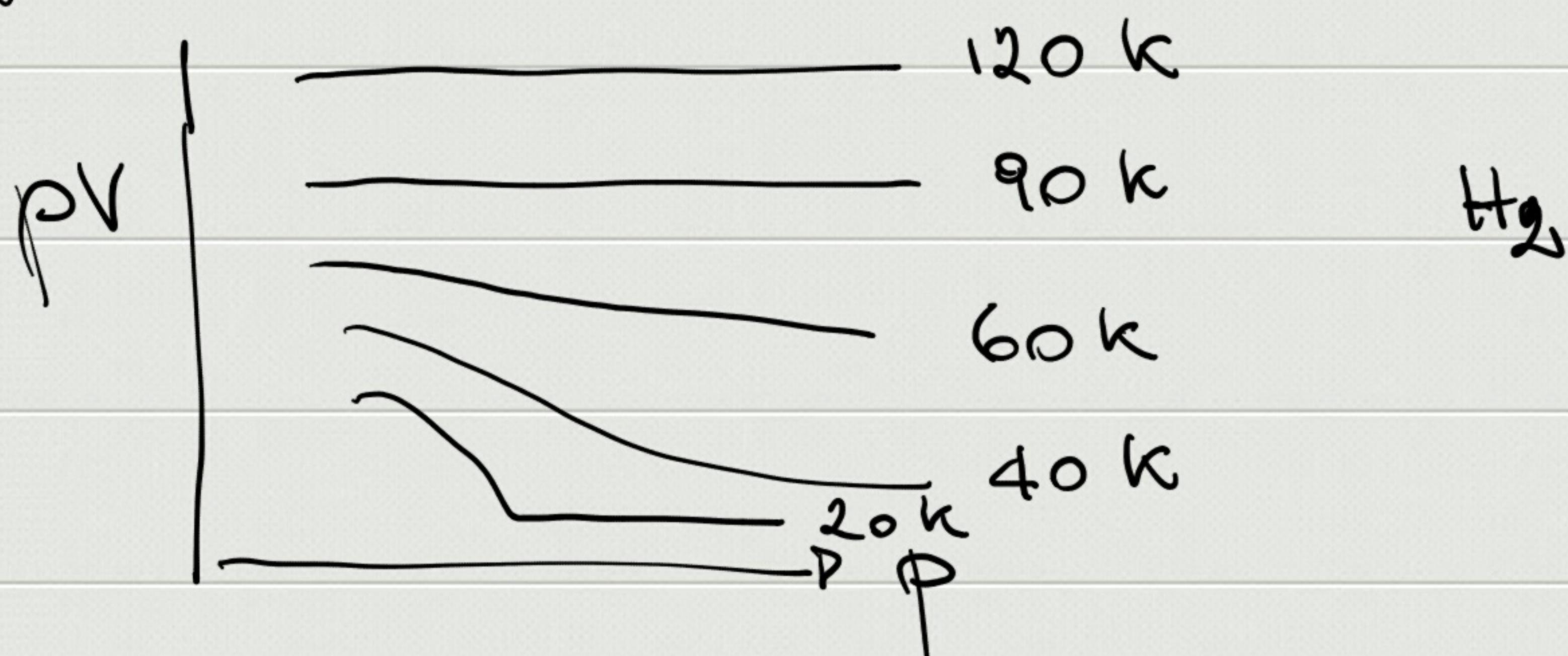


Gas $\Rightarrow P, V, T$



Equazione del volume

$$PV = c_0 + c_1 P + c_2 P^2 + c_3 P^3 + \dots$$

$$c_i = c_i(T)$$

