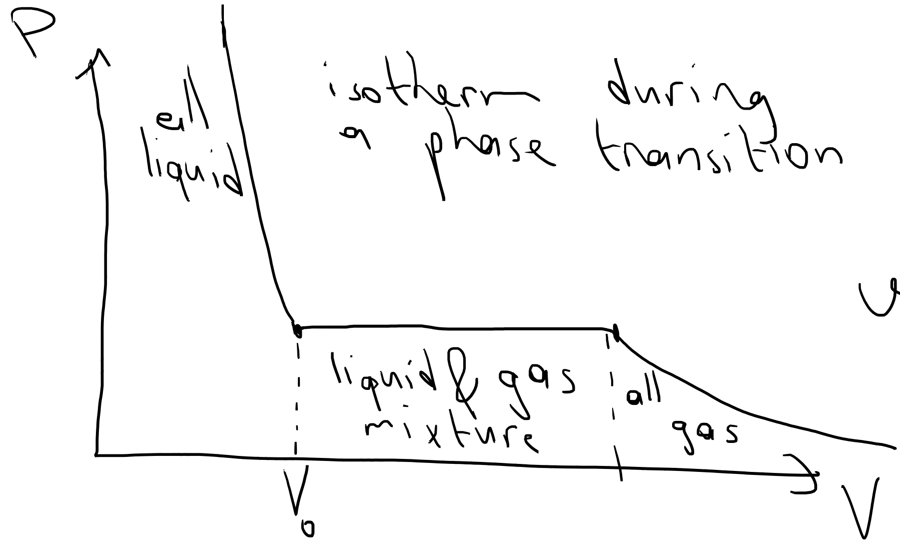


isotherm during a phase transition

$\left(\frac{\partial P}{\partial V}\right)_T$ is discontinuous.

$v \equiv \left(\frac{V}{N}\right)$ discontinuous (order parameter)

