# Doubt Clearing Session

Course on States of Matter for Class XI

**akhilesh** • Lesson 21 • Aug 18, 2021

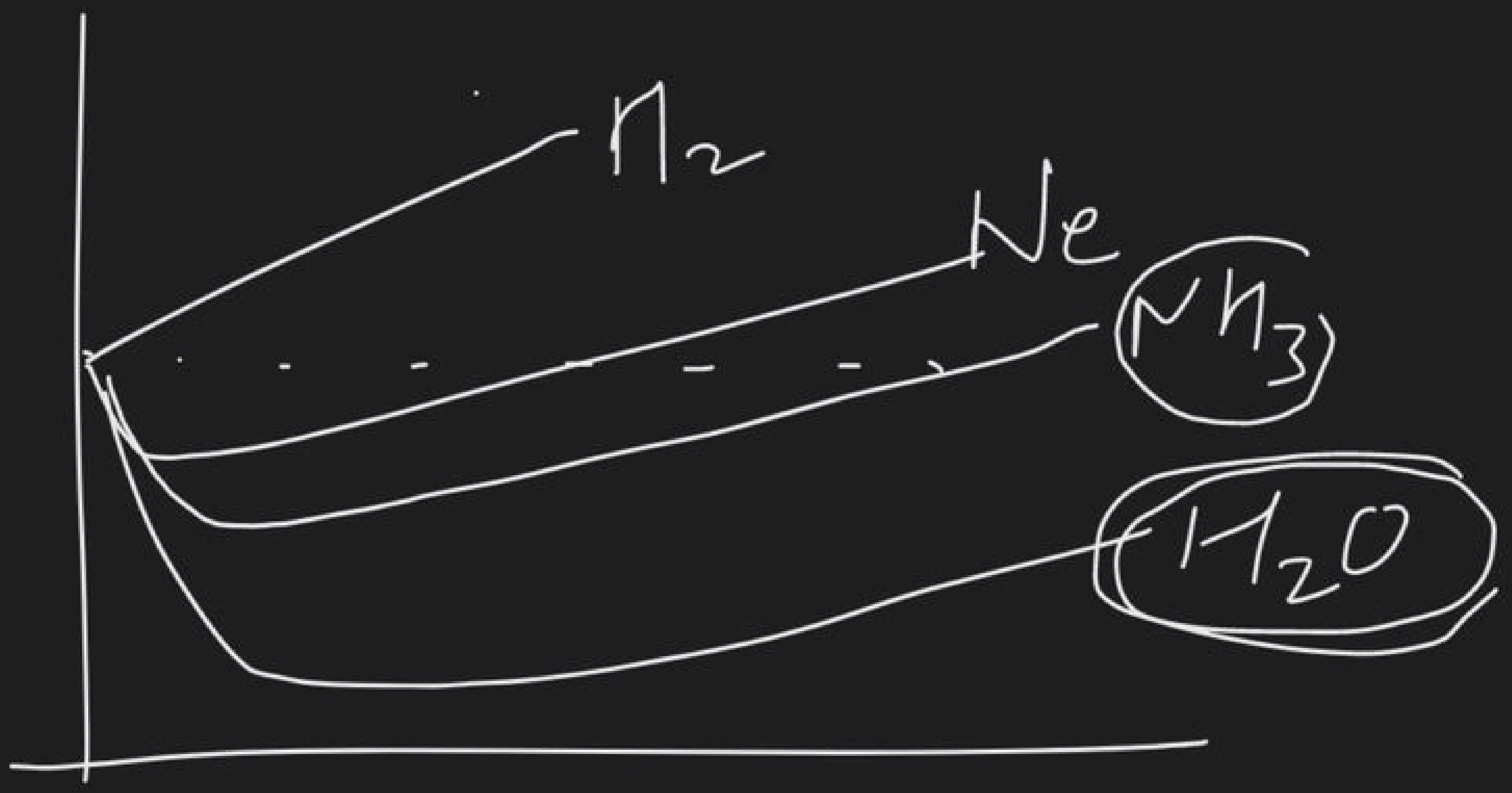
4) a $S_8$ $S_2$

$CH_4(g)$

g a $Z < 1$

$H_2$

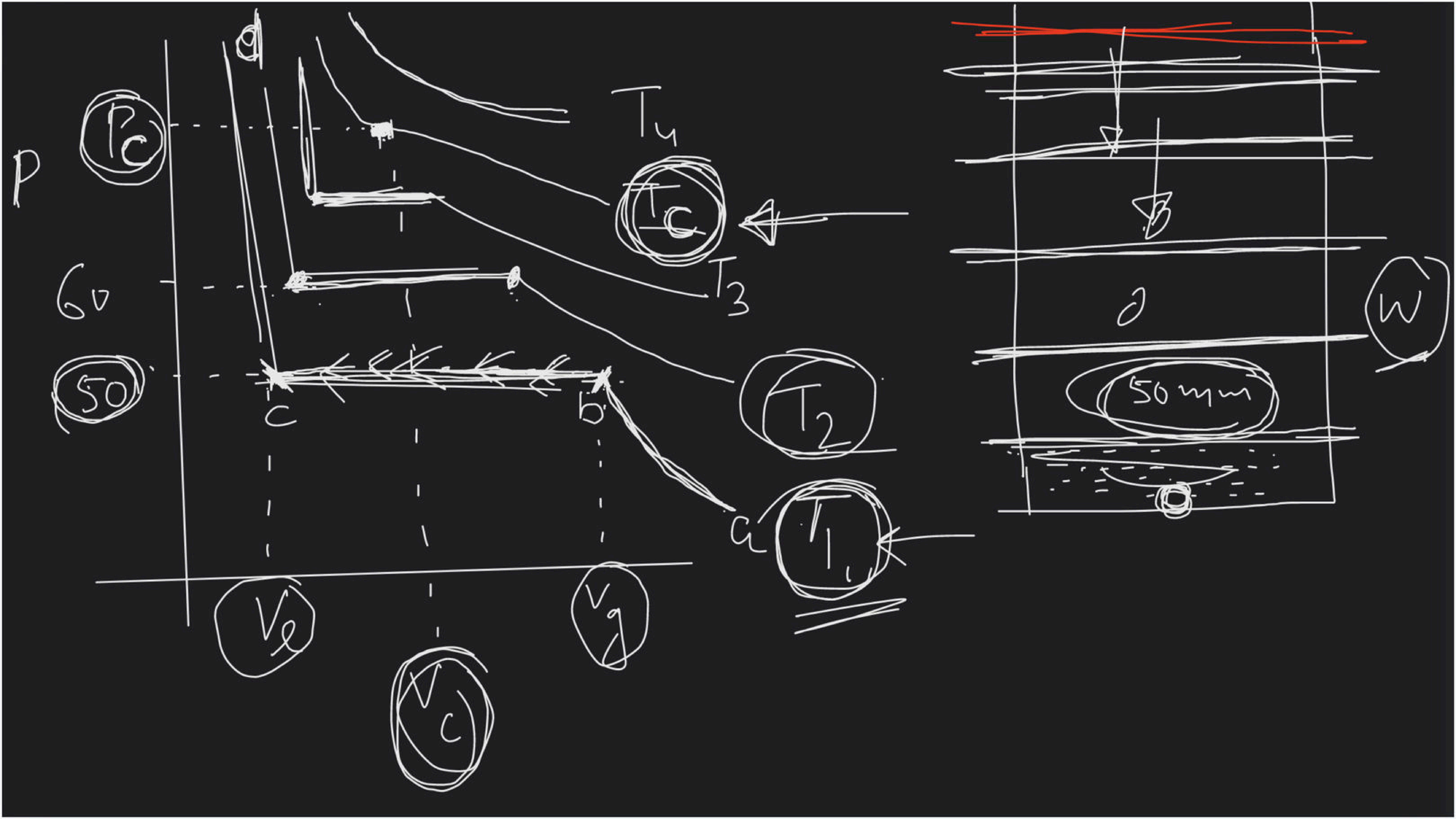
$H_2O(l)$



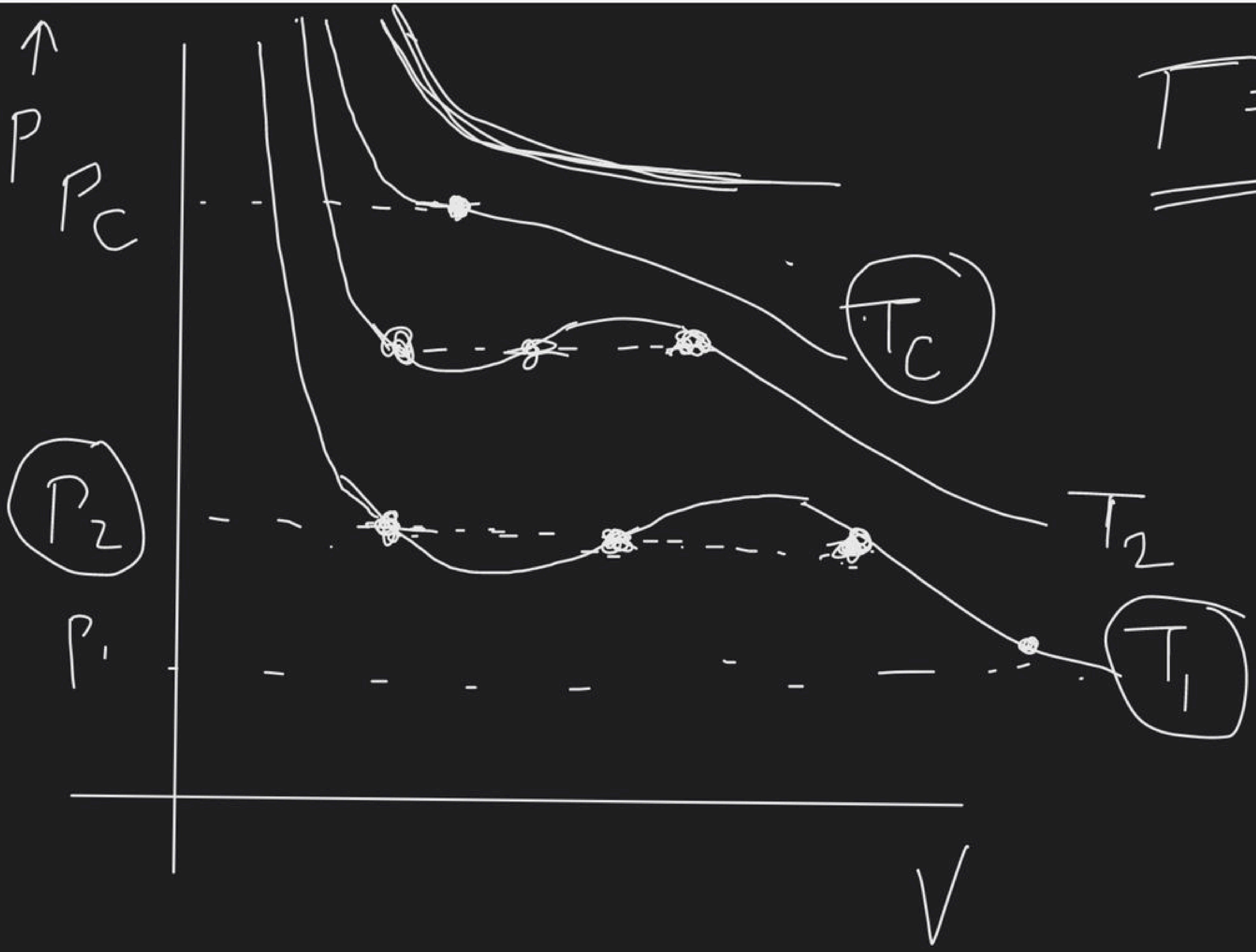
13 $Z = 1 - \frac{a}{V_m RT}$

$PV_m = ZRT$

$$Z = 1 - \frac{a \times P}{Z (RT)^2}$$



P
Pc
60
50
d
