h i 3002 | ~~Key~~ "Standard air" [constant, 25°C specific heats (A5)]

Key formulae for I.G. with constant specific heats: (reversible)

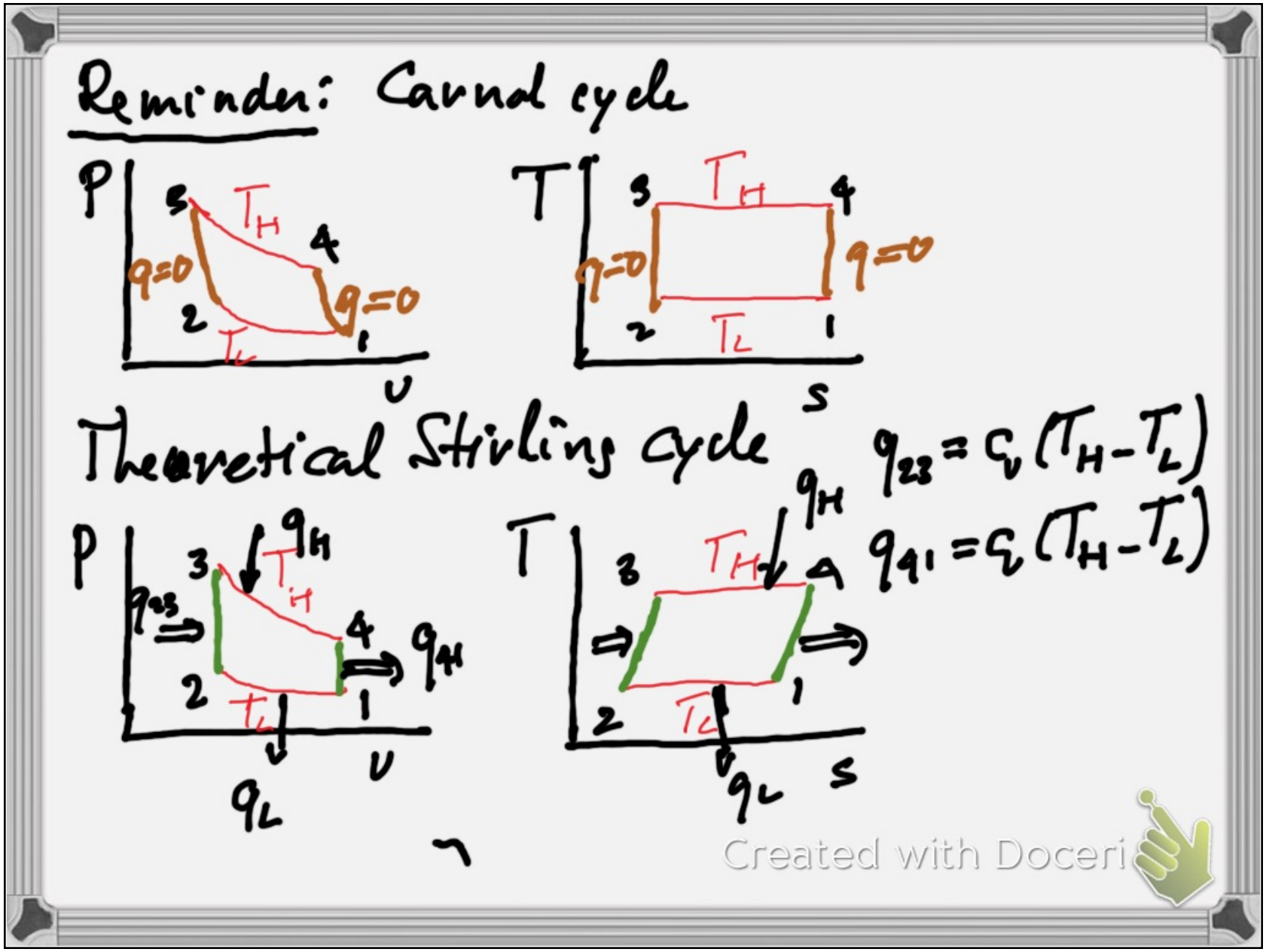
isothermal: $q_2 = RT \ln \frac{v_2}{v_1}$ $T_2 = T_1$

adiabatic: $q_2 = 0$ $\frac{T_2}{T_1} = \left(\frac{v_1}{v_2}\right)^{k-1} = \left(\frac{P_2}{P_1}\right)^{\frac{k-1}{k}}$

