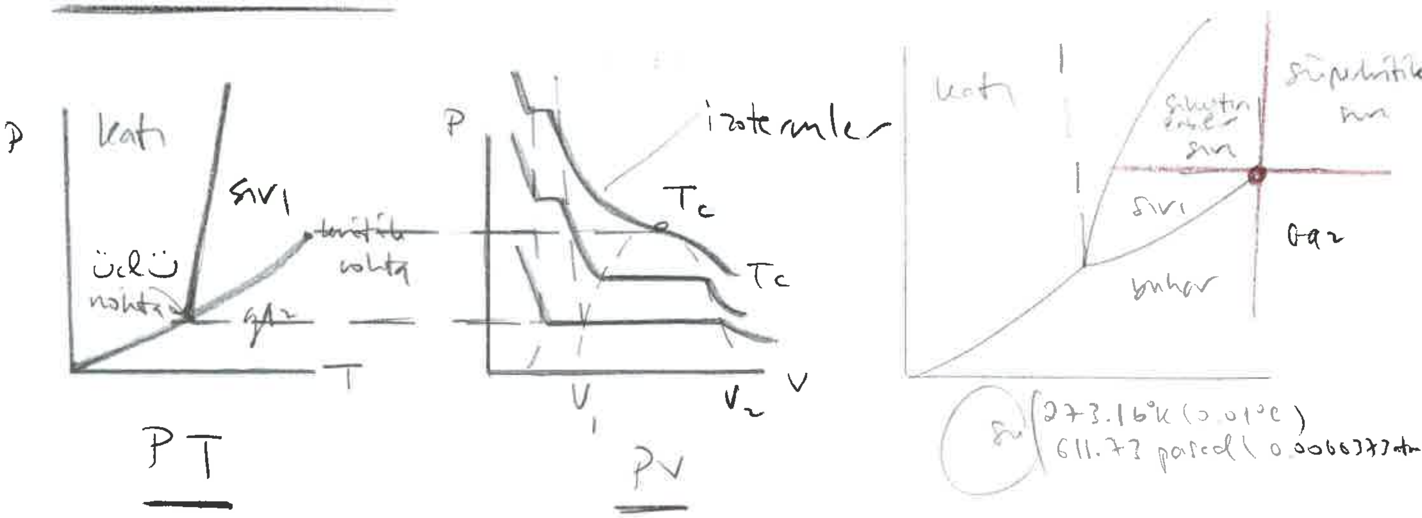
BÖLÜM 2_ TERMODİNAMİĞİN BAZI UYGULAMALARI

2.1. Faz Geçişleri:



PT

PV

(i) Faz geçişi esnasında P ve T sbt kalır

(ii) Gaz-sıvı karışımında sıvı 1 durumunda
gaz 2 " bulunur.

(iii) Sıvının kütlesi m_1, gazınki m_2 olsun. Verilen bir T ve P(T) denge durumunda G enerjisi minimum olur. $\delta G=0$

$$m_1+m_2=\text{sbt} \Rightarrow -\delta m_1=\delta m_2$$

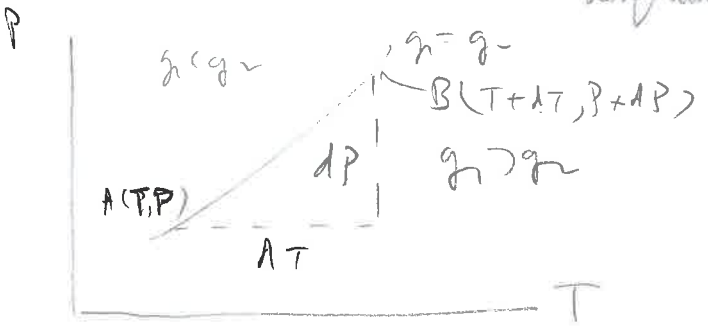
birim kütle başına Gibbs enerjisi g_1 ve g_2 olsun