c
b
a
T4
Tc
T3
T2
T1
Vl
Vc
Vg
50mm
W




$T = \text{Const}$

$$\left(p + \frac{a}{V_m^2}\right)(V_m - b) = RT$$

$$\left[pV_m + \frac{a}{V_m} - pb - \frac{ab}{V_m^2} = RT\right] \times \frac{V_m^2}{p}$$

$$V_m^3 - \left(b + \frac{RT_c}{P_c}\right)V_m^2 + \frac{a}{P_c}V_m - \frac{ab}{P_c} = 0 \tag{1}$$

$$\Rightarrow (V_m - x)(V_m - y)(V_m - z) = 0$$

at $T_c$ & $P_c$

$$\underline{(V_m - x)^3 = 0}$$

$$(V_m - V_c)^3 = 0$$

$$V_m^3 - 3V_c V_m^2 + 3V_c^2 V_m - V_c^3 = 0 \quad — (2)$$

$$3V_c = b + \frac{RT_c}{P_c} \quad — (3)$$

$$3V_c^2 = \frac{a}{P_c} \quad — (4)$$

$$V_c^3 = \frac{ab}{P_c} \quad — (5)$$

$$\frac{3}{V_c} = \frac{1}{b}$$

$$\boxed{V_c = 3b}$$

$$\boxed{P_c = a/27b^2}$$

$$\boxed{T_c = 8a/27Rb}$$

At critical condⁿ ($T_c$, $P_c$) all three roots become equal.

