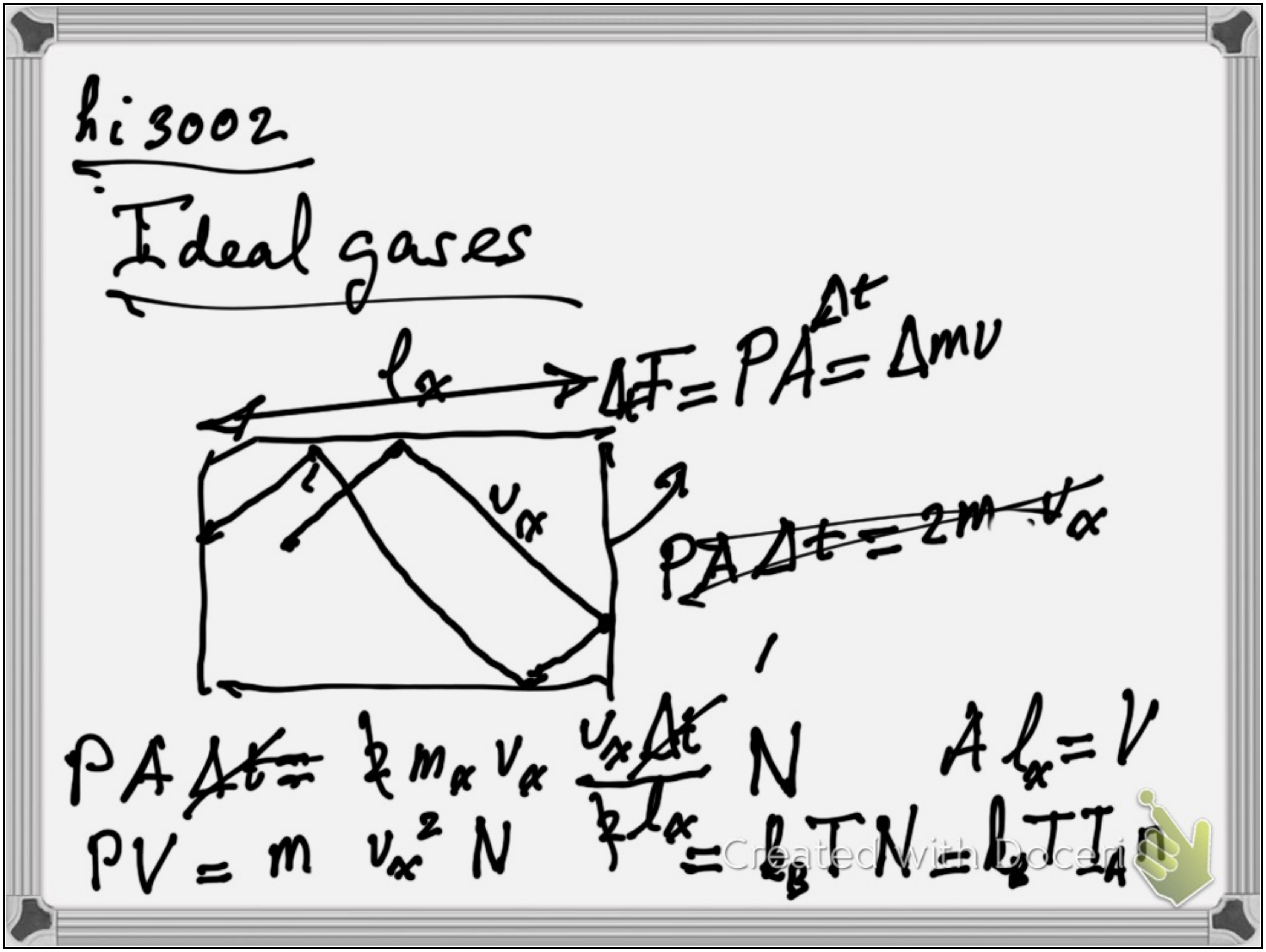
hi 3002
Ideal gases
l_x
v_x
ΔF = PA = Δmv
PAΔt = 2m v_x
PAΔt = 2 m_x v_x (v_x Δt)/(2 l_x) N
A l_x = V
PV = m v_x^2 N = k_B T N
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$PV = \bar{R}_u T n$ → A.1 $\quad R_u = k_B N_A$ $\quad$ A.5

