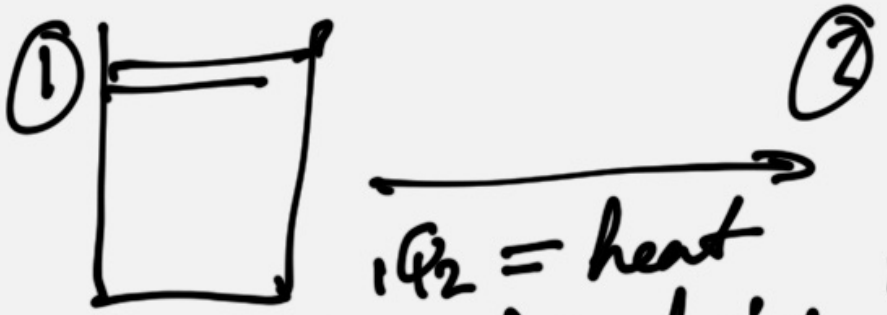
hi3002 (password)

Heat transfer

Heat = "energy transferred by virtue of temperature differences".



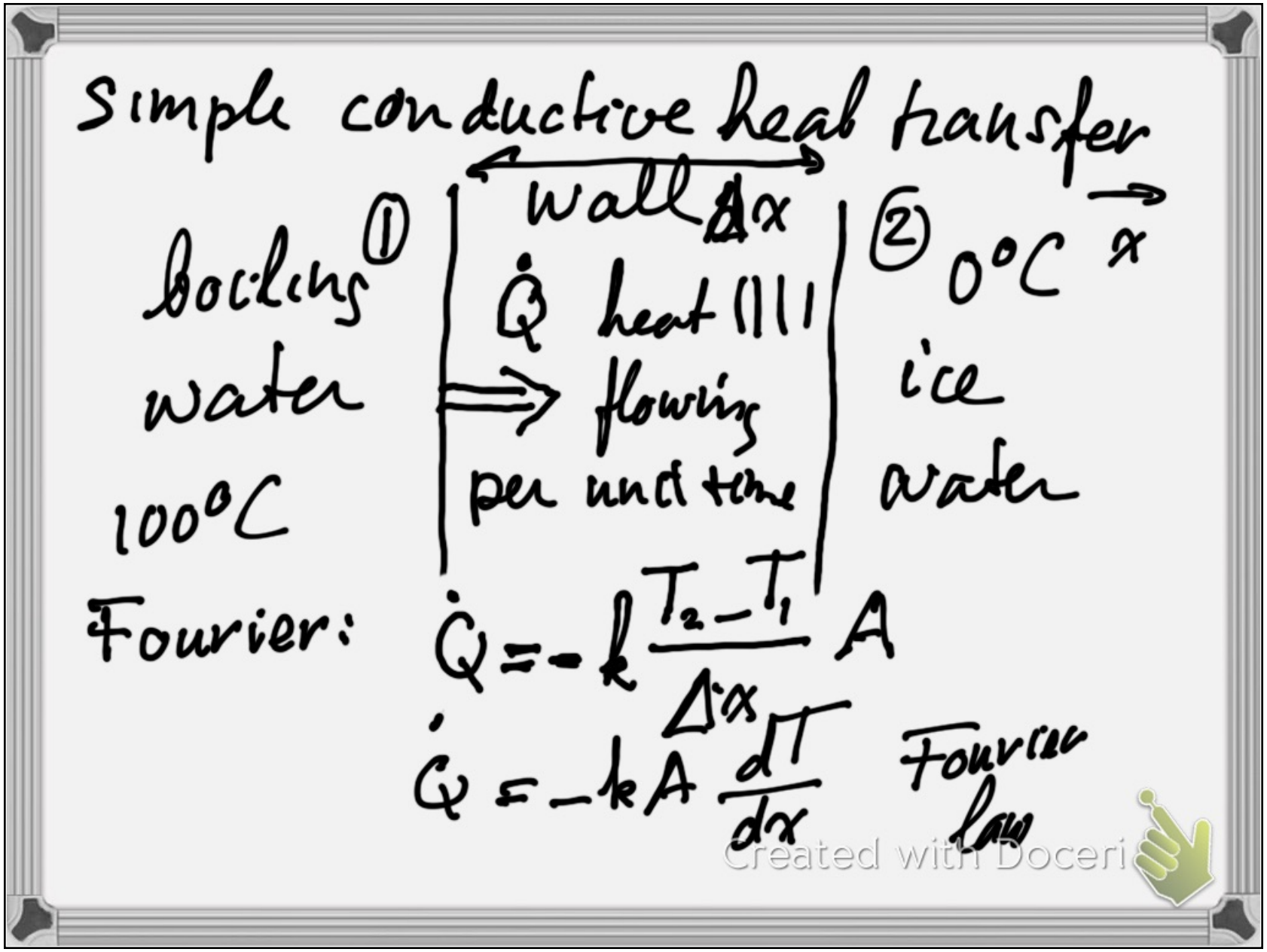
$_1W_2$ = Work done by the substance

