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4

O-I

$b = 4 \times \frac{4}{3}\pi r^3 \times N_A = 24$ ml

$(20)^{1/3}$

8 27

2.5
2.5
2.5

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2 b

$n = 1/2$

$dm^3 = lit$

$V = 0.5\ lit$

$a = 363.76 \frac{kPa\ (dm^3)^2}{mol^2}$

$b = 42.67 \times 10^{-3}\ lit/mol$

$a = \frac{363.76 \times 10^3}{1.01325 \times 10^5} \frac{atm.\ lit^2}{mol^2}$

$R = 0.0821$

$$1\ dm^3 = 1\ lit = 10^{-3}\ m^3$$

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4

S-I

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

$$\frac{V_1 = \frac{RT}{P_1} + b}{V_2 = \frac{RT}{P_2} + b}$$

$$= \boxed{0.011075 = \frac{\frac{R \times 273}{100} + b}{\frac{R \times 273}{1} + b}}$$

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

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S-I (5)

504.2 ml

$CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$

$1/4$ $\quad 1/4 \quad 1/4$ mol

Volume = 4.2 ml

500 ml

(6) $r = 100 \times 10^{-12}$ m

vol. of 1 mol $= \frac{4}{3}\pi r^3 \times N_A$

$b = 4 \times \left(\quad \right)$

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$$Z = \frac{V_{real}}{V_{ideal}} = \frac{PV}{nRT} = \frac{PV_m}{RT}$$

$$\boxed{V_m = V/n}$$

molar volume

$$\left(P + \frac{an^2}{V^2}\right)\left(V/n - b\right)\cancel{n} = \cancel{n}RT$$

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

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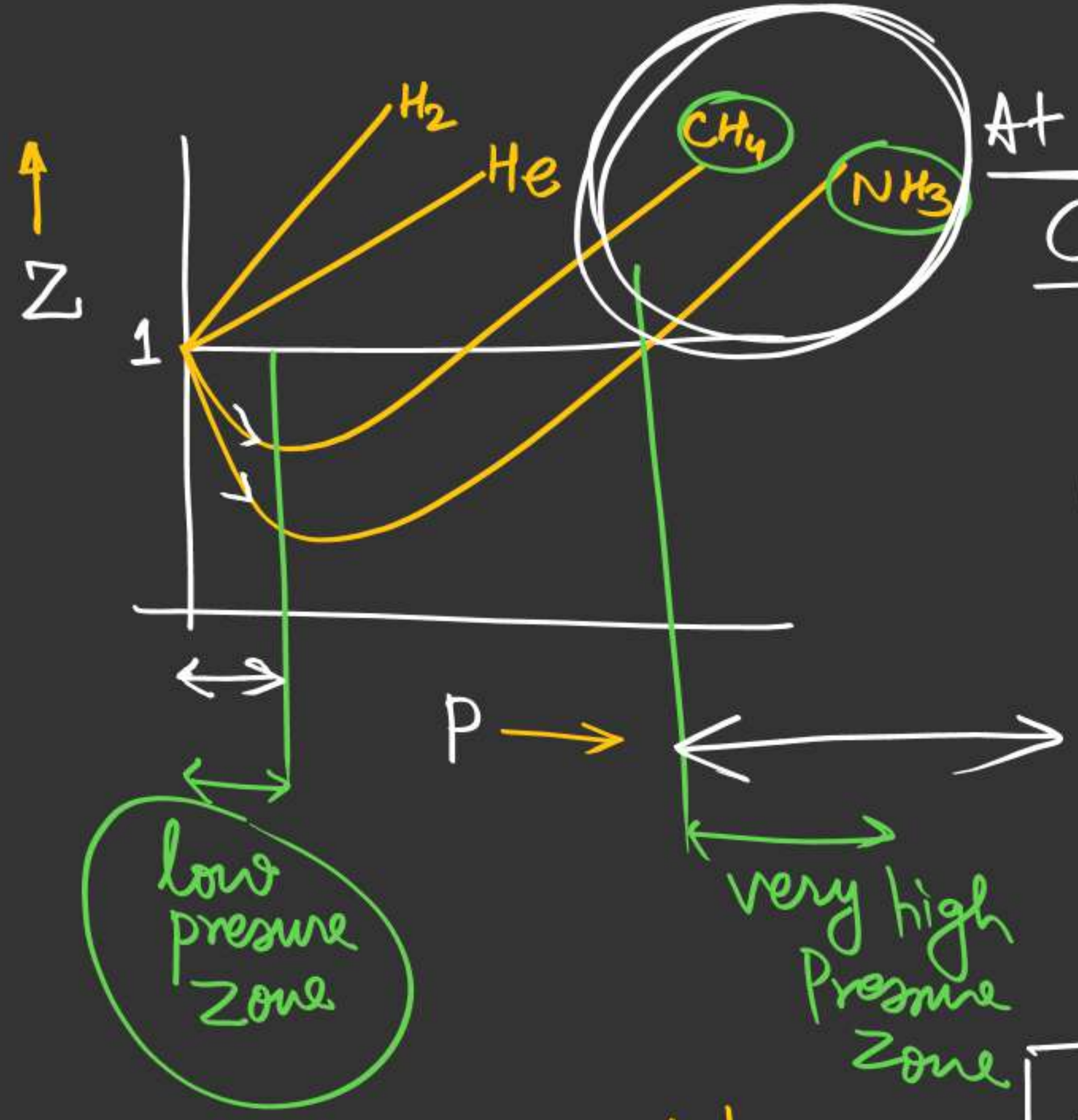