$$G=m_1 g_1+m_2 g_2 \quad \delta G=0 \Rightarrow -(g_1-g_2)\delta m=0$$

denge durumu

$$\Downarrow$$

$$\boxed{g_1=g_2}$$

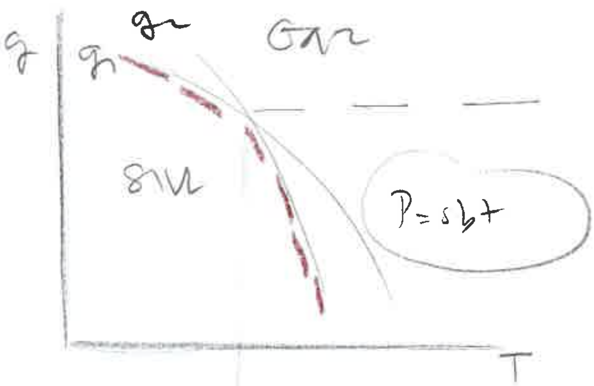


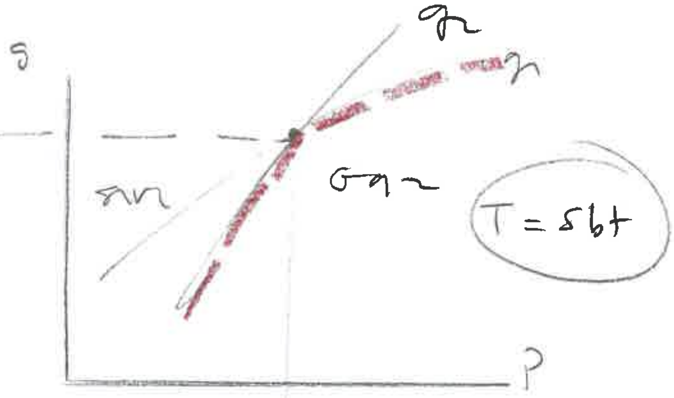
BS K

birim / pt.

$$\left(\frac{\partial g}{\partial T}\right)_P = -s \quad \text{birim kütle başına entropi}$$

$$\left(\frac{\partial g}{\partial P}\right)_T = v \quad \text{" " " karşılık gelen hacim.}$$





Geçiş sıcaklığı

buhar basıncı

$\Delta s = s_2 - s_1$

$$\frac{\partial}{\partial T}(g_2 - g_1)\Big|_P = -s_2 + s_1 < 0 \qquad \frac{\partial \Delta g}{\partial T}\Big|_P = -\Delta s$$

Δv

$$\frac{\partial}{\partial P}(g_2 - g_1)\Big|_T = v_2 - v_1 > 0 \qquad \frac{\partial \Delta g}{\partial P}\Big|_T = \Delta T$$

Δg

$$\frac{\partial \Delta g/\partial T|_P}{\partial \Delta g/\partial P|_T} = -\frac{\Delta s}{\Delta T} \qquad \frac{\partial \Delta g}{\partial T}\Big|_P \frac{\partial T}{\partial P}\Big|_{\Delta g} \frac{\partial P}{\partial \Delta g}\Big|_T = -1$$

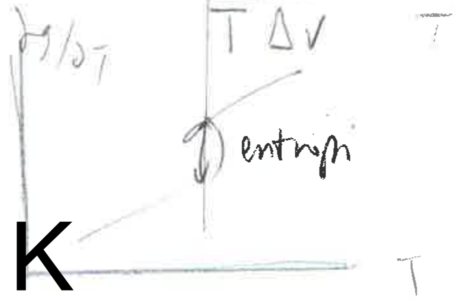
$$= -\left(\frac{\partial P}{\partial T}\right)_{\Delta g}$$

$$\frac{dP(T)}{dT} = \frac{\Delta s}{\Delta v} \Leftarrow \Delta s = \frac{\Delta Q}{T}$$

gizli ısı.