$$V_c = 3b$$

$$T_c = \frac{8a}{27Rb}$$

$$P_c = \frac{a}{27b^2}$$

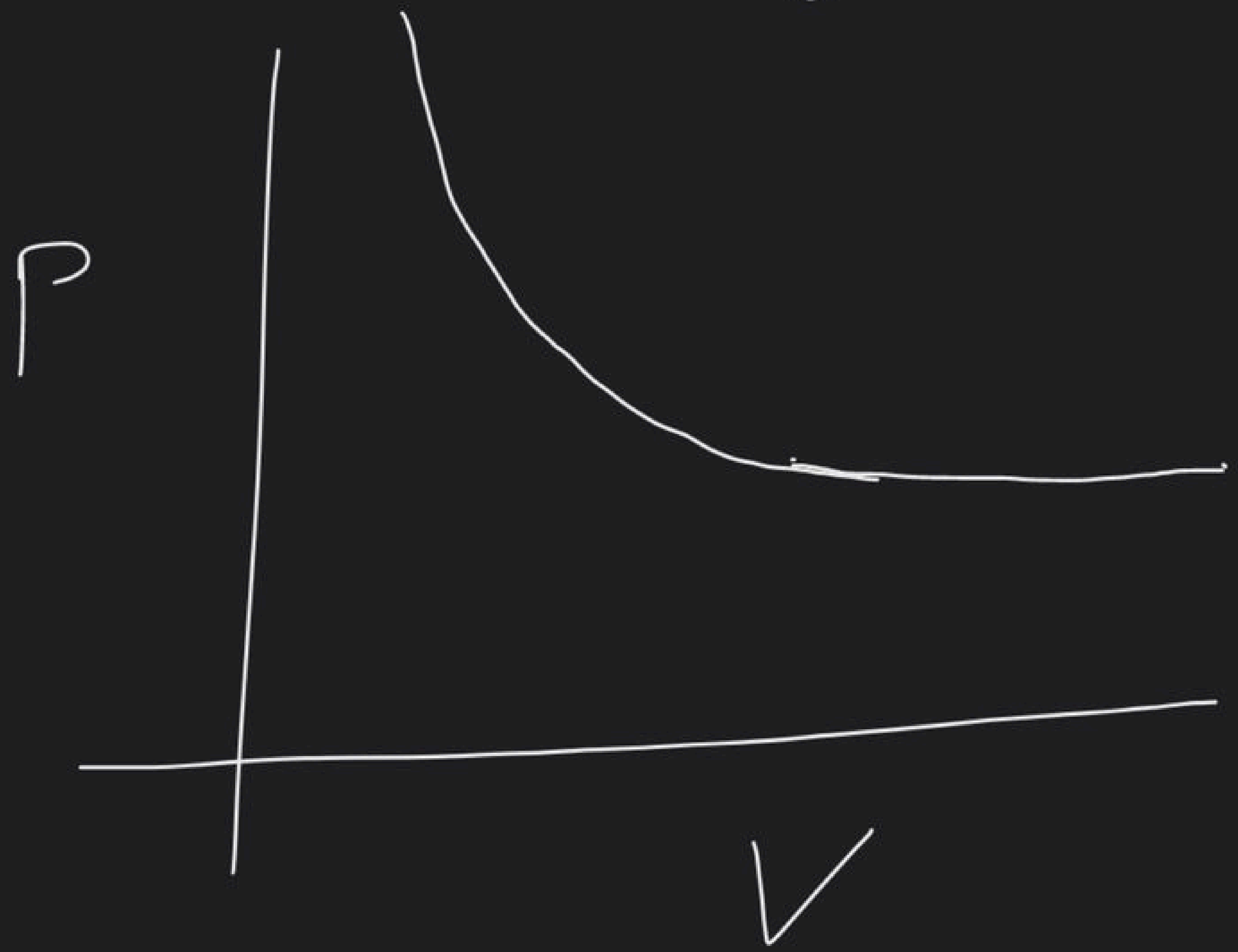
Compressibility factor at critical condn