$\frac{\partial V}{\partial}$ $\quad dN$

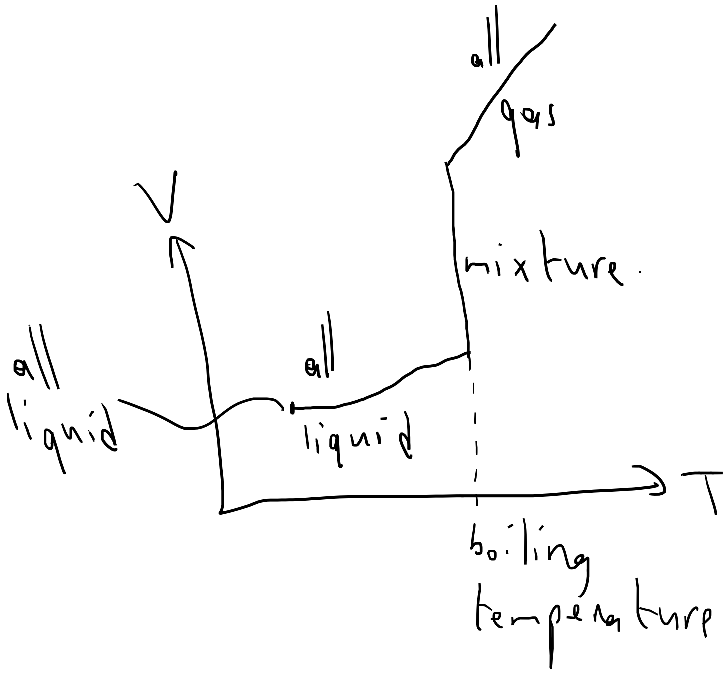
$\mu_A = \mu_B$

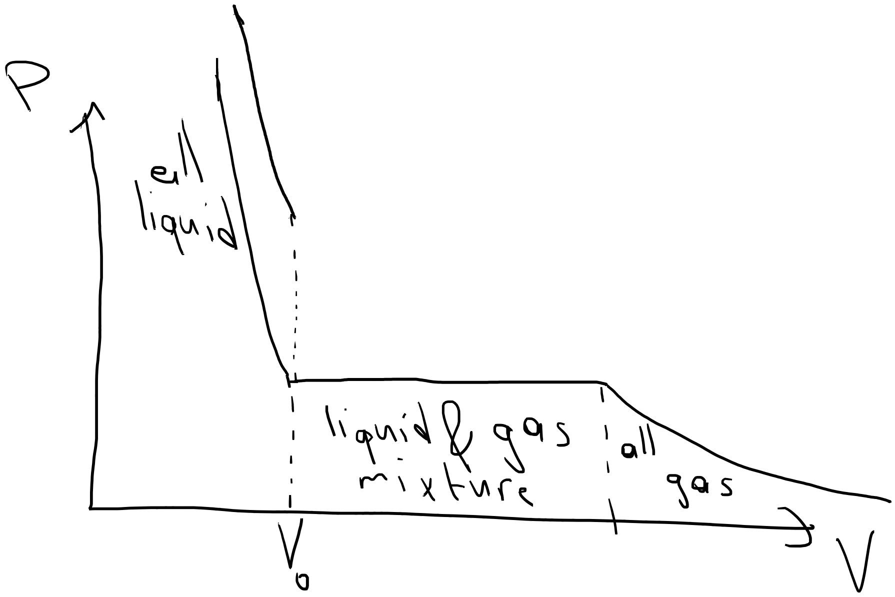
$$\boxed{PV = NkT}$$

$V = \text{const}$

$P\downarrow, N\downarrow \not\Rightarrow T\downarrow$

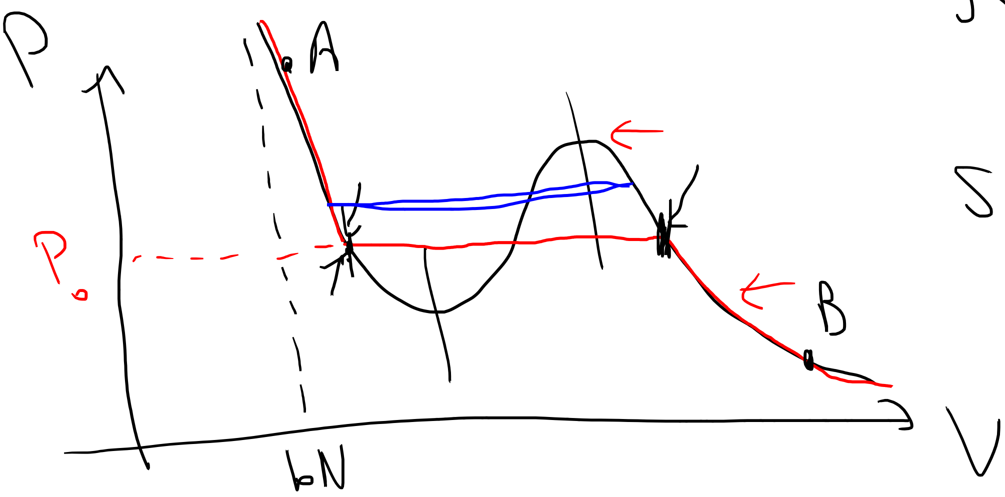
$E = 3NkT$





Van der Waals Gas

$$\left(P + a\frac{N^2}{V^2}\right)(V - bN) = NkT$$



$$K_T = -\frac{1}{V}\left(\frac{\partial V}{\partial P}\right)_T$$

S is maximum

$$\Rightarrow K_T > 0$$

$$\Downarrow$$

$$\left(\frac{\partial P}{\partial V}\right)_T < 0$$

Maxwell's Construction

$\mu(P,T)$ $\quad d\mu = 0$

S, A, q

$$dq = -S\,dT - P\,dV - N\,d\mu$$

$$q(T, \underset{\xi}{V}, \mu) = V \underbrace{f(T,\mu)}_{\xi}$$

$$P = -\left(\frac{\partial q}{\partial V}\right)_{T,\mu} = f(T,\mu)$$

$$q = -PV$$

$$dq = -S\,dT - P\,dV - N\,d\mu$$

$$\cancel{-P\,dV} - V\,dP = -S\,dT - \cancel{P\,dV} - N\,d\mu$$

$$d\mu = \left(\frac{V}{N}\right)dP - \left(\frac{S}{N}\right)dT$$

$$\boxed{d\mu = v\,dP - s\,dT}$$

$d\mu = 0$ during transition.

if $dT = 0 \Rightarrow d\mu = v\,dP$

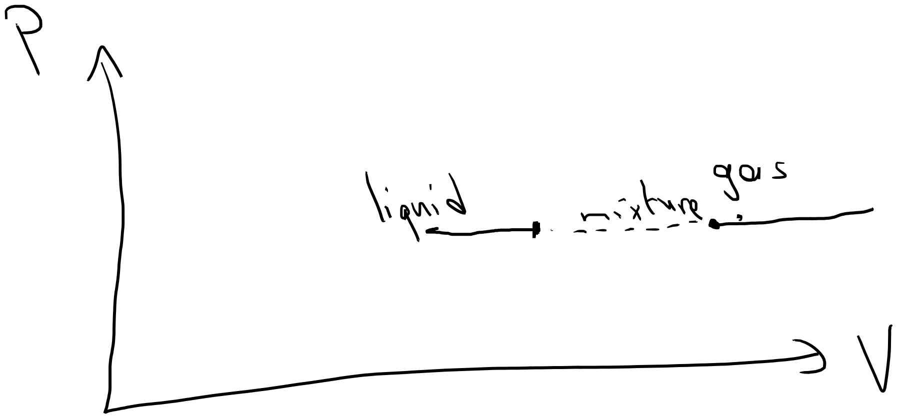
$$\Delta\mu = \int_{V_1}^{V_2} v\,dP = 0$$