At 25°C

Case-I In low pressure zone

P → low   V → high

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

low, low, high, low

$$PV_m + \frac{a}{V_m} = RT$$

At low 'p'

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

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Case-II In very high pressure zone

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

very high

high

low

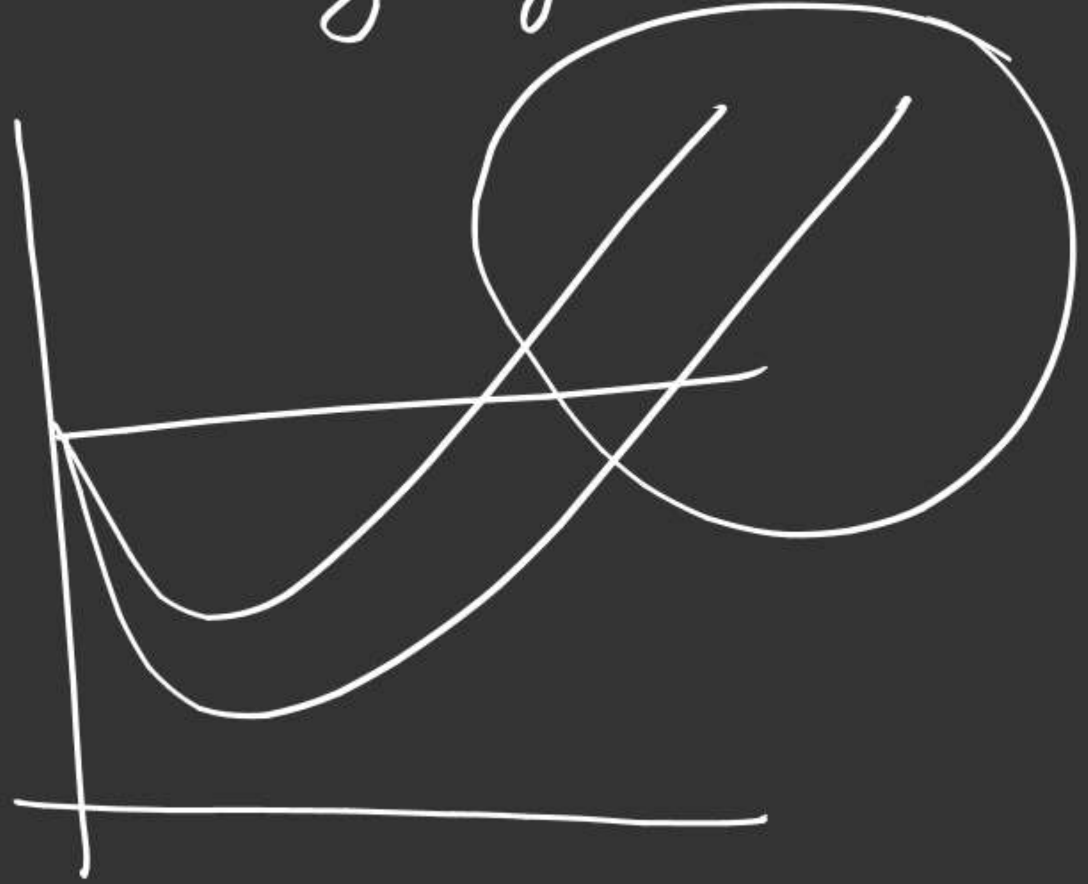
low

$$PV_m - Pb = RT$$