$$PV = d_0 + \frac{d_1}{V} + \frac{d_2}{V^2} + \frac{d_3}{V^3} + \dots$$

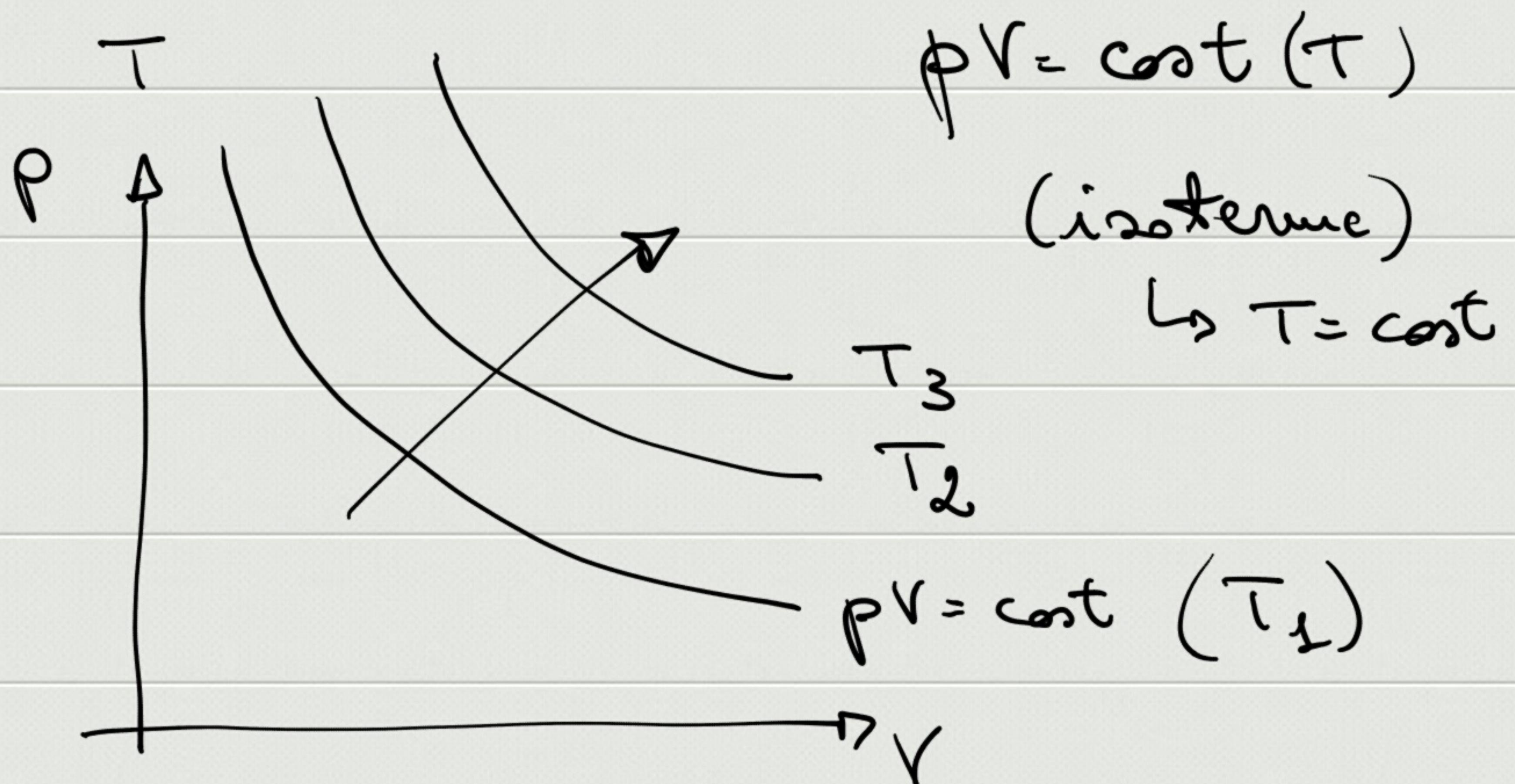
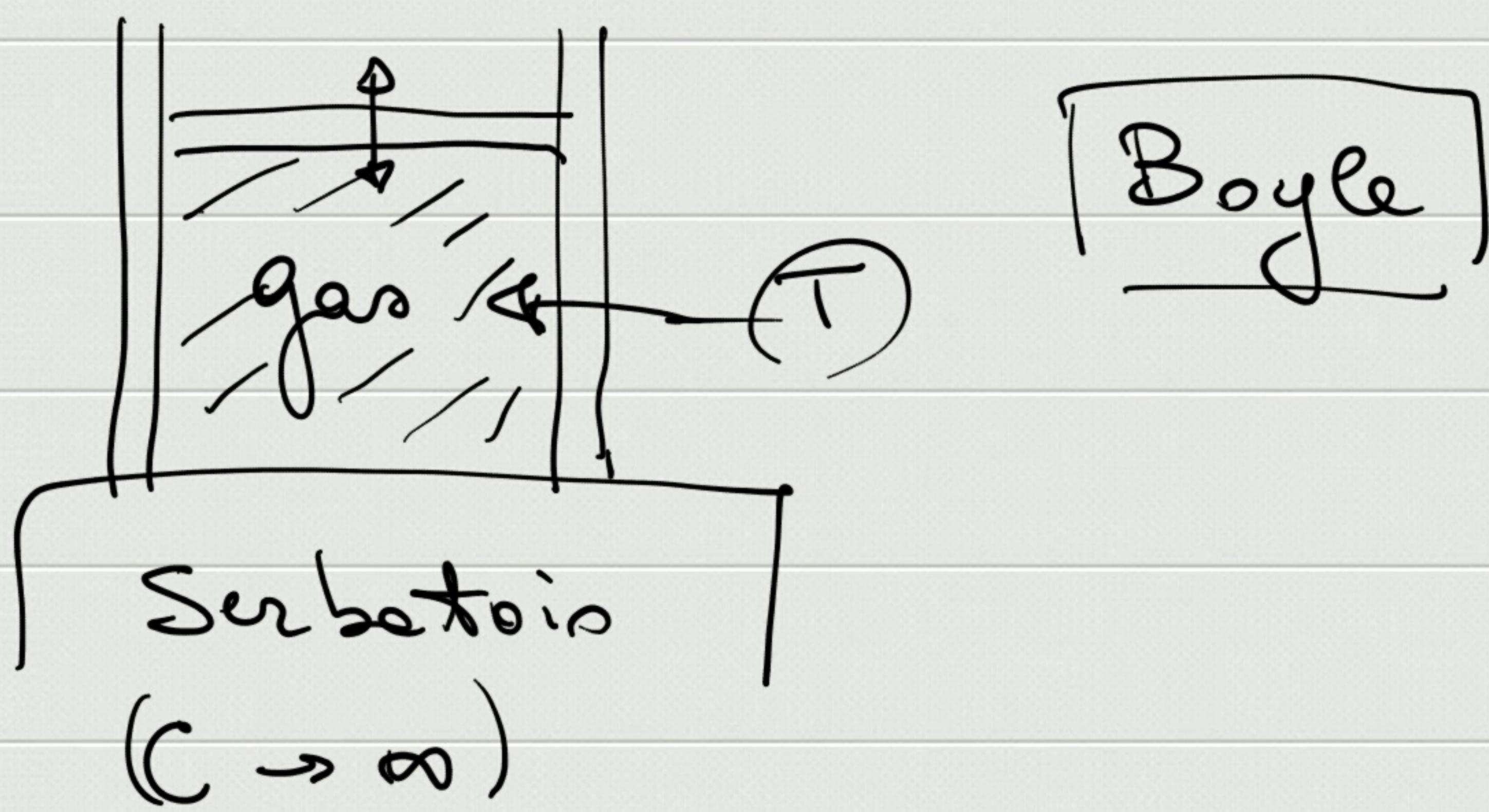
$$d_i = d_i(T)$$

