

Gibbs Free Energy Near Freezing/Melting [pln36]

First-order phase transition at $T = \text{const}$ or $p = \text{const}$.

Control variables: T, p, N .

Gibbs free energy: $G(T, p, N) = U - TS + pV = \mu N$.

Differential: $dG = -SdT + Vdp + \mu dN$.

Volume: $V = \left(\frac{\partial G}{\partial p} \right)_{T, N}$.

Entropy: $S = - \left(\frac{\partial G}{\partial T} \right)_{V, N}$.

Chemical potential: $\mu = \left(\frac{\partial G}{\partial N} \right)_{T, p} = \frac{G}{N}$.

Freezing/melting point at (T_m, p_m) for $N \rightarrow \infty$.

Latent heat of melting: $L_m = T_m \Delta S$.