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

AT high 'P' → low volume

At very high 'P' → low volume



Case-III for H_2 & He : $\longrightarrow$

a represents attraction

in H_2 & He attractions are very low

$$a \simeq 0$$

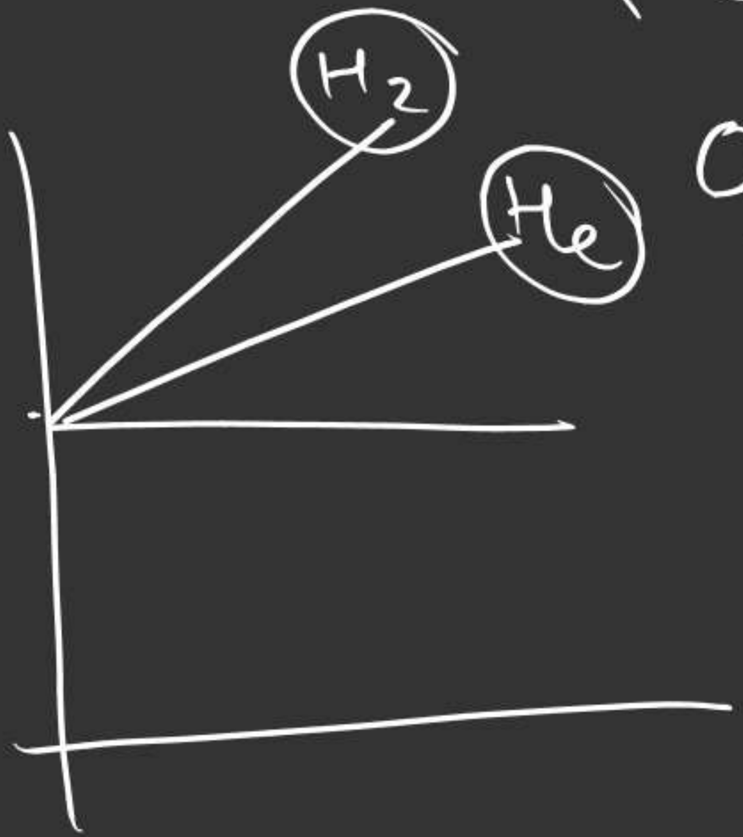
$$P(V_m - b) = RT$$

$$\boxed{Z = 1 + \frac{Pb}{RT}}$$

attraction $\propto$ polarity

($O_2 < NH_3$)

$\propto$ molar mass



$O_2 > N_2$

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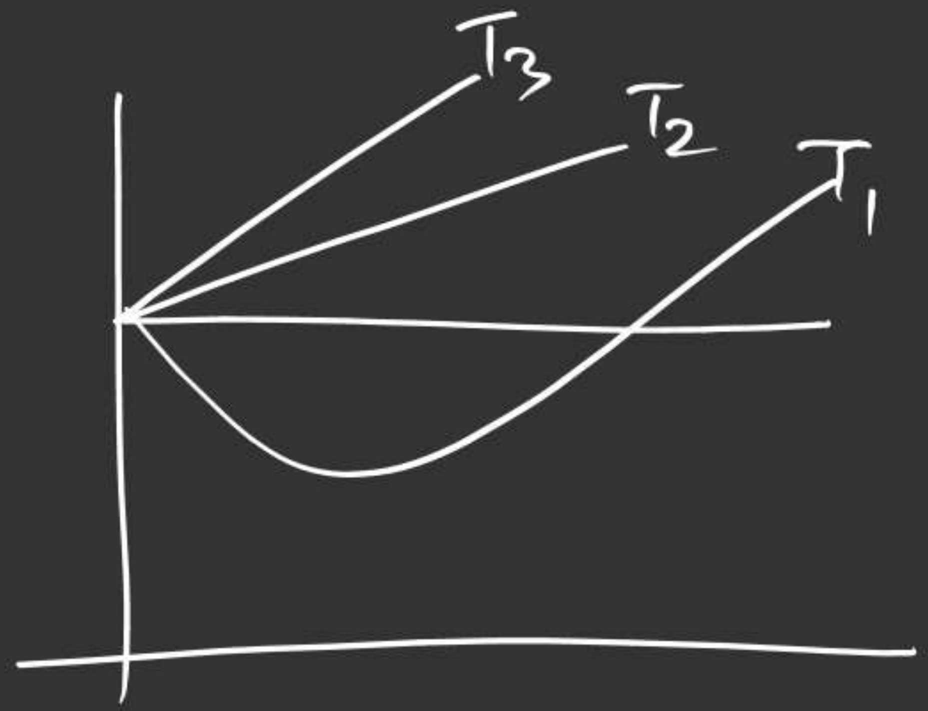