gas barre pressione $P \rightarrow 0$ ($V \rightarrow \infty$)
 (gas ideale)

$$pV \rightarrow c_0 \quad \left. \begin{array}{l} p \rightarrow 0 \\ V \rightarrow \infty \end{array} \right\} \Rightarrow c_0 = d_0$$

$$pV \rightarrow d_0 \quad \left. \begin{array}{l} p \rightarrow 0 \\ V \rightarrow \infty \end{array} \right\}$$

gas ideale $\Rightarrow pV = \text{const} = \text{const}(\tau)$



Volte - Gay Lussac (Charles)

$$P = \text{cost} \Rightarrow V = V(t) = V_0 (1 + \alpha t)$$

↑
temperature

V_0 = volume a $t = 0^\circ\text{C}$

t : temperature in $^\circ\text{C}$

α : coefficient

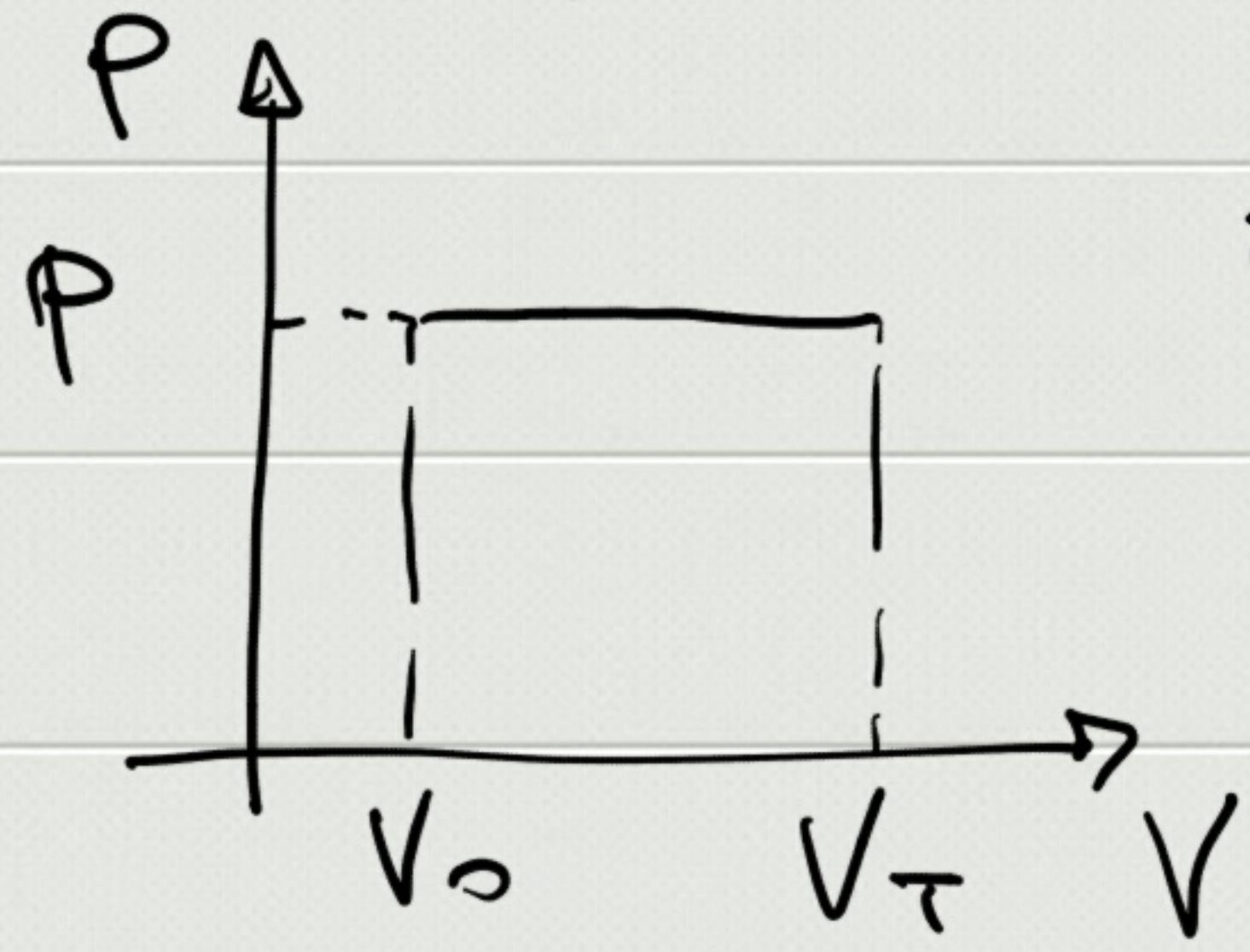
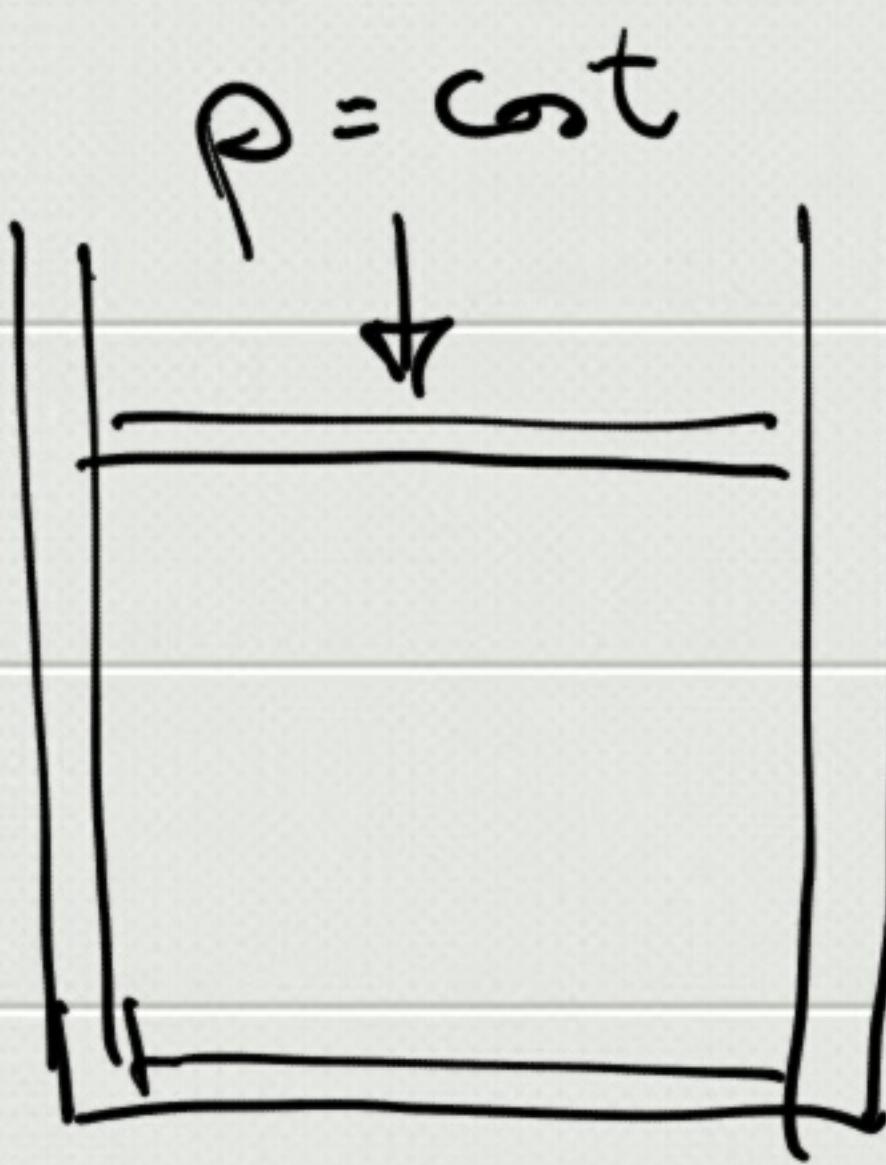
↓
isobare

