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0-1 S-12

S-1 7-12

(8) $Z = 1 - \frac{a}{V_m RT}$

$\frac{PV_m}{RT} = Z$

$Z = 1 - \frac{aP}{Z(RT)^2}$

$Z = 1 - \frac{100 \times 0.1}{Z(20)^2}$

$(2Z-1)^2 = 0$

$Z = 1 - \frac{1}{4Z}$

$4Z^2 = 4Z - 1$

$Z^2 - Z + 1/4 = 0$

$Z = \frac{+1 \pm \sqrt{1+1}}{2}$

$= \frac{1+0}{2} = \frac{1}{2}$

$= 0.5$

(9) $Z = \frac{PV}{}$

$\frac{PV}{n} = RT + Pb$

$PV = nRT + nPb$

$nRT = 40$

$RT = 20$

(12) $Z = 1 + \frac{Pb}{RT}$

$\frac{b}{RT} = 0.01$ $\quad b = 0.20$

PV vs P

$\frac{PV_m}{RT} = 1 + \frac{Pb}{RT}$

$PV_m = RT + Pb$

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## Boyle's temperature :⟶

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

$$\frac{V_m}{RT} \times \left[P = \frac{RT}{V_m - b} - \frac{a}{V_m^2}\right]$$

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

$$Z = \frac{1}{(1 - b/V_m)} - \frac{a}{V_m RT}$$

$$Z = (1 - b/V_m)^{-1} - \frac{a}{V_m RT}$$

$$(1-x)^{-1} = 1 + x + x^2 \cdots$$

$$\left(1 - \frac{b}{V_m}\right)^{-1} = 1 + \frac{b}{V_m} + \frac{b^2}{V_m^2} \cdots$$

$$Z = 1 + \frac{b}{V_m} + \frac{b^2}{V_m^2} \cdots - \frac{a}{V_m RT}$$

$$Z = 1 + \left(b - \frac{a}{RT}\right)\frac{1}{V_m} + \frac{b^2}{V_m^2} \cdots$$

$P \to$ low

$$b - \frac{a}{RT} = 0$$

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

$T_B$ + low $P$ ⟶ Real gas – ideal gas

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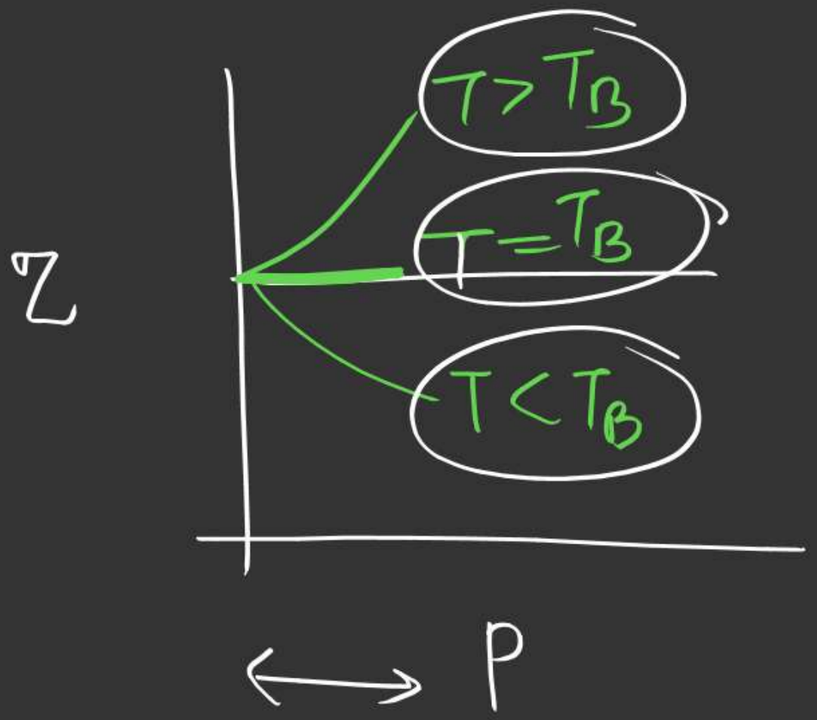


$$Z = 1 + \left(b - \frac{a}{RT}\right)\frac{1}{V_m}$$

# Other eqn for real gases

## (1) Berthlot eqn

$$\left(P + \frac{an^2}{TV^2}\right)(V - nb) = nRT$$

## (2) Dietrici eqn

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

## (3) Virial eqn

$$Z = 1 + \frac{B}{V_m} + \frac{C}{V_m^2} \cdots \cdots \cdots \cdots$$

$B, C \ldots$ are temperature dependent virial const which are determined experimentally