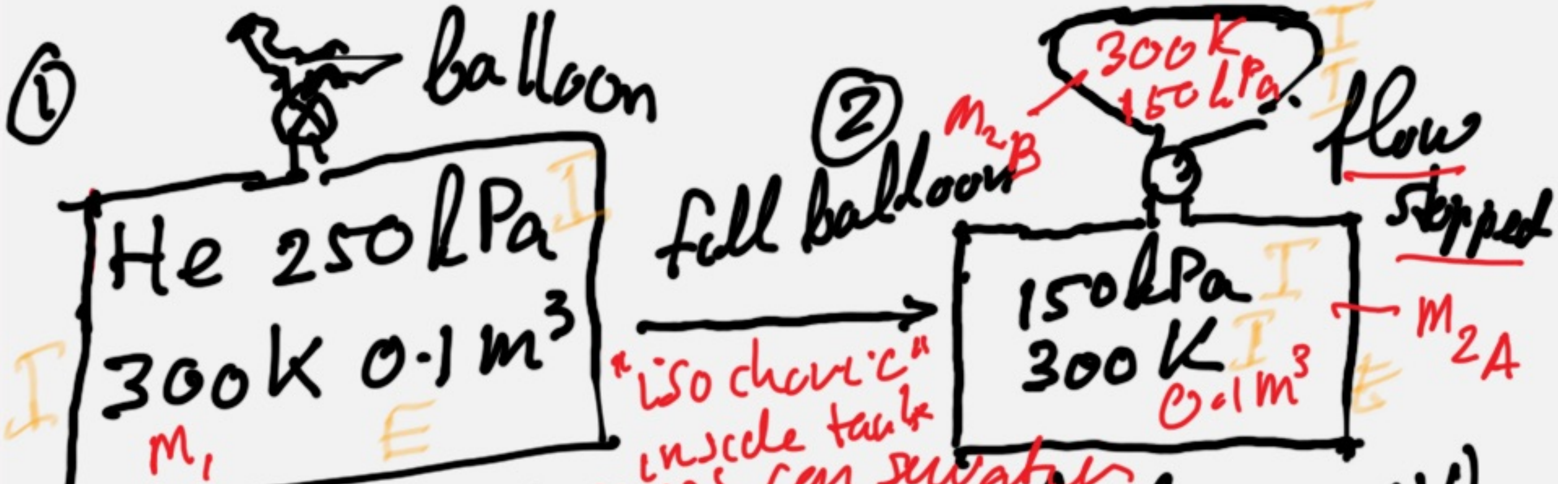
$R = \dfrac{\bar{R}_u}{M}$ specific gas constant

$PV = n\bar{R}_u T$	$PV = mRT$
$P\bar{v} = \bar{R}_u T$	$Pv = RT$

$\bar{v} = \dfrac{V}{n}$ = "molar specific volume"

$m = nM \quad M$: molecular mass units $\dfrac{kg}{kmol}$

v = specific volume



Asked: how big is the balloon (V)

Solution: $m_1 = m_{2A} + m_{2B}$

$P_1 V_1 = m_1 R T_1$ T must be in Kelvin

$R = 2.0771 \frac{kJ}{kg\,K}$ (from A5)

$$P_1 V_1 = m_1 R T_1$$

$$250\ \text{kPa}\ 0.1\ \text{m}^3 = m_1\ 2.0771\ \frac{\text{kJ}}{\text{kg K}}\ 300\ \text{K}$$

$$\boxed{\text{kPa}\ \text{m}^3 = \text{kJ}}$$

$$m_1 = \frac{250 \cdot 0.1}{2.0771 \cdot 300}\ \text{kg} = 0.04012\ \text{kg}$$

$$m_{2A}:\ P_{2A} V_{2A} = m_{2A} R T_{2A}$$

$$150\ \text{kPa}\ 0.1\ \text{m}^3 = m_{2A}\ 2.0771\ \frac{\text{kJ}}{\text{kg K}}\ 300\ \text{K}$$