$$\Rightarrow Z_c = \frac{P_c V_c}{R T_c} = \frac{3}{8}$$

$$\Rightarrow P_c M = Z d_c R T_c$$

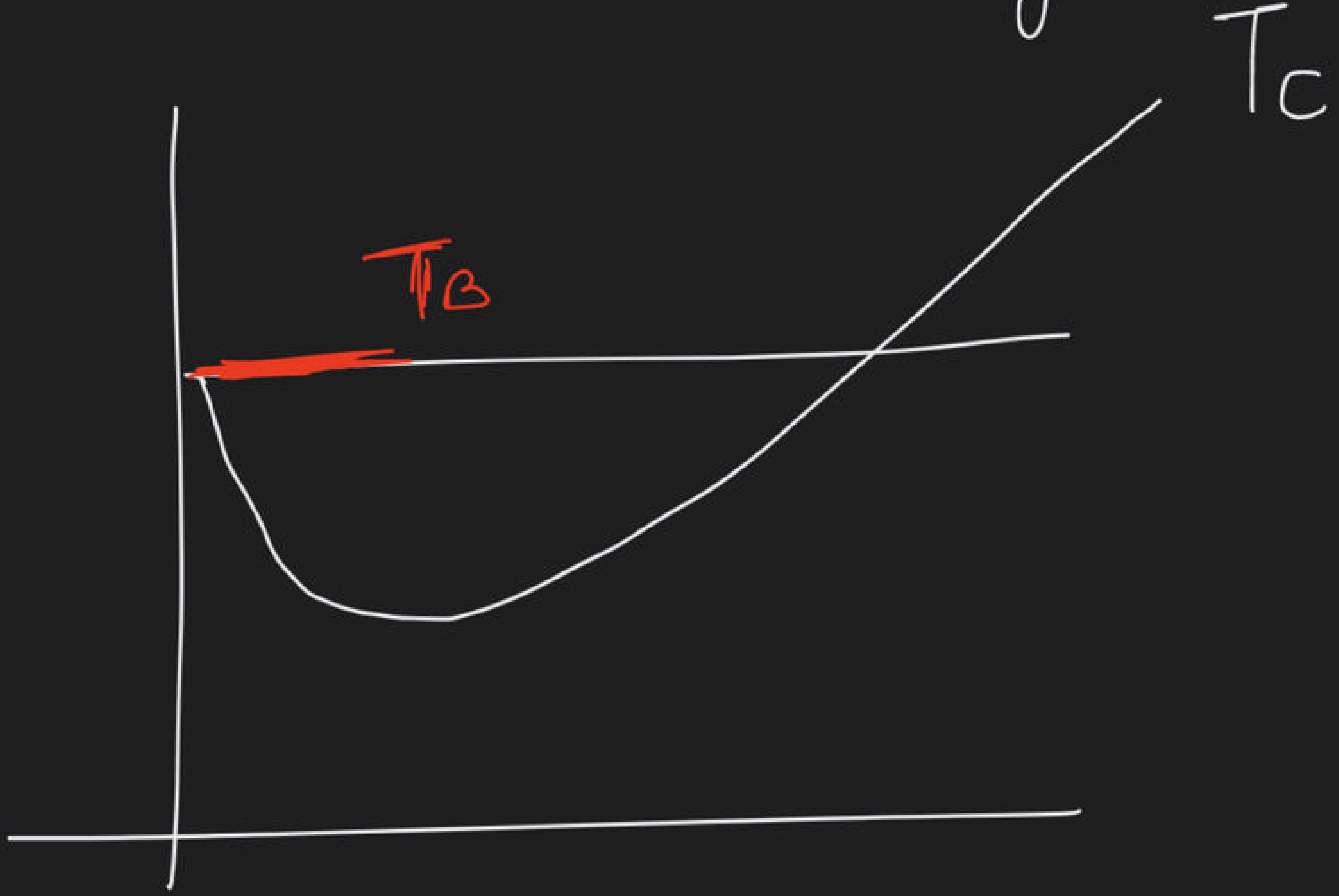
$$d_c = \frac{W}{V_c}$$

Ideal gas never liquifig




$T_c$

At critical temp real gas do not act as ideal gas.