$T_3 > T_2 > T_1$

for gas A

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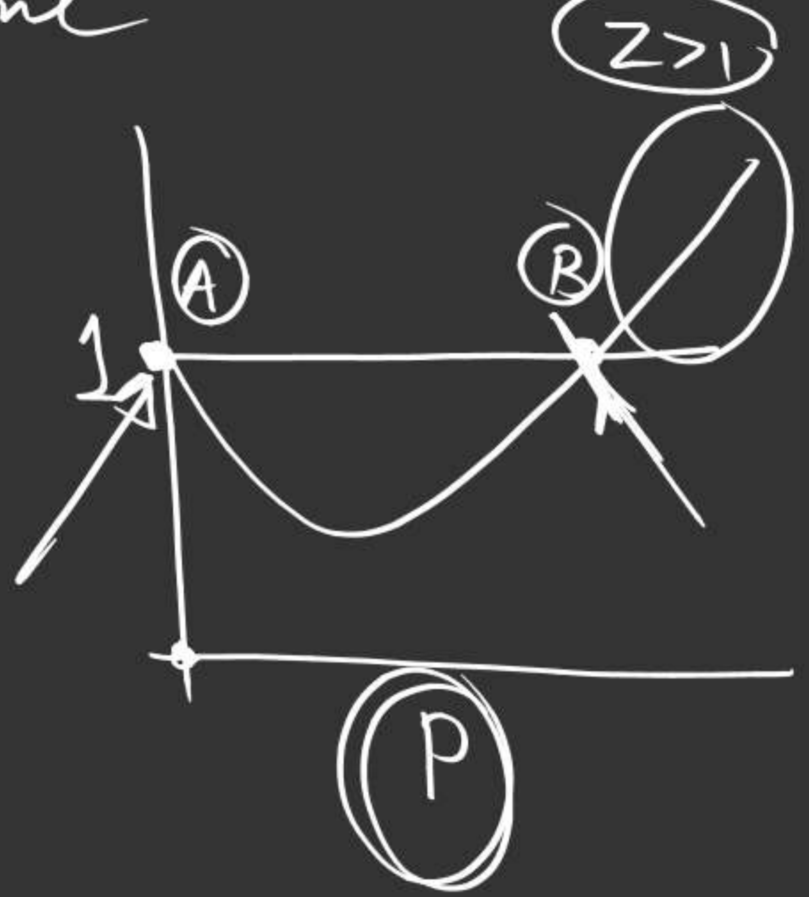
In low pressure zone $Z = 1 - \frac{a}{V_m RT}$ 'b' is neglected $a\uparrow$ $Z\downarrow$

In very high 'P' zone $Z = 1 + \frac{Pb}{RT}$ 'a' is neglected $b\uparrow$ $Z\uparrow$