$$V = \text{cost} \Rightarrow P = P(t) = P_0 (1 + \beta t)$$

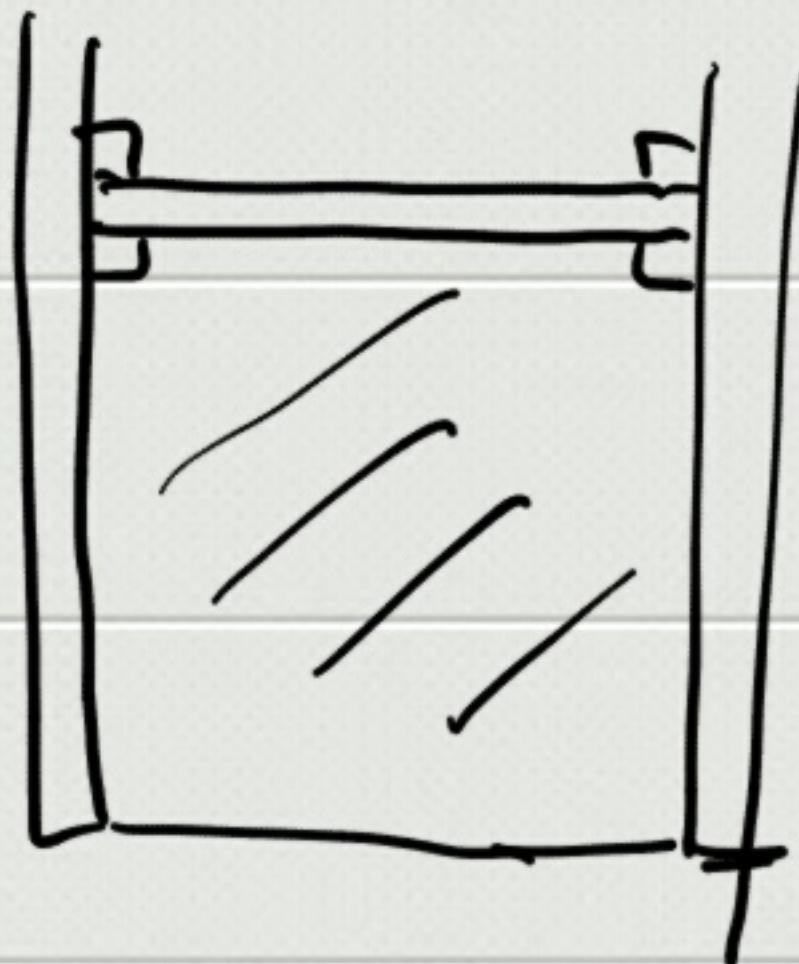
↓
isocora

$$P_0 = P(t = 0^\circ\text{C})$$

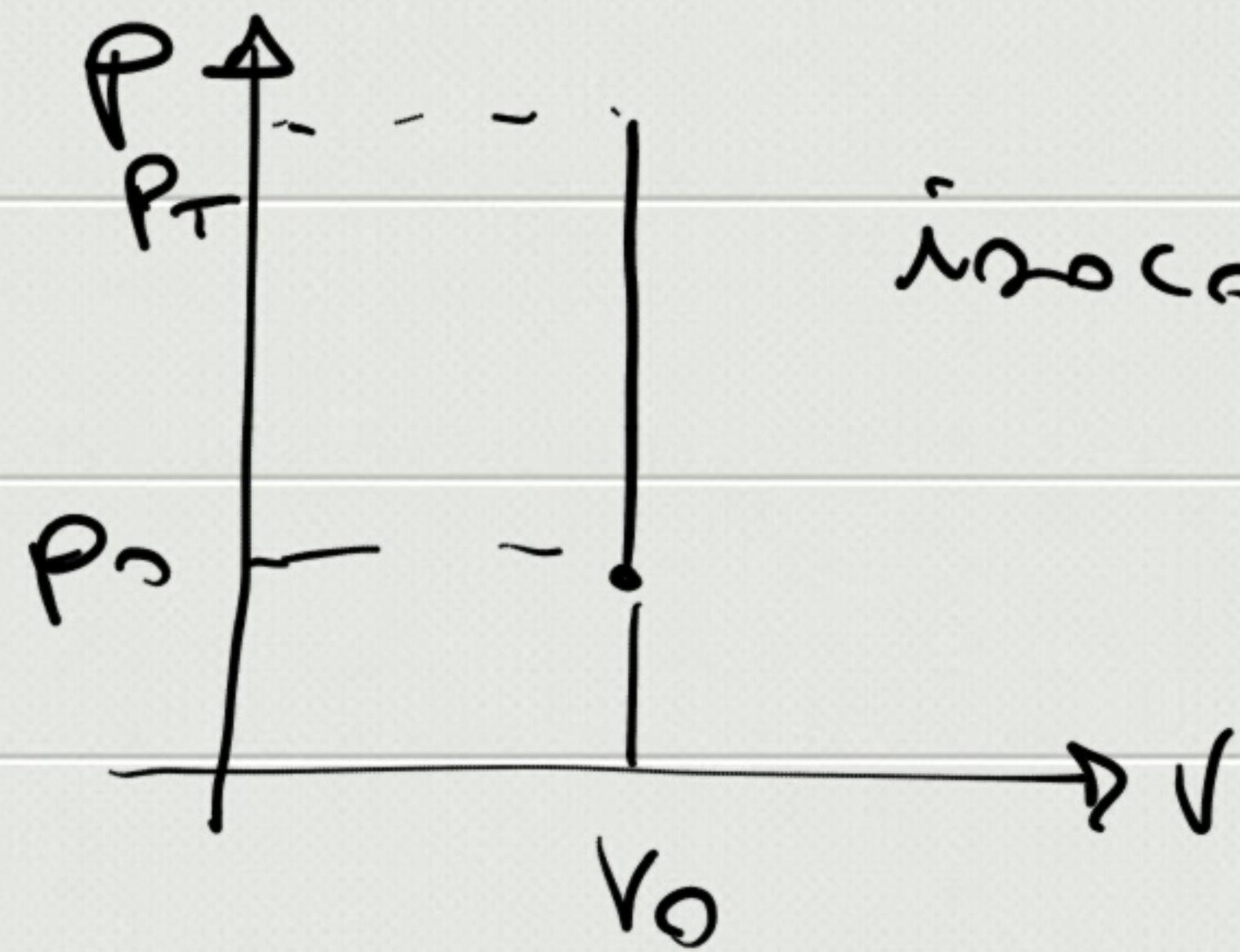
β = coefficient



↓
isocora



$$V = \text{const}$$

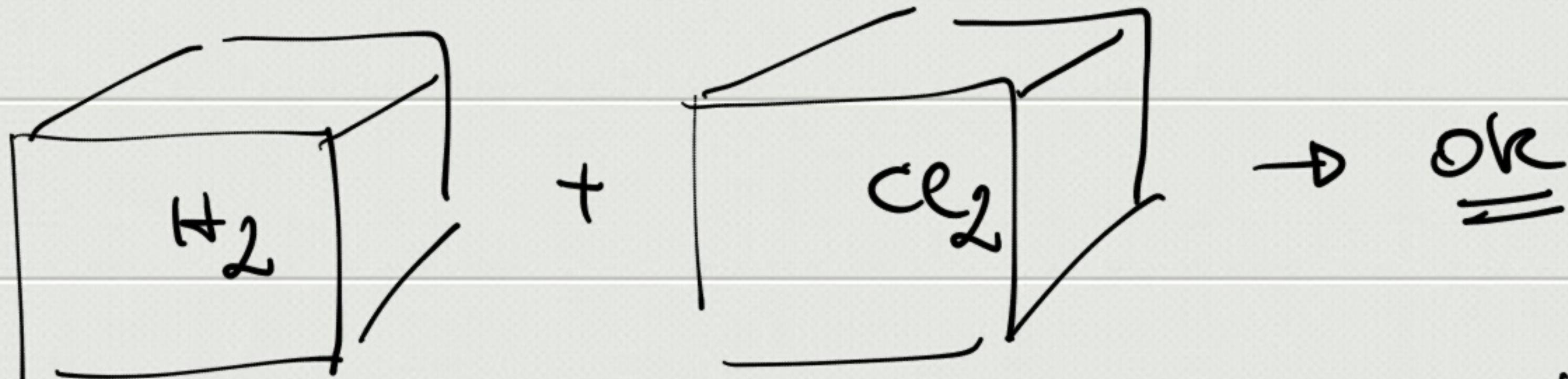
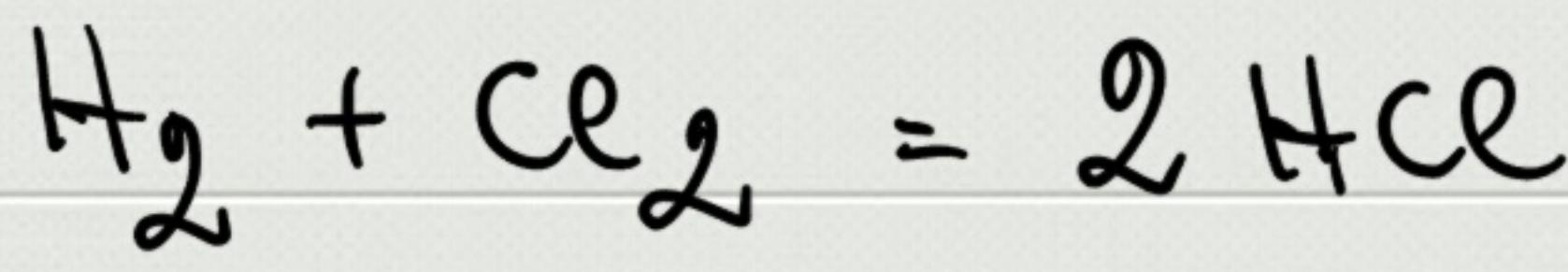


gas ideale $\Rightarrow \alpha = \beta = \frac{1}{273.15} \text{ } ^\circ\text{C}^{-1}$

$$V = V_0 (1 + \alpha t) = V_0 \alpha \left(\frac{1}{\alpha} + t \right) = V_0 \alpha (273.15 + t) =$$