$$E_2 - E_1 = {}_1Q_2 - {}_1W_2$$

1st law of thermodynamics

specific heat transferr

$$_1q_2 = \frac{{}_1Q_2}{m}$$


Simple conductive heat transfer
wall Δx
boiling water
100°C
①
②
0°C
x
Q̇ heat flowing per unit time
ice water
Fourier: $\dot{Q} = -k\frac{T_2 - T_1}{\Delta x}A$
$\dot{Q} = -kA\frac{dT}{dx}$
Fourier law
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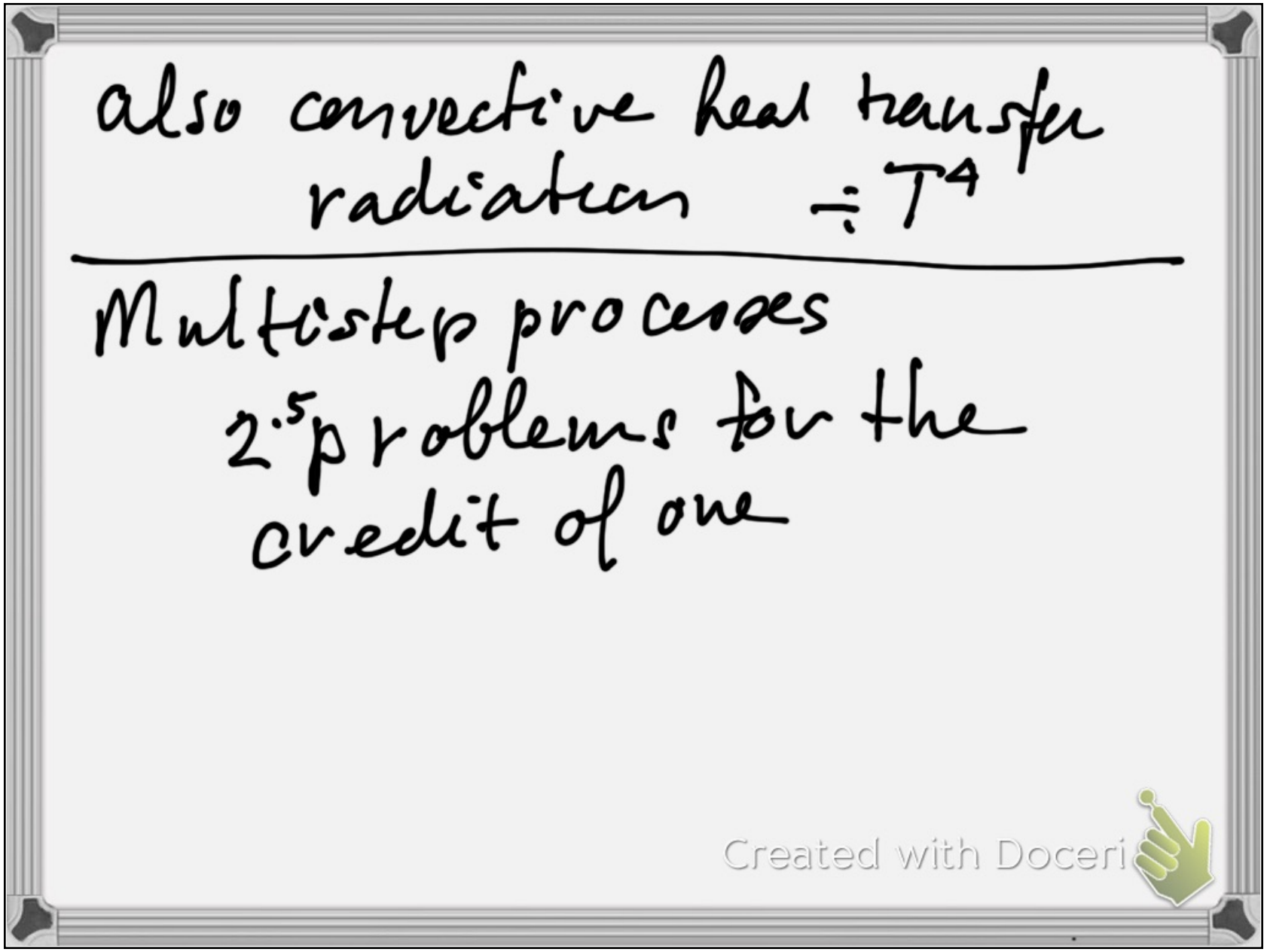
also convective heat transfer
radiation ÷ T^4
Multistep processes