$$T_B = \frac{a}{Rb}$$

$$T_C = \frac{8}{27}\frac{a}{Rb}$$

a - b  Comp$^n$ of gas

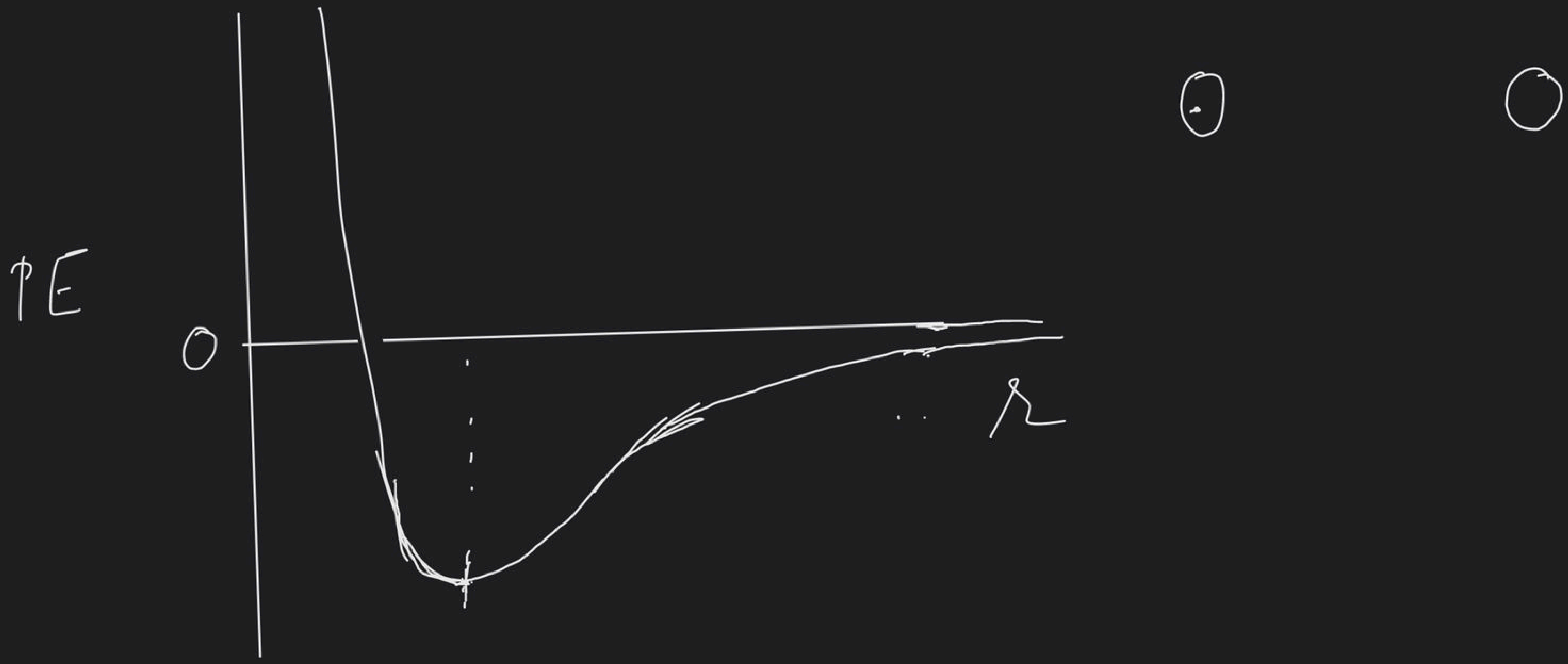
b - c  condensation

c - d  Compp$^n$ of liq

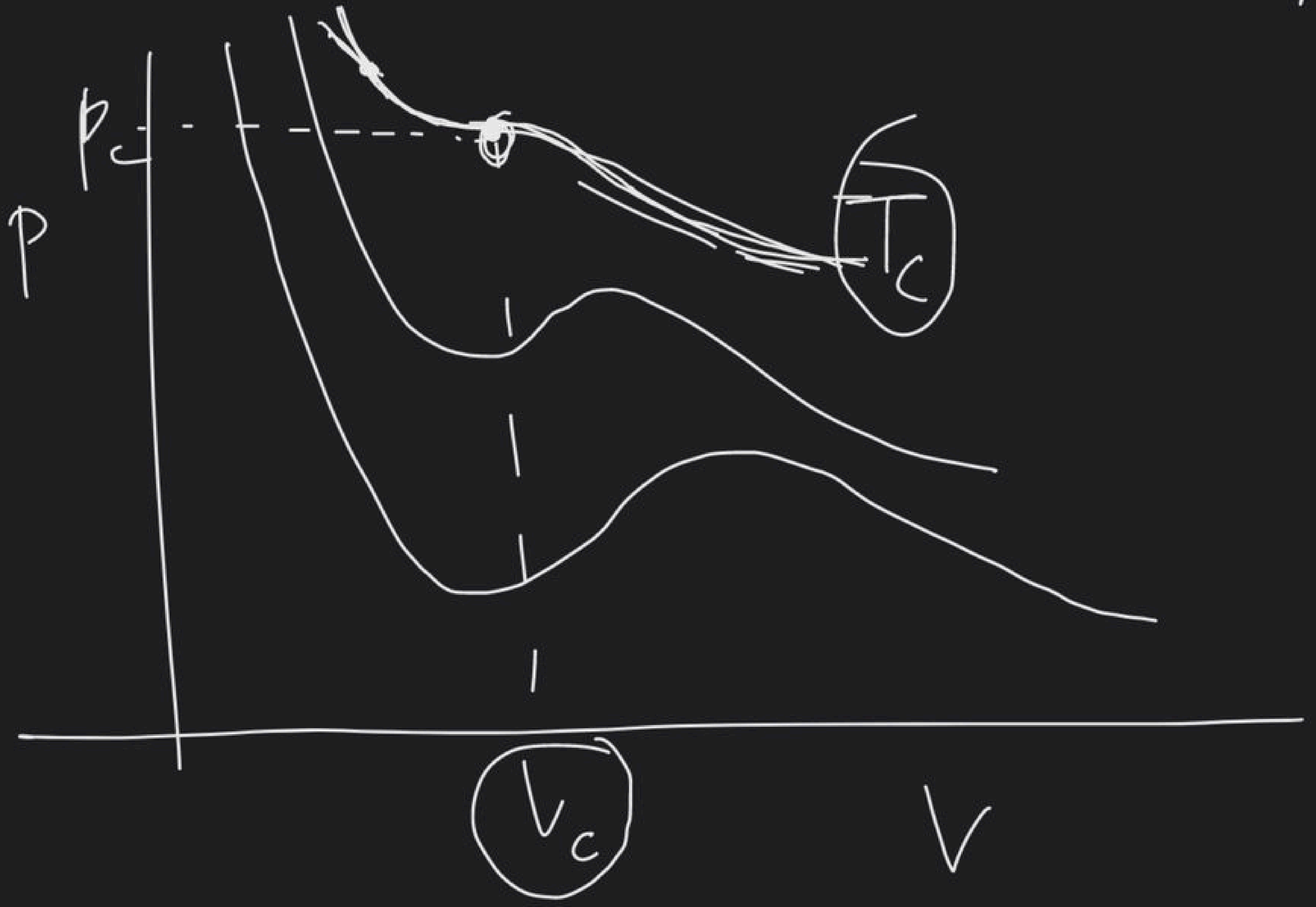
$T_c$ = Temperature above which a gas can not be liquified whatsoever may be the pressure.

$P_c$ = (critical pressure) <u>minimum</u> pressure required to condense a gas at $T_c$.

$\underline{V_c}$ :$\rightarrow$ Volume of gas at $T_c$ & $P_c$.