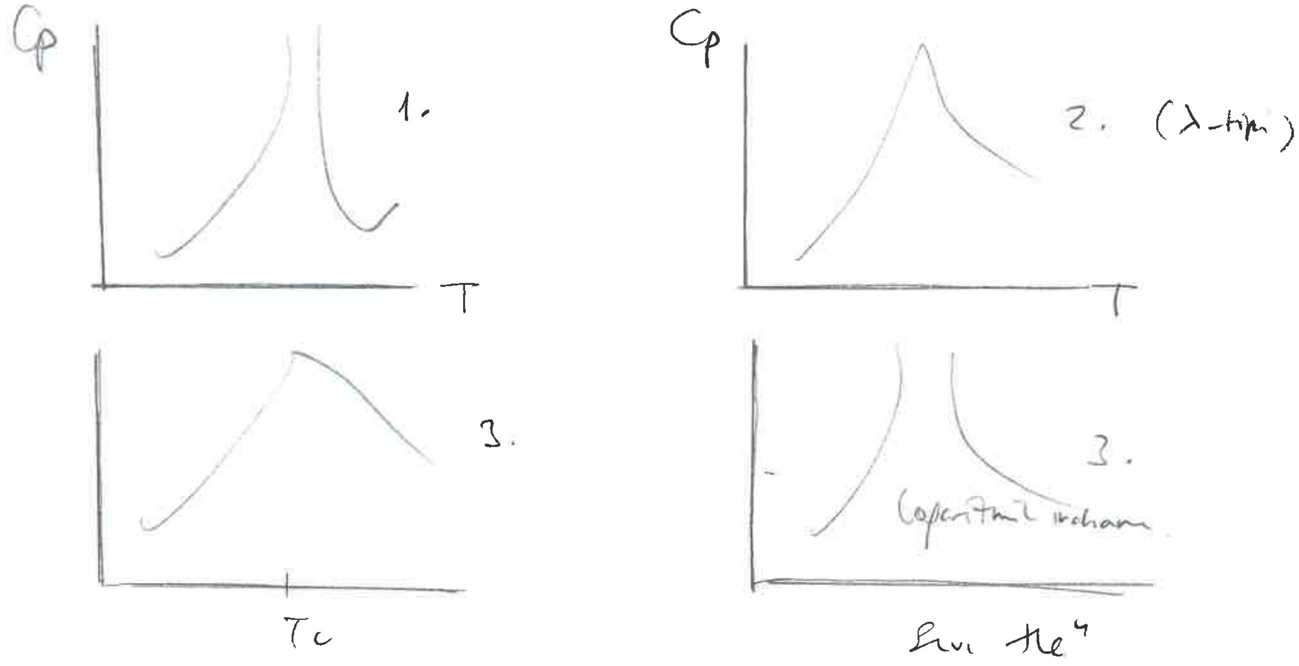
$$= \frac{\Delta Q}{T \Delta v} = \frac{L}{T \Delta v}$$

Clapeyron eşitliği.

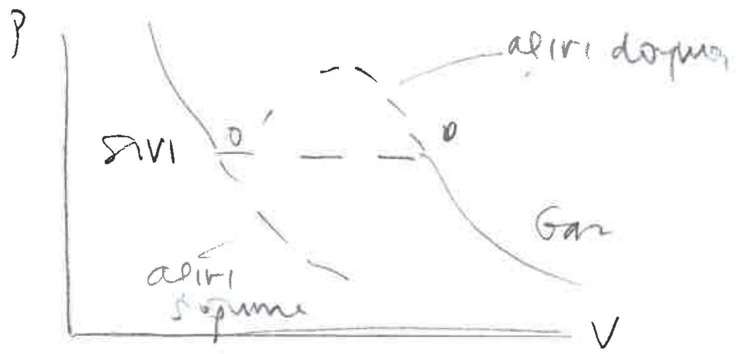


Ehrenfest sınıflandırması :

$$\left.\begin{array}{l} \dfrac{\partial^n g_1}{\partial T^n} \neq \dfrac{\partial^n g_2}{\partial T^n} \\[2ex] \dfrac{\partial^n g_1}{\partial p^n} \neq \dfrac{\partial^n g_2}{\partial p^n} \end{array}\right\} \text{ n. mertebeden faz geçişi}$$