2.5 problems for the
credit of one
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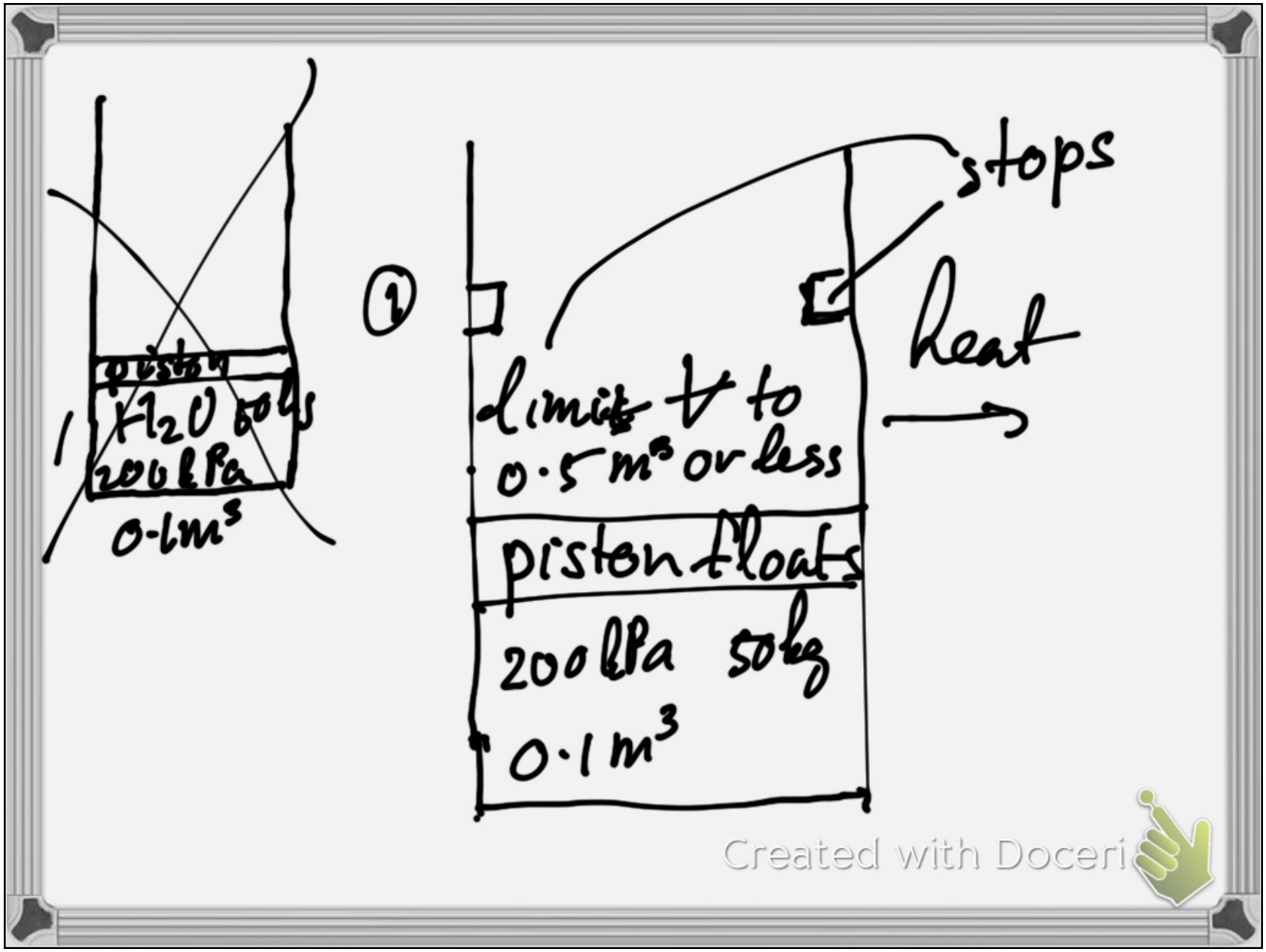
piston
H_2O 50kg
200kPa
0.1m³
1
2
stops
heat
limit ↓ to
0.5 m³ or less
piston floats
200kPa 50kg
0.1 m³