$$\rightarrow m_{2A} = 0.02407\ \text{kg}$$

$$m_{2B} = m_1 - m_{2A} = 0.016048\ \text{kg}$$

$$P_{2B} V_{2B} = m_{2B} R T_{2B}$$

$$\frac{kJ}{kPa} = m^3$$

$$150\ kPa\ V_{2B} = 0.016048\ kg\ 2.0771\ \frac{kJ}{kg\,K} \times 300\ K$$

$$V_{2B} = 0.00666\ m^3$$

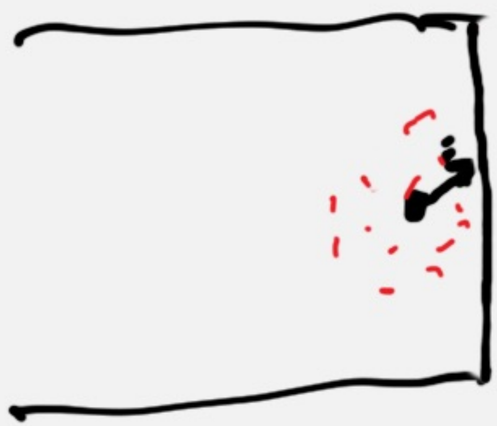
$$1\ J = 1\ Nm$$

$$1\ Pa = 1\ N/m^2$$

Appendix A1

Van der Waals

molecules attract → reduces pressure



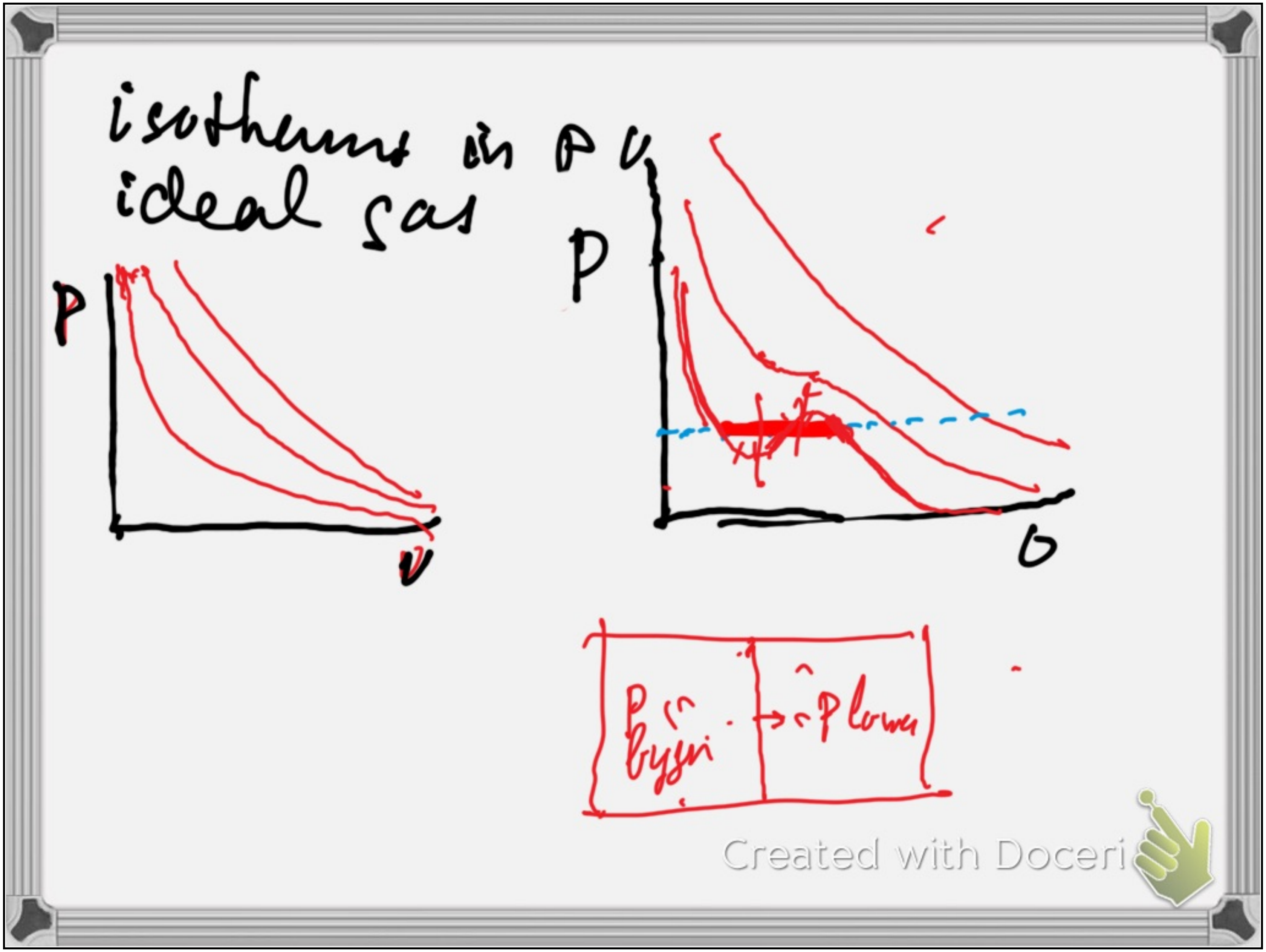
P_{app}

$P - \frac{a}{V^2}$ actual

lost volume $V \to V - b$

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

Van der Waals


isotherms in P V
ideal gas
P
V
P
V
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