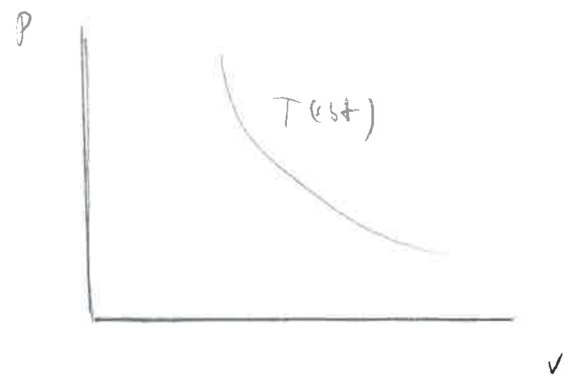
2.2. Yoğunlaşmada yüzey etkileri

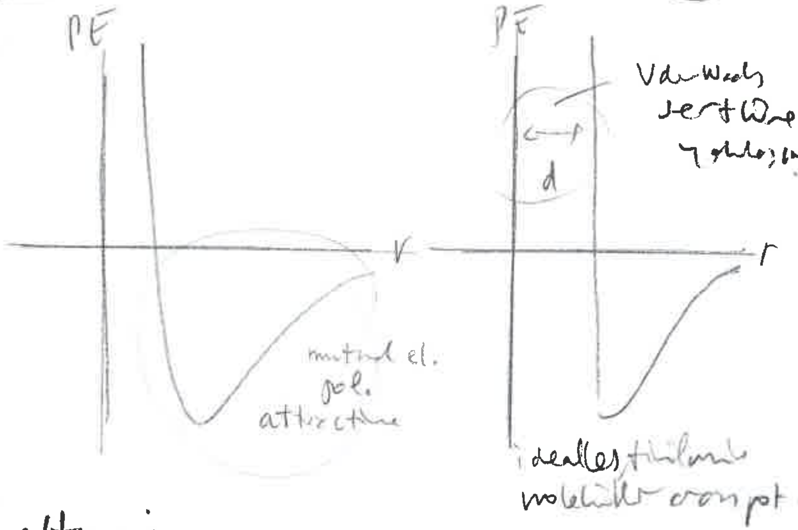


bir gazı izotermal olarak sıkıştırırsak O da yoğuşmaya başlar

BS K

2.3. Van der Waals Durum Denklemi :

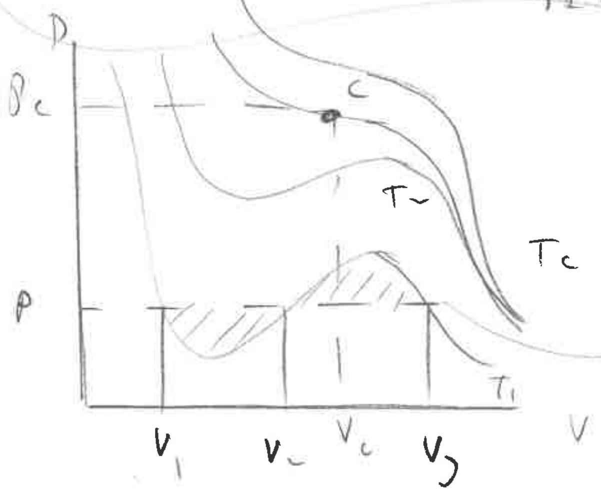




$V_{etk} = V - b$ hacim düzeltmesi

$P = P_{kin} - \dfrac{a}{V^2}$ bağlı durum olması sebebi ile gerçek basınç da düşük.

$(V-b)\left(P+\dfrac{a}{V^2}\right) = nRT = RT$
1 mol



bu üç kök $T \to T_c$ iken V_c ye yaklaşır.