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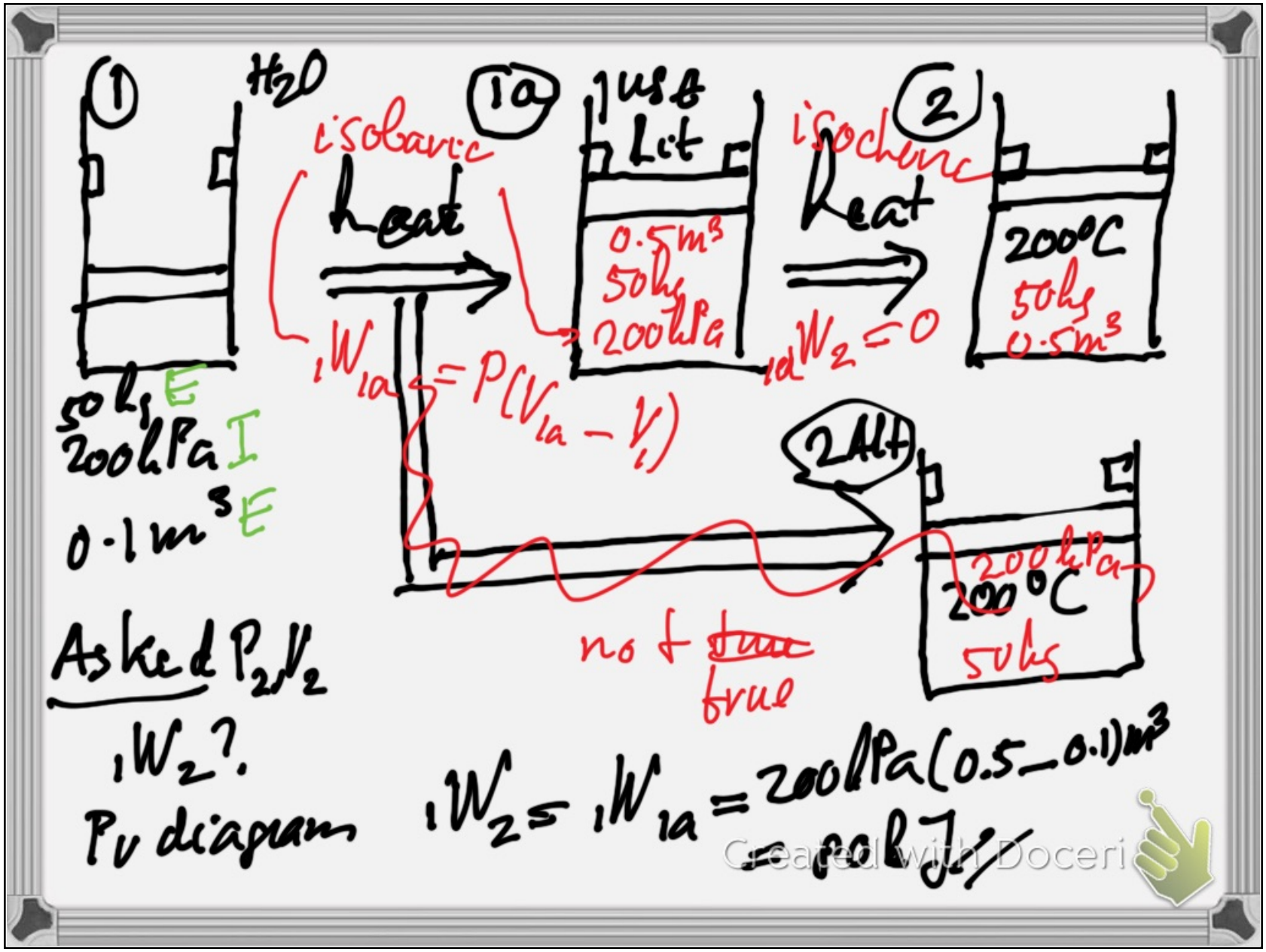
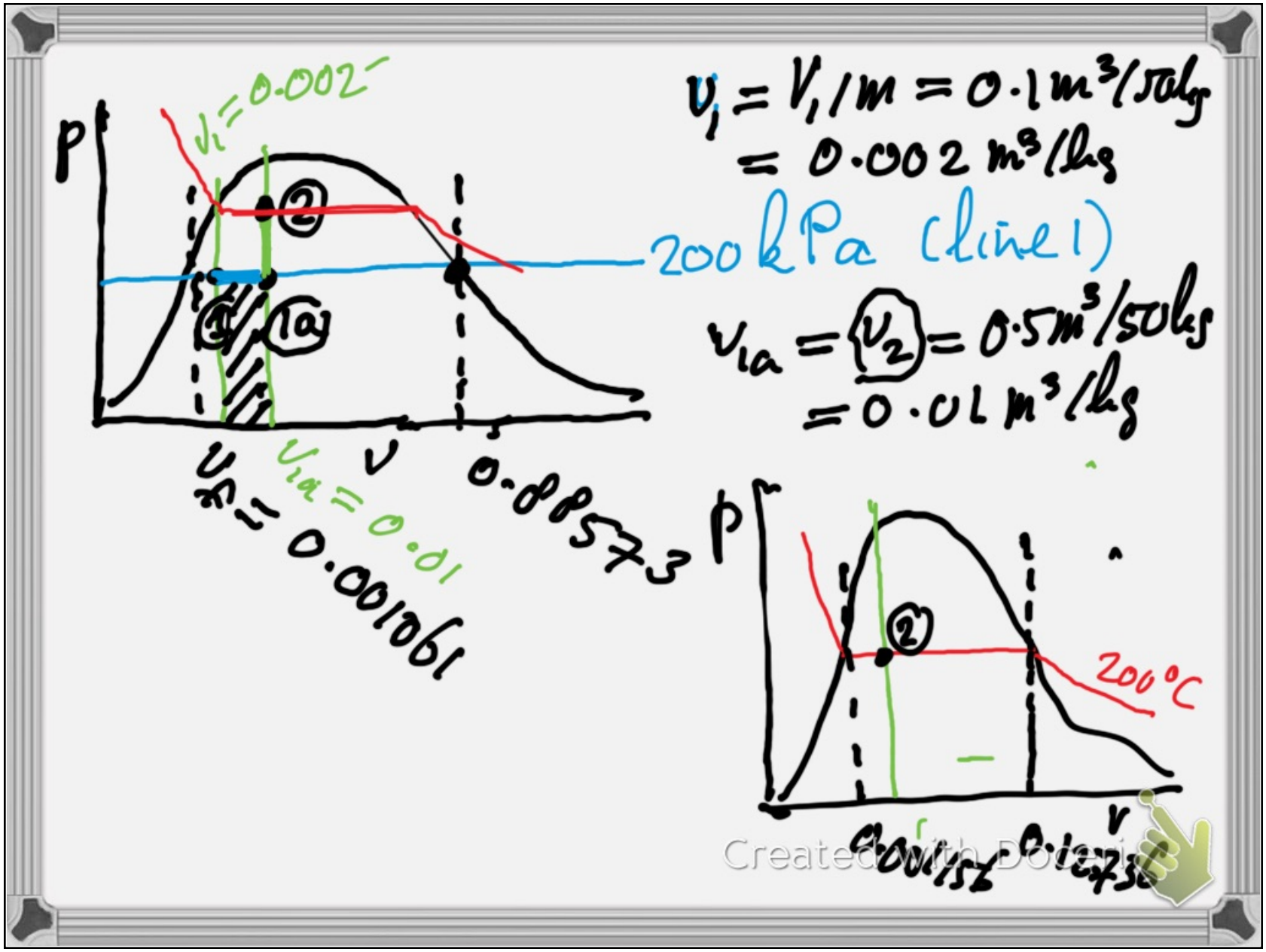
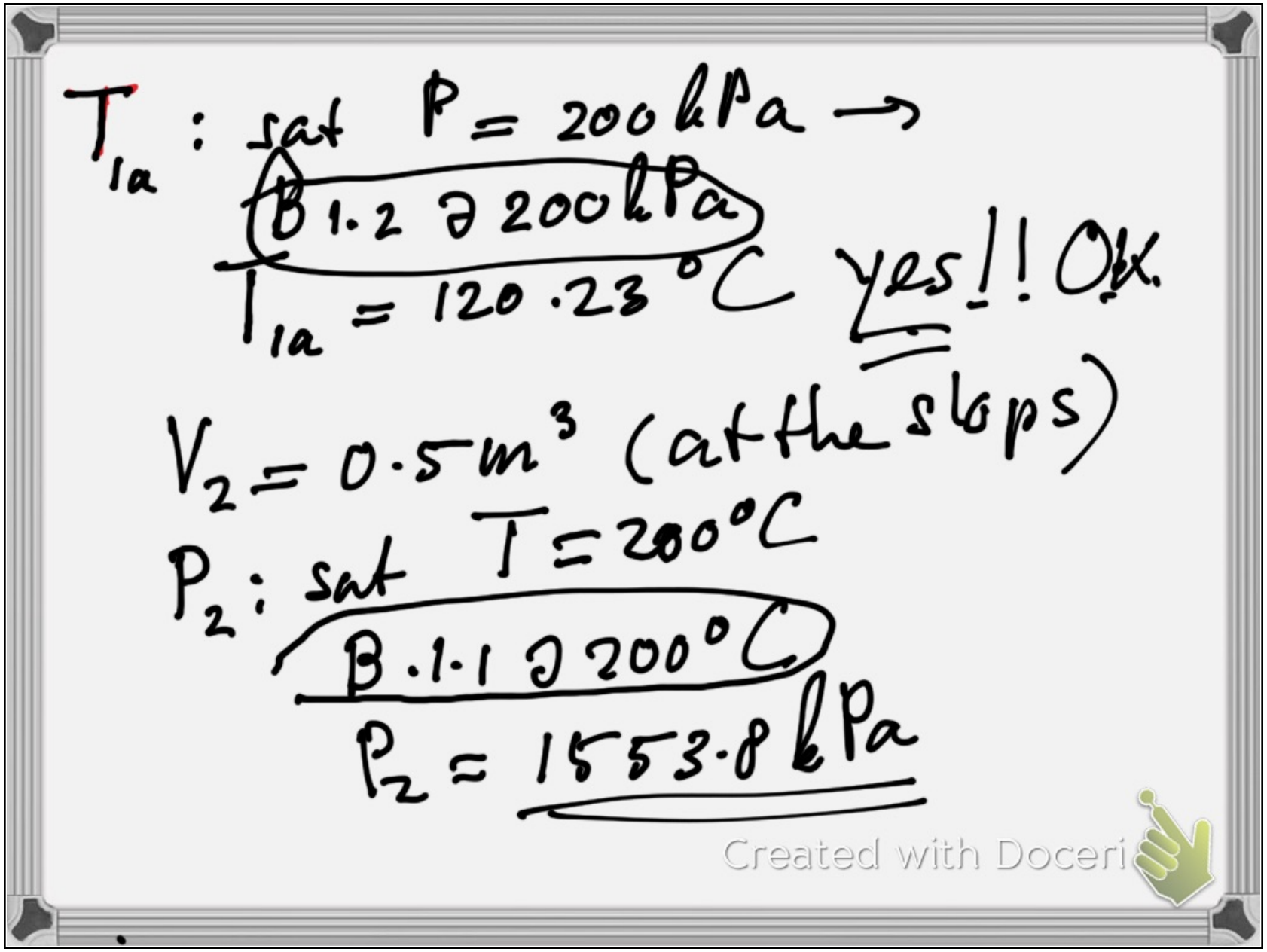

1
H2O
50kg
200kPa
0.1m³
1a
isobaric
heat
0.5m³
50kg
200kPa
1W1a = P(V1a − V1)
2
isochoric
heat
1dW2 = 0
200°C
50kg
0.5m³
2 alt
200kPa
200°C
50kg
no & ~~true~~ true
Asked P2V2
1W2?
PV diagram
1W2 = 1W1a = 200kPa(0.5 − 0.1)m³
= 80kJ
Created with Doceri


$v_1 = V_1/m = 0.1\ m^3/50kg$
$= 0.002\ m^3/kg$
200 kPa (line 1)
$v_{1a} = v_2 = 0.5\ m^3/50kg$
$= 0.01\ m^3/kg$
P
v
$v_1 = 0.002$
$v_{1a} = 0.01$
$v_f = 0.001061$
0.00857 3
200 °C
Created with Doceri


T_{1a} : sat $P = 200\ kPa \rightarrow$
B 1.2 @ 200 kPa
$T_{1a} = 120.23\ ^\circ C$ yes!! Ok.