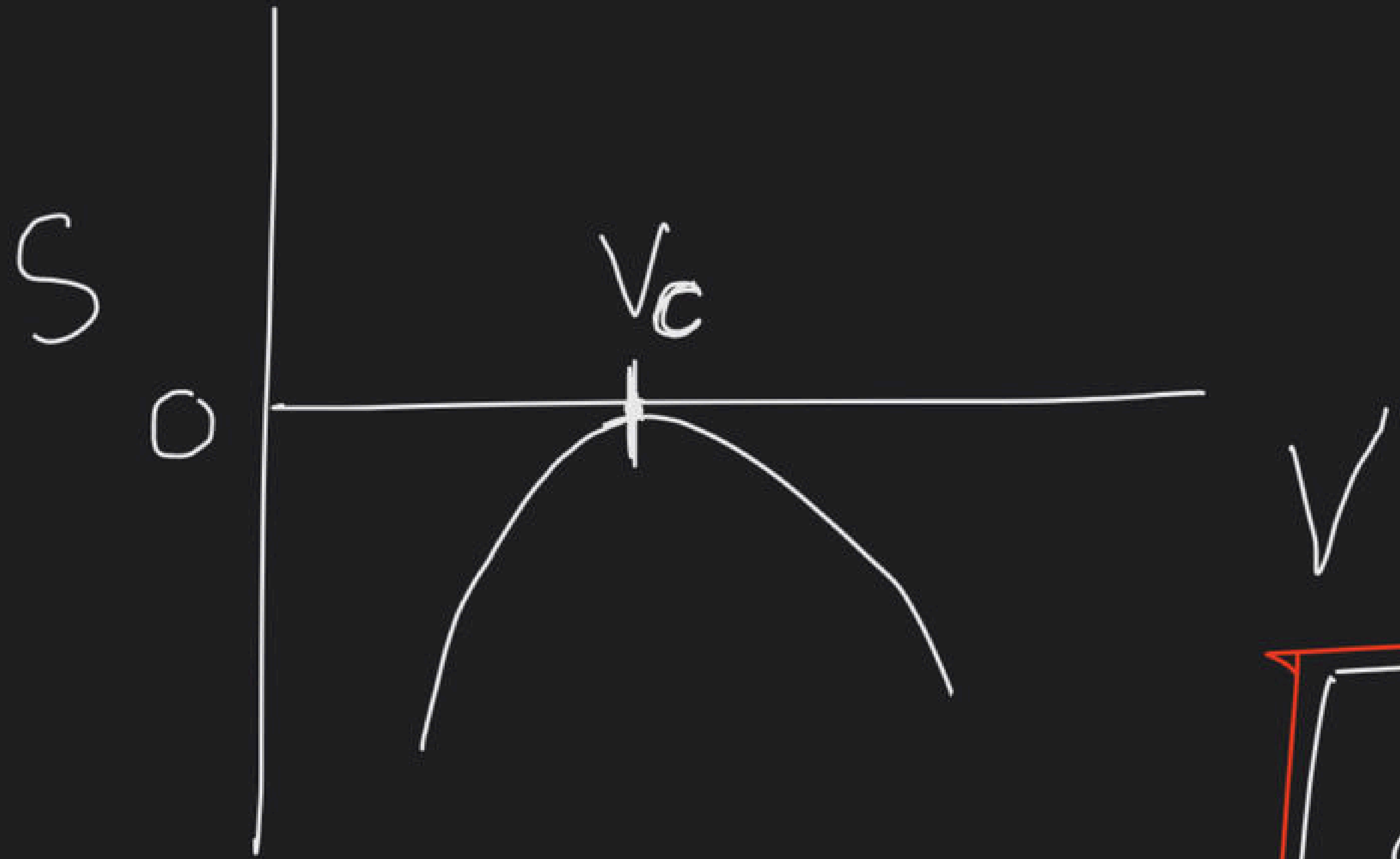

PE
0
r

$$P e^{-a/V_m RT}(V_m - b) = RT$$




At critical cond^n

$$\left(\frac{dP}{dV}\right) = 0$$




$$\left(\frac{dS}{dV}\right)_{\text{at critical condn}} = 0$$

$$\boxed{\frac{d^2P}{dV^2} = 0}$$

$$\left(P + \frac{a}{V_m^2}\right)(V_m - b) = RT$$

$$P_c = \frac{RT_c}{V_m - b} - \frac{a}{V_m^2} \quad \text{--- } 1$$

$$\frac{dp}{dV} = -\frac{RT_c}{(V_m - b)^2} + \frac{2a}{V_m^3} = 0 \quad \text{--- } 2$$

$$\frac{d^2p}{dV^2} = +\frac{2RT_c}{(V_m - b)^3} - \frac{6a}{V_m^4} = 0$$

At critical condⁿ

slope is zero $\qquad \dfrac{dp}{dV} = 0$

and slope is maximum $\qquad \dfrac{d^2p}{dV^2} = 0$

**Question**

from Yugam

Sir Vanderwaal equation mein 'b' repulsion and size of gas moelcules show karta hai. Iska logic kya hum aisa soch sakte hai ki b mein x4  repulsion ke kaaran hi aaya?

