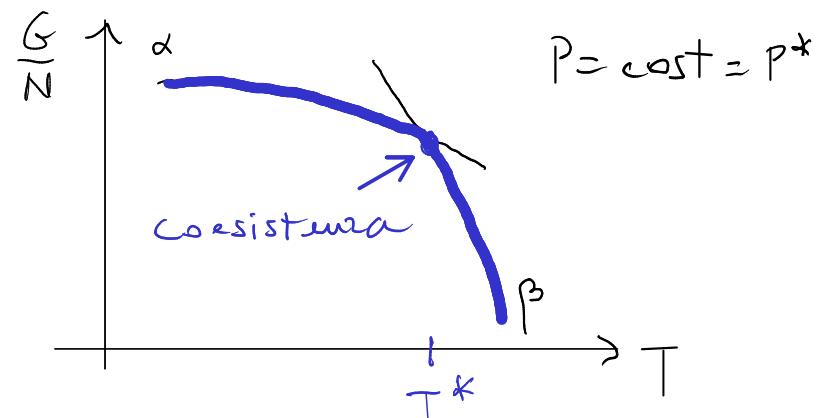
# DIAGRAMMI DI FASE

α β Coesistenza di fase : equilibrio termico ( $T_\alpha = T_\beta$ ), meccanico ( $P_\alpha = P_\beta$ ), chimico ( $\mu_\alpha = \mu_\beta$ )

Potenziale di Gibbs :  $G = E - TS + PV$

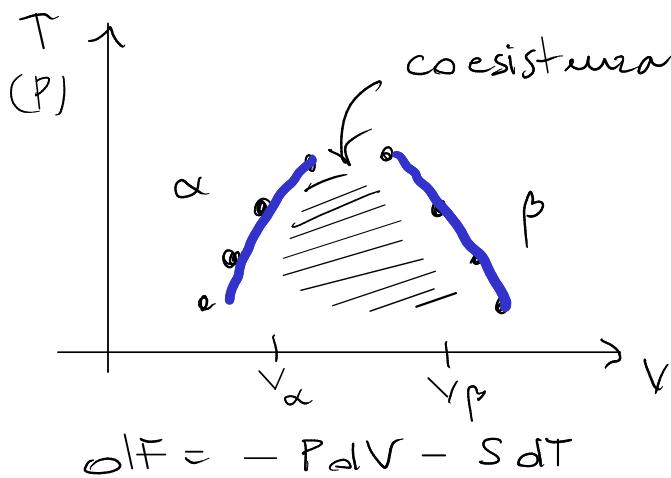
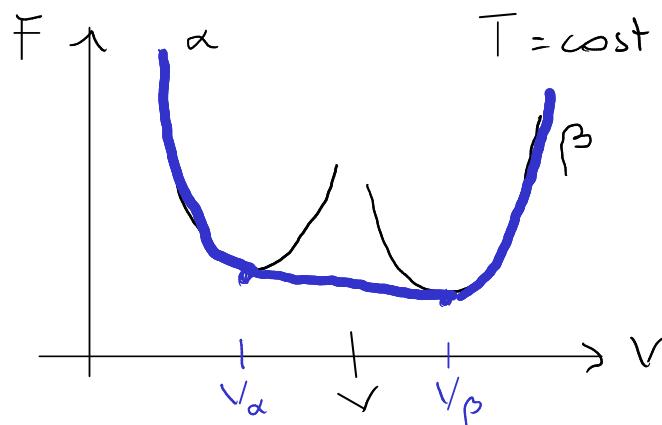
$P = \text{cost}$ ,  $T = \text{cost}$   $g = G/N = \mu$

equilibrio :  $\min \{ g_\alpha, g_\beta \}$



Potenziale di Helmholtz :  $F = E - TS$

$V = \text{cost}$   $T = \text{cost}$



Equazione clausius - Clapeyron

$$\frac{dP}{dT} = \frac{L_{\alpha\beta}}{T(\sigma_\beta - \sigma_\alpha)} \quad \alpha \rightarrow \beta$$

$$\begin{cases} L_{\alpha\beta} = \text{calore latente per part.} \\ \sigma = \frac{V}{N} \rightarrow \text{volume specifico} \end{cases}$$

Tangente comune  $x = x_\alpha$   
 $1-x = x_\beta$

$$\begin{cases} \frac{\partial F}{\partial x}(V_\alpha) = \frac{\partial F}{\partial x}(V_\beta) \quad (*) \\ F(V_\alpha) = F(V_\beta) + \frac{\partial F}{\partial V}(V_\beta)(V_\alpha - V_\beta) \end{cases}$$

