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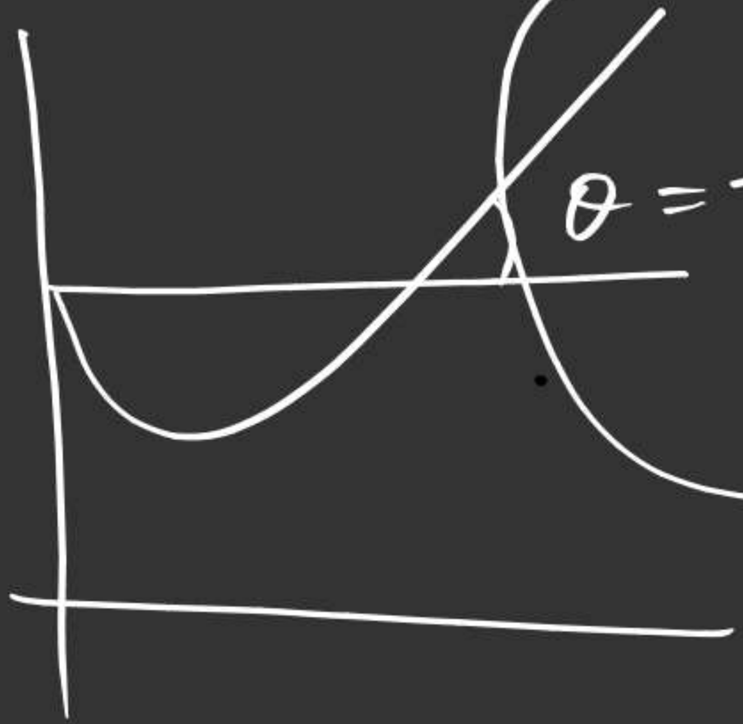

$$\theta = \tan^{-1}(0.005)$$

$$\frac{b}{RT} = 0.005 \Rightarrow b = 0.005 R \times 400$$

$$T_c = \frac{8a}{27Rb} = 500$$

$$Z = 1 + \frac{bP}{RT}$$

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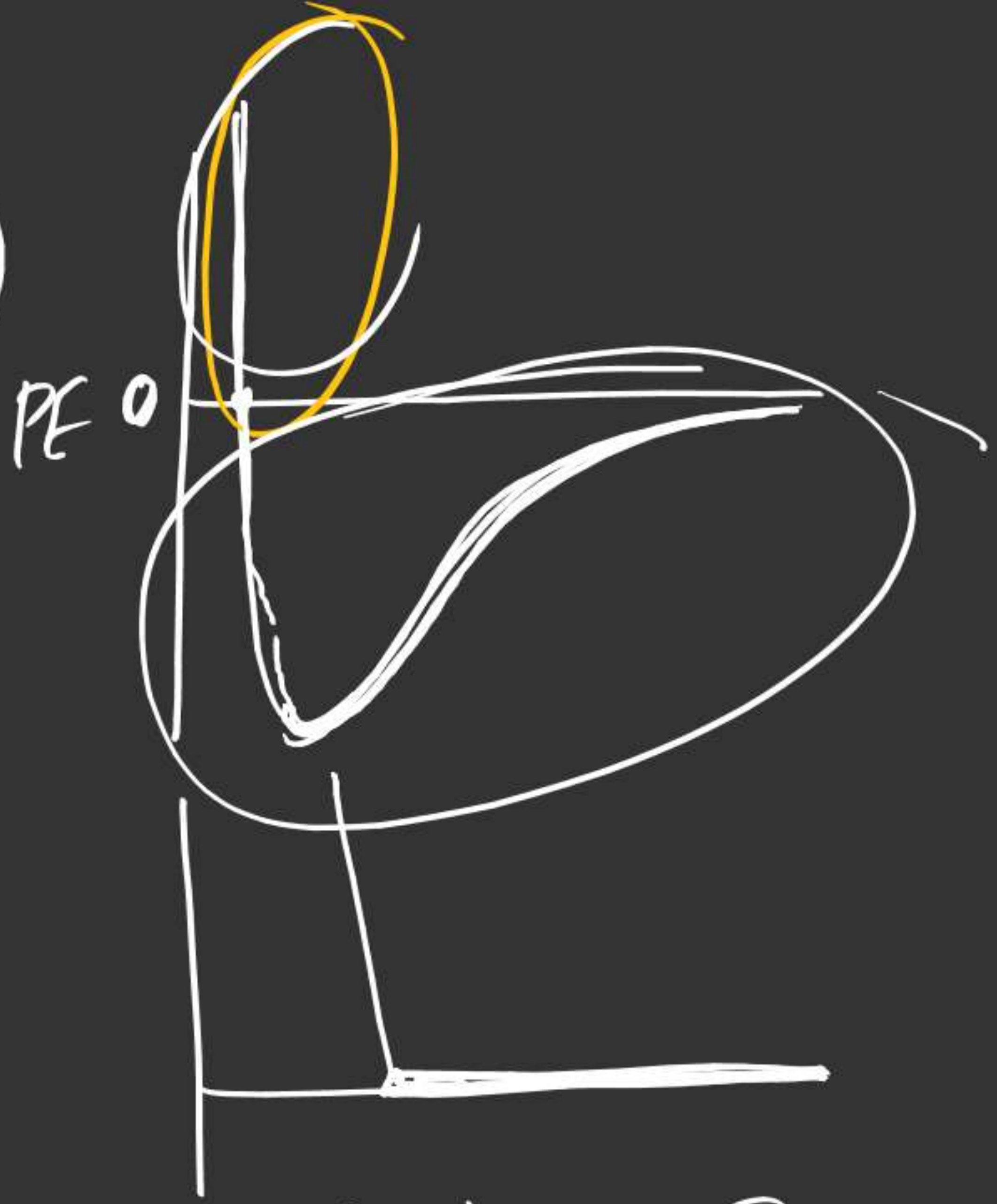
$b = 0$