$V_2 = 0.5\ m^3$ (at the slops)
P_2 : sat $T = 200^\circ C$
B.1.1 @ 200°C
$P_2 = 1553.8\ kPa$
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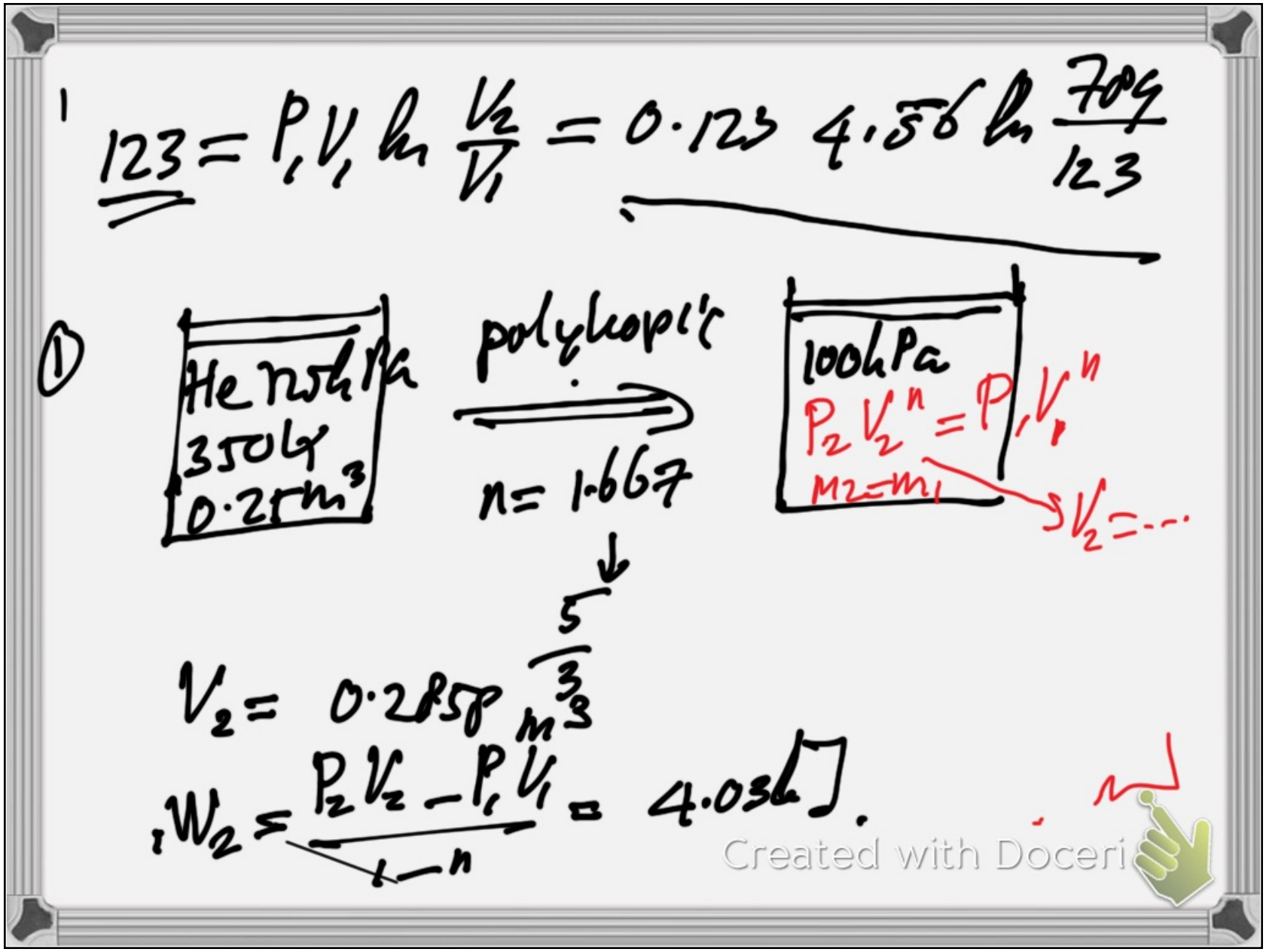
1
123 = P1V1 ln V2/V1 = 0.123 4.56 ln 704/123
①
He 150kPa
350K
0.2m³
polytropic
n = 1.667
100kPa
P2V2^n = P1V1^n
m2 = m1
V2 = ...
5/3
V2 = 0.285 m³
W2 = P2V2 − P1V1 / 1 − n = 4.03kJ
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