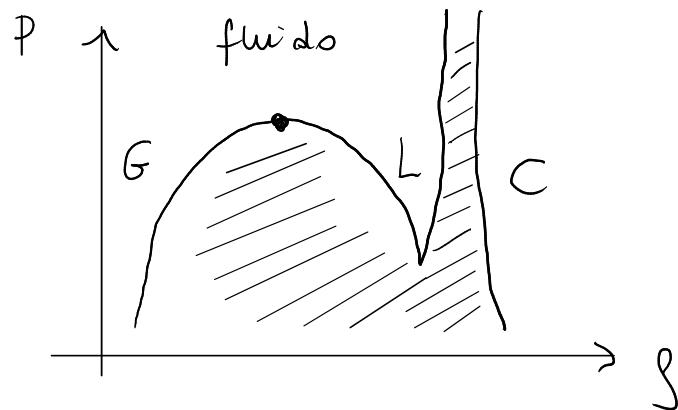
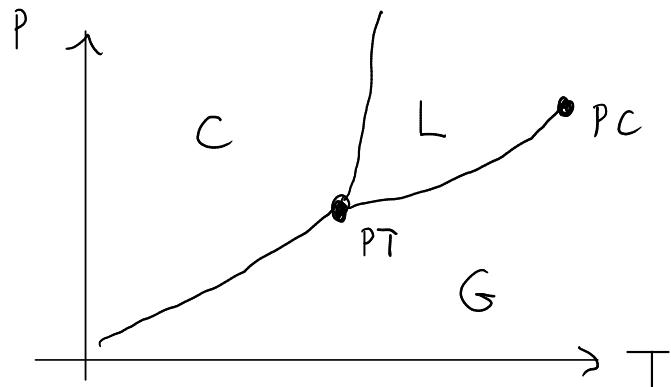
$$F(V_\beta) - \frac{\partial F}{\partial V}(V_\beta) V_\beta = F(V_\alpha) - \frac{\partial F}{\partial V}(V_\alpha) V_\alpha$$

$$F_\beta + P_\beta V_\beta = F_\alpha + P_\alpha V_\alpha \rightarrow G_\alpha = G_\beta$$

# TOPOLOGIA DEI DIAGRAMMI DI FASE

## Sistemi atomici / molecolari

1. Sistemi "normali" es.: Argon

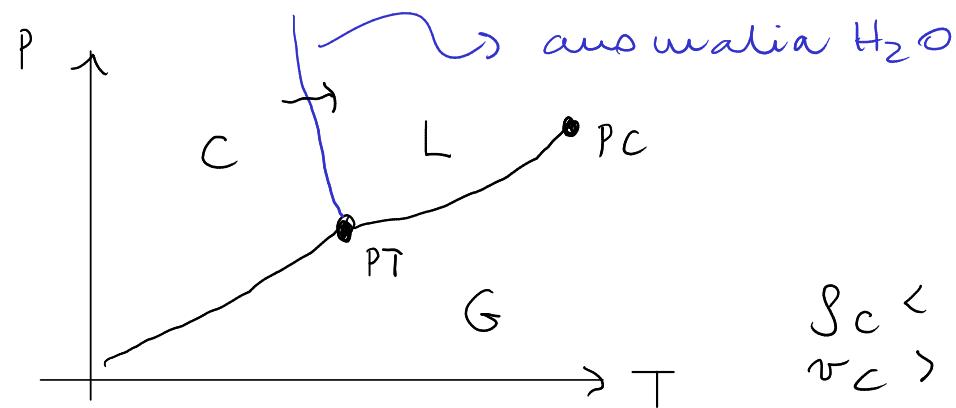


$$\frac{dP}{dT} = \frac{L_{\alpha\beta}}{T(\nu_{\beta} - \nu_{\alpha})}$$

$$\alpha = C, \beta = L$$

$$\begin{cases} L_{CL} > 0 \\ T > 0 \\ \nu_L > \nu_C \end{cases} \Rightarrow \frac{dP}{dT} > 0$$

2. Sistemi "anomali" es.: H<sub>2</sub>O, Si, Ge



$$\begin{cases} \rho_C < \rho_L \\ \nu_C > \nu_L \end{cases} \Rightarrow \frac{dP}{dT} < 0$$

3. Transizioni liquido-liquido: H<sub>2</sub>O, Si, Ge  
P<sub>1</sub>, S<sub>1</sub>, ...