**Question**

from sarthak

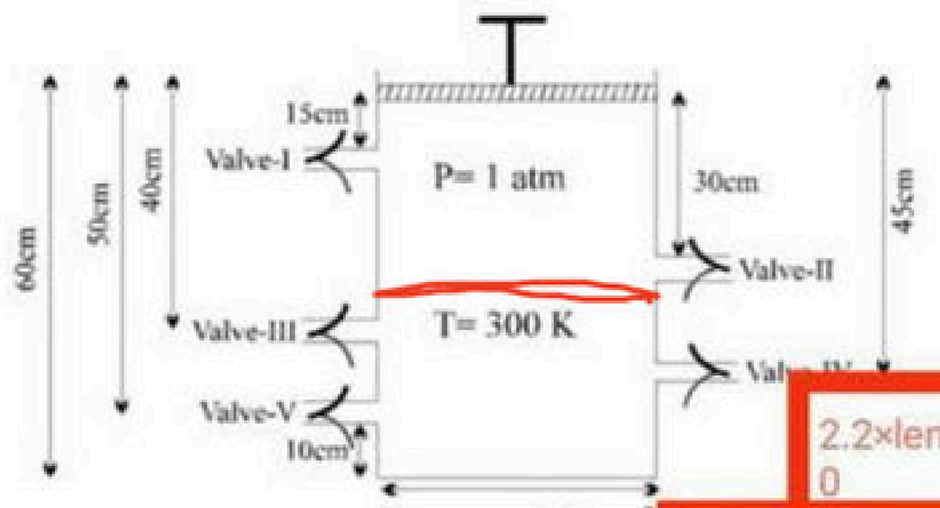
Mole concept se sir...kuch jada nhi aata na?lekin sab chiz me use hota ha na?

Question
from Aman

Sir try kiya yahi aa rha pls bata dijiye kahan galat hun plss

Q.12 A container fitted with frictionless massless piston consist of five **valves–I, II, III, IV** and **V.** These valves open automatically if pressure exceed over **1.5, 2.2, 2.5, 4.4** and **4.8 atm** respectively. Under the given initial conditions (mentioned in given diagram) system is in state of equilibrium. Piston is now pressed in downward direction very slowly.

*[Note: Consider the diameter of valve tube negligible and temperature remain constant.]*




2.2×length×821/1000=2×.0821×300

sir is question m 2.2 atm pressure par hum length nikal rhe h to 300/11 cm aa rhi

$1 \times 60 = 2.2 \times \ell$

Select the correct option(s):

(A) **Valve –II** will be opened first

(B) As the piston crosses the valve which will be opened first, the remaining number of moles in container are $\frac{5}{3}$.

300/11 to 30 se kam h to 2.2 atm pressure to phle hi hojayega to valve to khul jaani chaiyye???

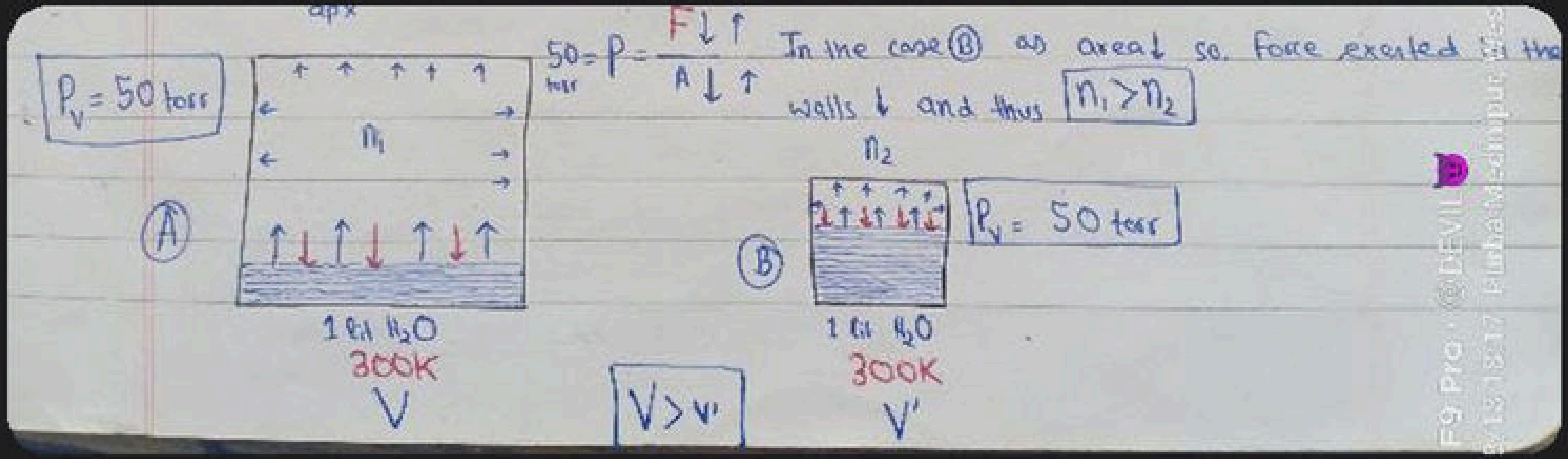
(C) **Valve–V** will be the second valve which open

(D) Number of moles will zero as piston crosses **Valve–V**

**Question**

from Souvik

sir plzzz batabdij

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