$$= V_0 \alpha T \quad \leftarrow V_T$$

$$P = P_0 (1 + \beta t) = P_0 \alpha T \quad \leftarrow P_T$$



$$N_{H_2} = N_{Cl_2} \quad P, T = \text{cost}$$

$M \rightarrow$ molar mass

$N \rightarrow$ # molecule

$m \rightarrow$ molar mass

$$N = \frac{M}{m}$$

1 mole oxygen : molecule è O_2

O : $8p + 8n \Rightarrow$ molar atomic 16

\Rightarrow 1 mol. O_2 ha $2 \cdot 16 = 32$ molar atomic

1 mole O_2 ha una massa di 32 g

1 mole H_2O : H: 1p $\times 2 = 2$



O: 8p + 8n $\times 1 = 16$

$\overline{18}$

18 g

$$\boxed{M = n \cdot m^*}$$

$n \rightarrow$ numero di moli

$m^* \rightarrow$ massa moleare

$$M_u \rightarrow$$
 numero molecola $= u.m.a \cdot m^*$

$$1.6604 \cdot 10^{-24} \text{ g}$$

$u.m.a.$ → unità di massa atomica

m^* → # di u.m.a. nelle molecole

$$\boxed{M_u = u.m.a \cdot m^*}$$

$$N = \frac{M}{m} = \frac{n \cdot m^*}{u.m.a. m^*} [\text{mol} \cdot g / \text{mol}] =$$