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



At Point A effect of 'a' & b are negligible

At Point B effect of a & b cancel out each other

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

$$PV = P'(V - b)$$

$$(P + P_{corr} + P'_{corr})(V) = nRT$$

'b' is the measure of repulsive forces as well as size

$$PV = nRT$$ ideal V, T, n

$$P'(V - b) = nRT$$ Real V, T, n

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very high

high

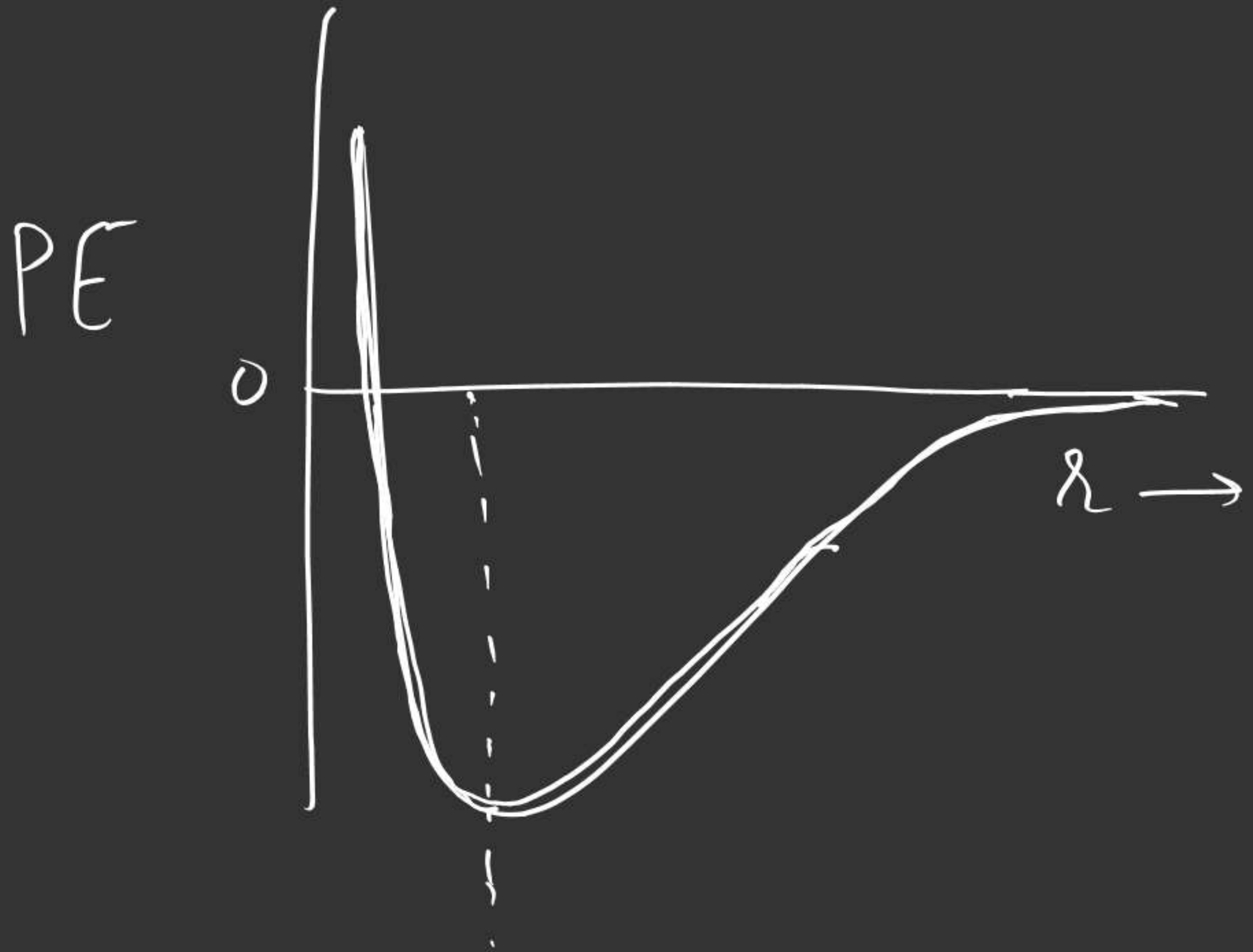
low

very low

Real gas → ideal gas

1. when 'V' is very large
2. when $P \to 0$
3. when $P \to$ low & T is high

Repulsive force are significant when molecules are very close to each other



If attraction dominates PE<0

If repulsion dom PE>0

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0 - I	5 — 12
5-I	7 — 12