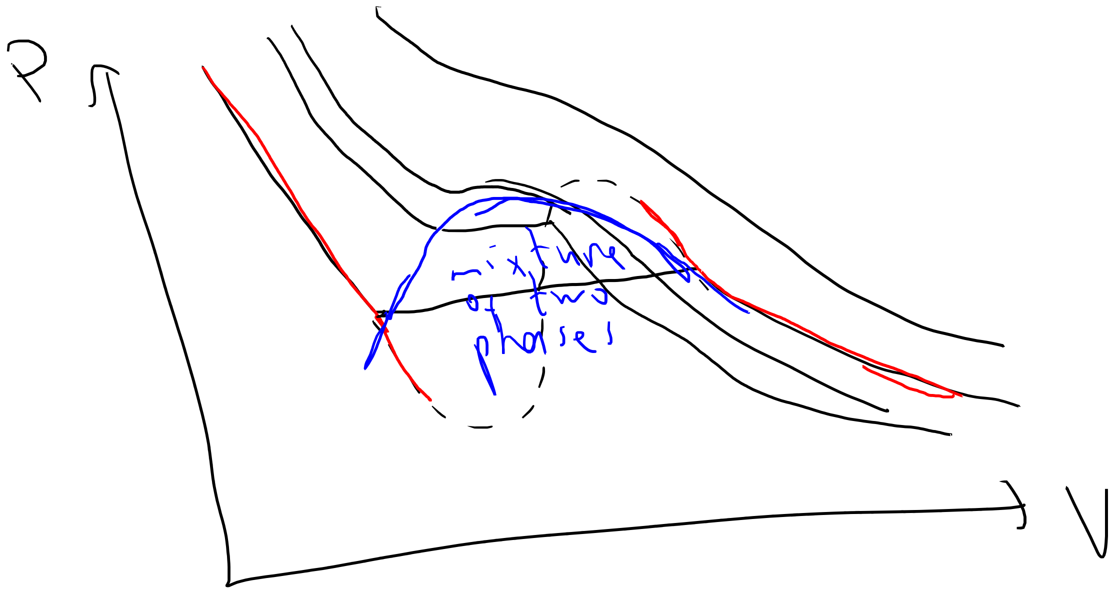
solids liquids gas

tar - liquid in "normal conditions"

$$PV = NkT$$

$$\left(\frac{V}{N}\right) = \frac{kT}{P}$$

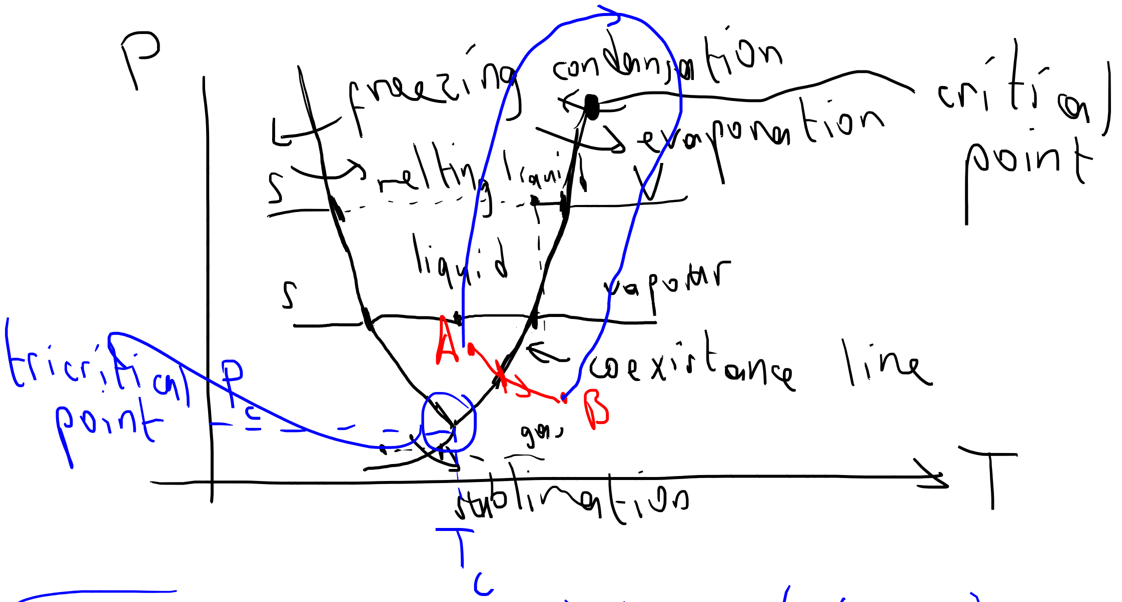




supercooled
superheated systems

nucleation sites

$$\frac{\partial P}{\partial V} < 0$$
if $T > T_c$



amorphous solids (is glass a liquid?)

$T_c = 0.01^\circ C$