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

$$PV_m = RT - a\left(\frac{1}{V_m}\right)$$

Remaining sheet

14



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A H_2 very high $Z>1$ repulsive forces

$a=0$ $P(V-b) = RT$

$\boxed{P, S}$

B H_2 ($P \to 0$) ideal $\boxed{R}$

C CO_2 1atm $Z<1$ attractive $\boxed{P, Q}$

D $Z=1$ $\boxed{R}$

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

P_c = minimum pressure required to liquify a real gas at T_c.

V_c = Volume occupied by real gas at T_c & P_c

$$S = \left(\frac{dp}{dV}\right)_{\text{critical con}^n} = 0$$

At critical con^n slope is zero as well as maximum.

$$\left(\frac{dS}{dV}\right)_{\text{critical con}^n} = 0 \Rightarrow \left(\frac{d^2p}{dV^2}\right)_{\text{critical con}^n} = 0$$

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$$P = \frac{RT}{V_m - b} - \frac{a}{V_m^2}$$

$$\frac{dP}{dV} = -\frac{RT}{(V_m - b)^2} + \frac{2a}{V_m^3}$$

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

At critical condⁿ

$$P_c = \frac{RT_c}{V_c - b} - \frac{a}{V_c^2} \quad \text{—} (1)$$

$$-\frac{RT_c}{(V_c - b)^2} + \frac{2a}{V_c^3} = 0 \quad \text{—} (2)$$

$$\frac{2RT_c}{(V_c - b)^3} - \frac{6a}{V_c^4} = 0 \quad \text{—} (3)$$

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

by eq (2) ÷ (3)

$$\frac{V_c - b}{2} = \frac{V_c}{3} \Rightarrow \boxed{V_c = 3b}$$

by eq (1)

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

by eq (2) $\rightarrow$ $\boxed{T_c = \frac{8a}{27Rb}}$

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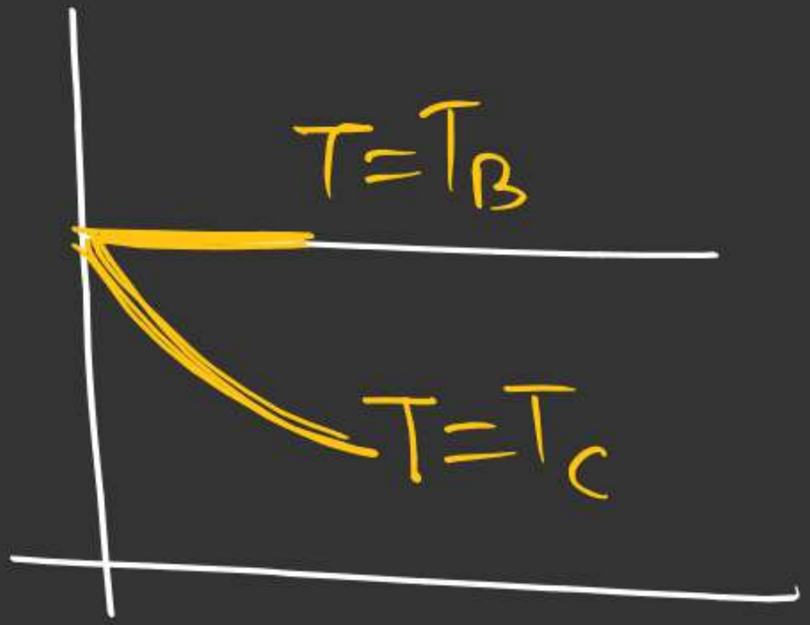
$T_C < T_B$ (Boyle's temp



$$Z_{\substack{critical\\ cond^n}} = \frac{P_c V_c}{R T_c} = \frac{\left(\frac{a}{27b^2}\right)(3b)}{R\left(\frac{8a}{27Rb}\right)} = \frac{3}{8}$$