$$= \frac{n}{1.6604 \cdot 10^{-24}} = 6.022 \cdot 10^{23} \text{ N}$$

Numero di molecole in 1 mole di gas

$$N_A = \frac{N}{N} = 6.022 \cdot 10^{23} \quad (\text{numero di Avogadro})$$

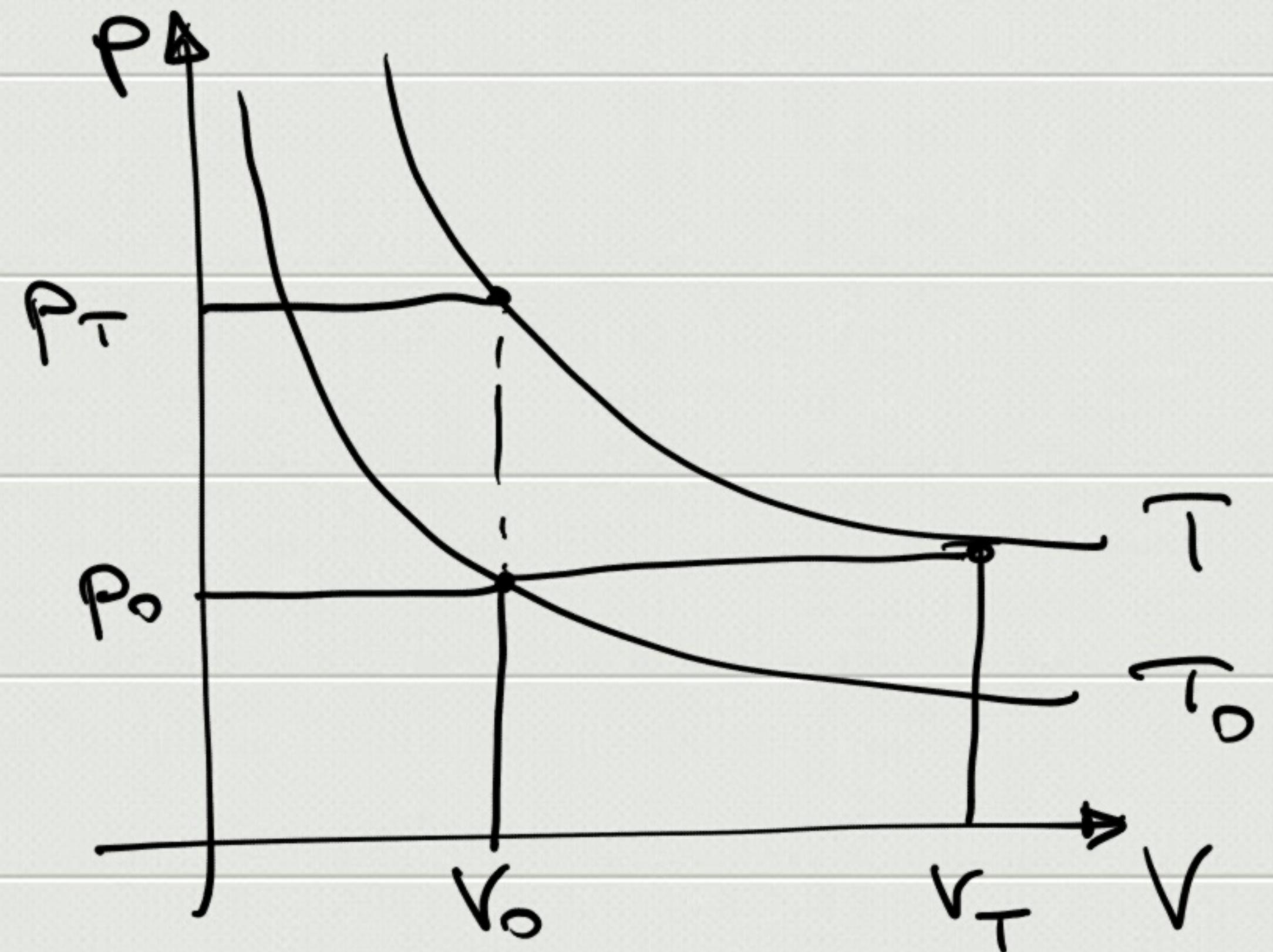
1 mole di gas, $T_0 = 273.15 \text{ K}$,
 $p_0 = 1.01325 \cdot 10^5 \text{ Pa}$ \Rightarrow occupa il
 "volume molare" V_M

$$V_M = 0.022414 \text{ m}^3$$

n moli gas $P_0 = 1.01325 \cdot 10^5 \text{ Pa}$

 $T_0 = 273.15 \text{ K}$

$V_0 = n V_{\text{m}}$



$V = \text{cost} \Rightarrow P_T = P_0 \propto T \Rightarrow (P_T, V_0, T)$

$P = \text{cost} \Rightarrow V_T = V_0 \propto T \Rightarrow (P_0, V_T, T)$

Boyle : $P_T V_0 = P_0 V_T = PV \quad (T = \text{cost})$

Per ogni stato alle temperature T :

$$PV = P_T V_0 = P_0 \propto T n V_{\text{m}} = n (P_0 \propto V_{\text{m}}) T \Rightarrow$$

$\underbrace{R}_{\text{ }}$

$$PV = nRT$$

Equazione di stato
dei gas

$$R = 8.314 \text{ J/K mol}$$

costante universale
dei gas

$$N = n \mathcal{N}$$

$$\Rightarrow PV = \frac{N}{\mathcal{N}} RT = N \left(\frac{R}{\mathcal{N}} \right) T = N k_B T$$

$$k_B = 1.3807 \cdot 10^{-23} \text{ J/K}$$

\hookrightarrow costante di Boltzmann