$k = c_p / c_v$

isobaric: $q_2 = c_p (T_2 - T_1)$ $P_2 = P_1$

isochoric: $q_2 = c_v (T_2 - T_1)$ $v_2 = v_1$


Reminder: Carnot cycle
P
T
V
S
3
4
2
1
T_H
T_L
q=0
Theoretical Stirling cycle
q_H
q_L
$q_{23} = c_v (T_H - T_L)$
$q_{41} = c_v (T_H - T_L)$
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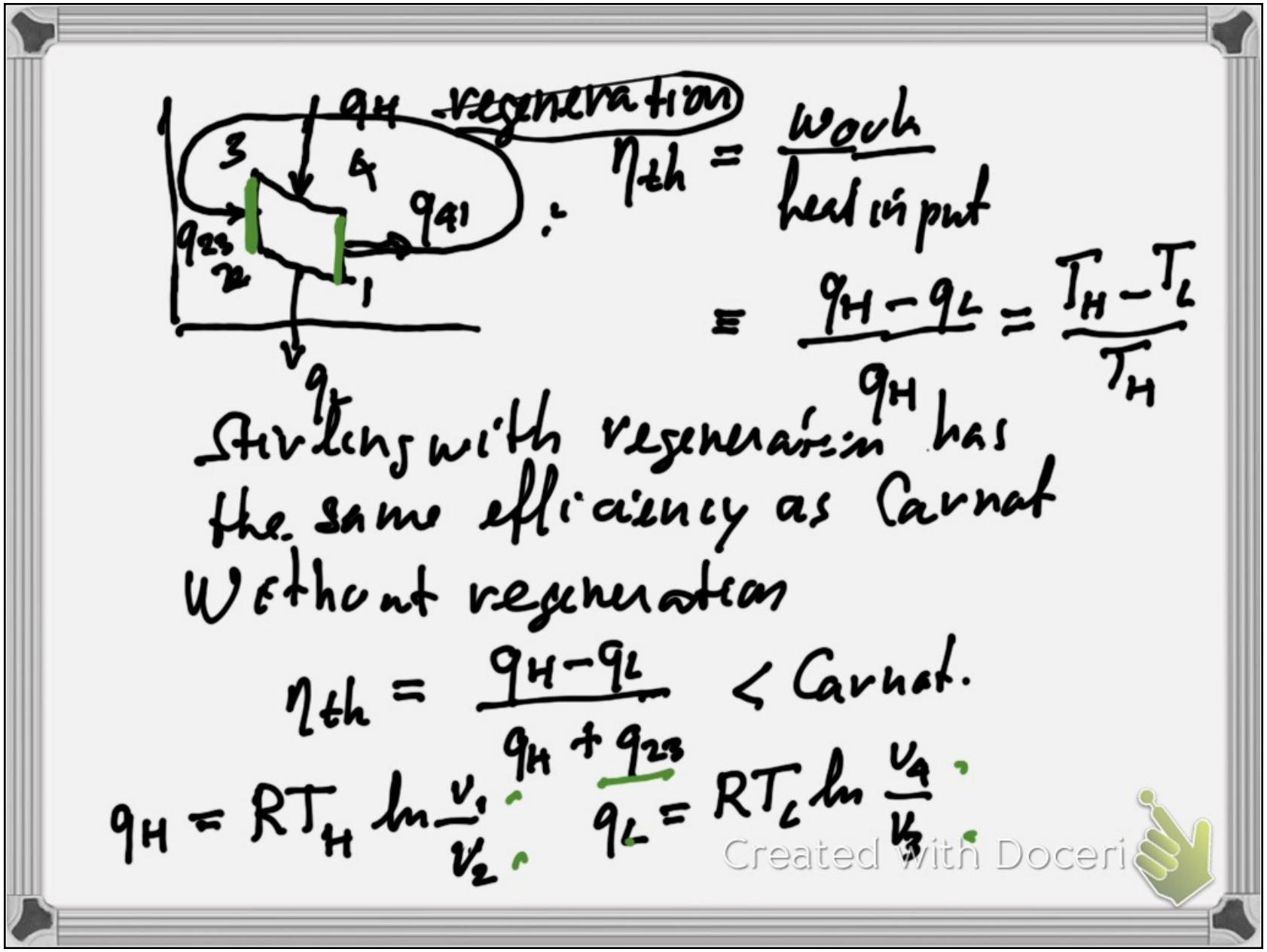

regeneration

$\eta_{th} = \frac{\text{work}}{\text{heat input}}$

$\therefore \equiv \frac{q_H - q_L}{q_H} = \frac{T_H - T_L}{T_H}$

Stirling with regeneration has the same efficiency as Carnot

Without regeneration

$\eta_{th} = \frac{q_H - q_L}{q_H + q_{23}} <$ Carnot.

$q_H = RT_H \ln \frac{v_1}{v_2}$ $\quad q_L = RT_L \ln \frac{v_4}{v_3}$

$$\eta_{th} = \frac{T_H - T_L}{T_H}$$

Different gasses

→ need of same

of number of

molecules

→ need to look

at molar basis

quantities

$R \rightarrow \overline{R_u}$

$\overline{c_p}, \overline{c_v}$