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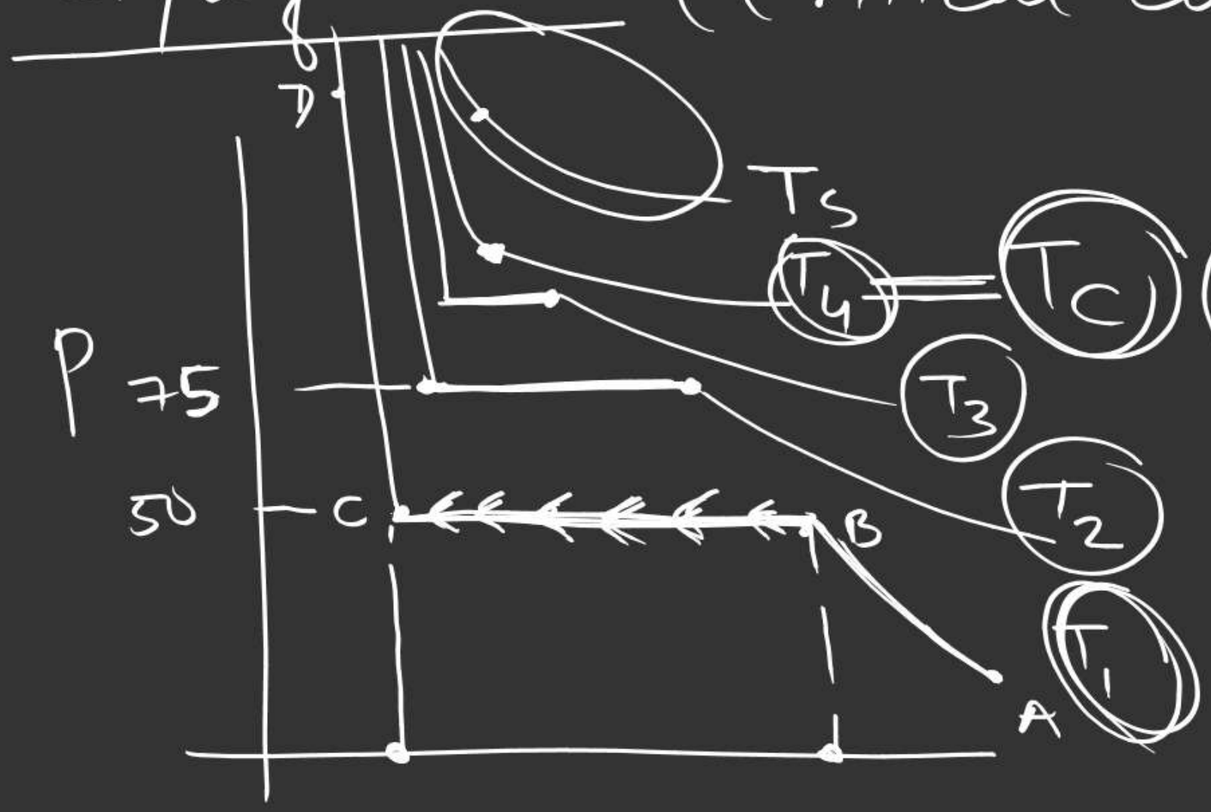
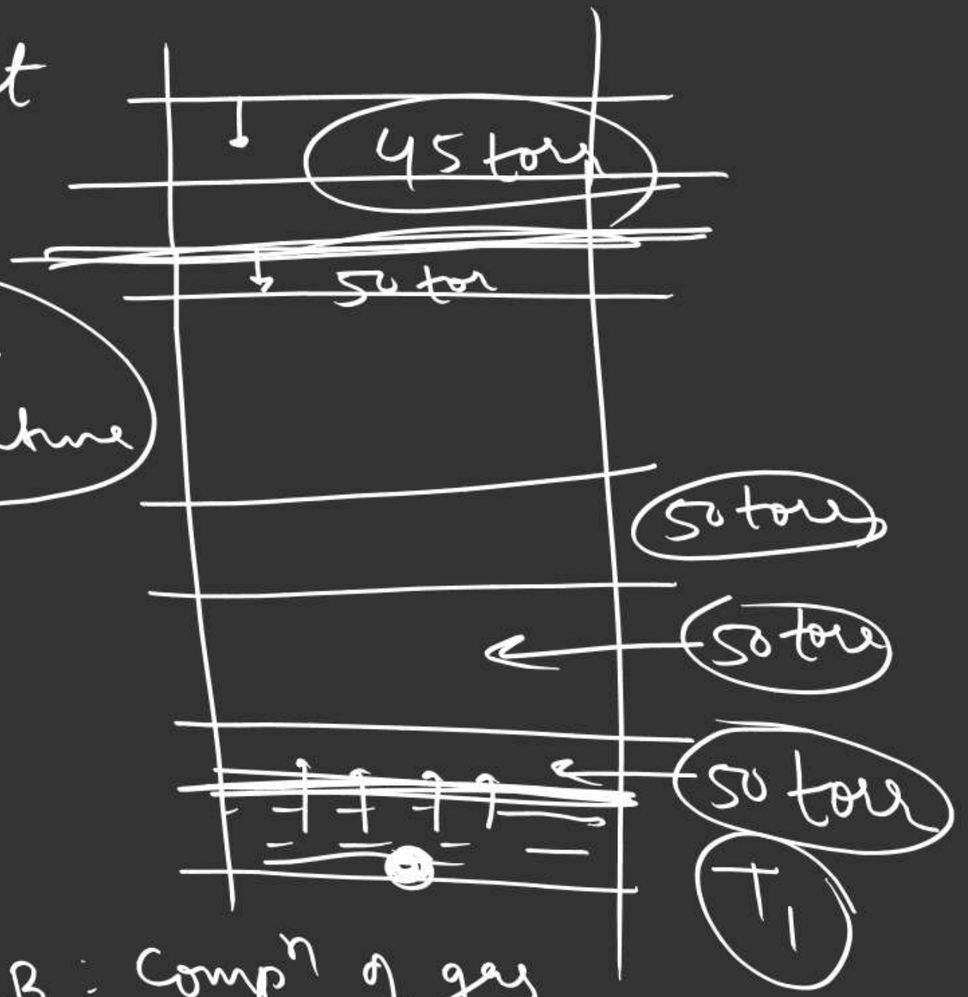
# Liquification ((Critical Constant




Critical temperature

as T ↑ vapor ↑




AB : Compⁿ of gas
BC : condensation (liquification)
CD : Compⁿ of liq

O-I 1, 2 3, 4,

J-Adv 2, 3, 4, 5, 6

10, 12, 13, 14, 15

Atomic str