$(V-V_c)^3 = 0$

$\Rightarrow V^3 - 3V^2V_c + 3VV_c^2 - V_c^3 = 0$ bunu $T=T_c$ $P=P_c$ de bununla kıyaslarsak

$(V-b)\left(P_c+\dfrac{a}{V^2}\right) = RT_c$

$P_cV^3 - ab - bP_cV^2 - V^2RT_c + aV = 0$

$3V_c = b + \dfrac{RT_c}{P_c}$

$3V_c^2 = a/P_c$

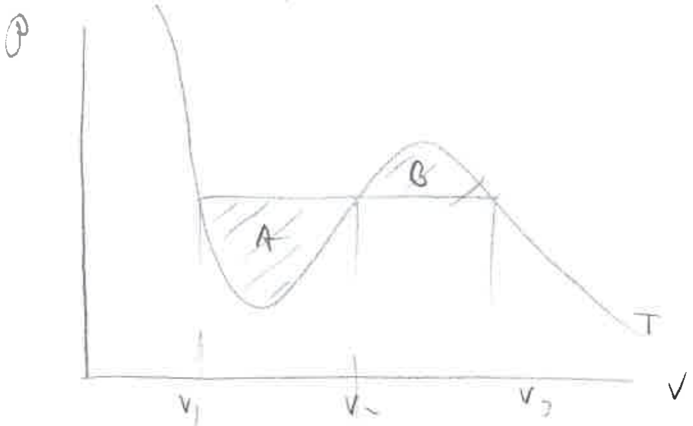
$V_c^3 = ab/P_c$

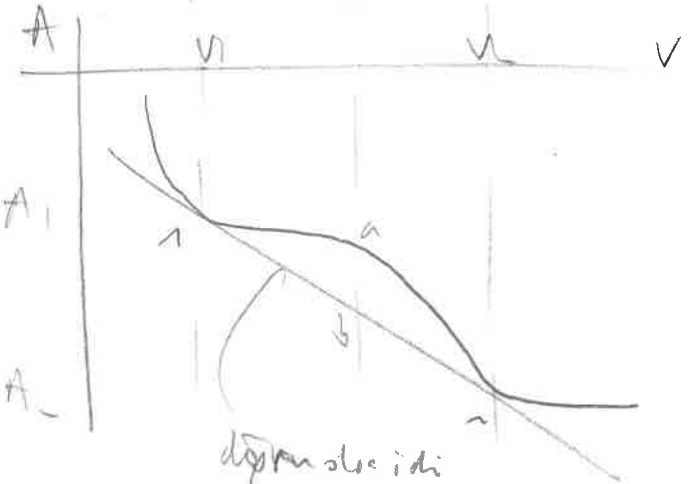
$\bar{P} = P/P_c$ $\bar{T} = T/T_c$ $\bar{V} = V/V_c$ dersek $\left(\bar{P}+\dfrac{3}{\bar{V}^2}\right)\left(\bar{V}-\dfrac{1}{3}\right) = \dfrac{8}{3}\bar{T}$

karşılık gelen durumlar yasası [illegible]

$$Z_c = \frac{P_c V_c}{R T_c} = \frac{3}{8} = 0.375$$ ideal gaz için bu $Z = 1$

deneysel olarak $Z_c < 3/8$ Chap 16. 16.7 figure





$A(T,V) = -\int P\, dV$ Maxwell
isoterm construct.

doğru olacaidi

$A = B$

$$-\frac{\partial A}{\partial V_1} = -\frac{\partial A}{\partial V_2} \quad ; \quad \frac{A_2 - A_1}{V_2 - V_1} = \frac{\partial A}{\partial V_1}$$

eşit basınç tanjant

$$-(V_2 - V_1)\frac{\partial A}{\partial V_1} = -(A_2 - A_1)$$

yani $P_1 (V_2 - V_1) = \int_1^2 P\, dV \Rightarrow A = B$