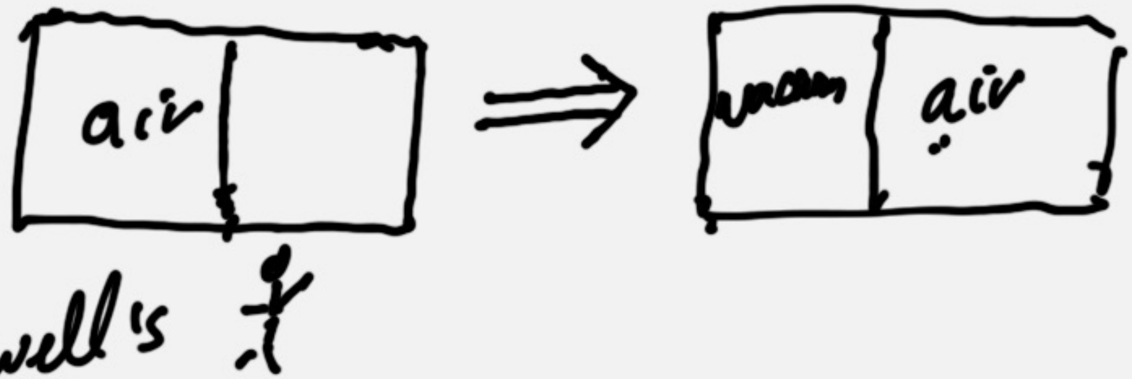
hi 3002



maxwell's demon

accounting system for the 2nd law

nature more ordered → less ordered

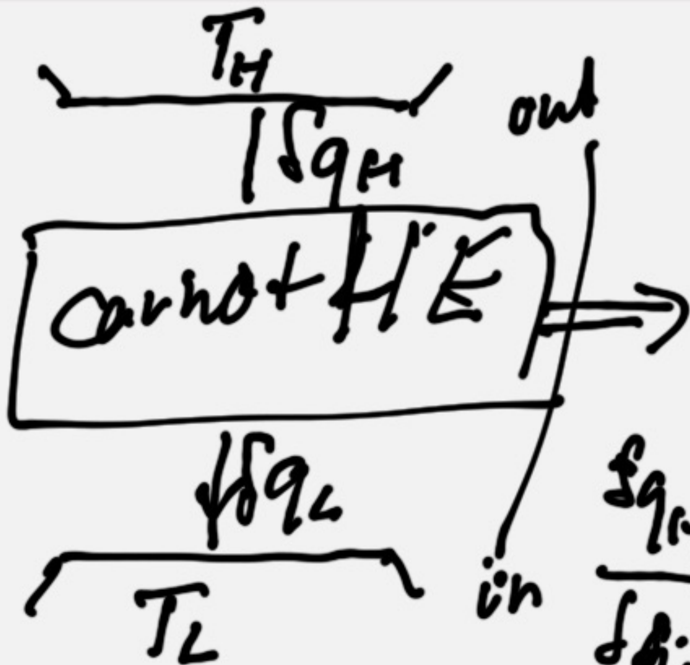
amount of disorderliness

called "entropy" = enthalpy

$= S$

new quantity

$$s = \frac{S}{m}$$



$$\frac{\delta q_H}{T_H} = \frac{\delta q_L}{T_L} = ds$$

$$\frac{\delta q_H}{\delta q_L} = \frac{T_H}{T_L}$$

$$ds \geq \frac{\delta q}{T}$$

$ds = 0 \Rightarrow \delta q = 0$ adiabatic reversible

Can define for a substance entropy as

$\left(\frac{\delta q}{T}\right)_{AB} =$

$\left(\frac{\delta q}{T}\right)_{DC}$

arbitrary state P

reversible

$$S_P - S_{ref} = \int_{ref}^{P} \frac{\delta q}{T}$$

adiabatic + reversible processes are isentropic (constant entropy)

isentropes are lines of constant entropy (in brown)

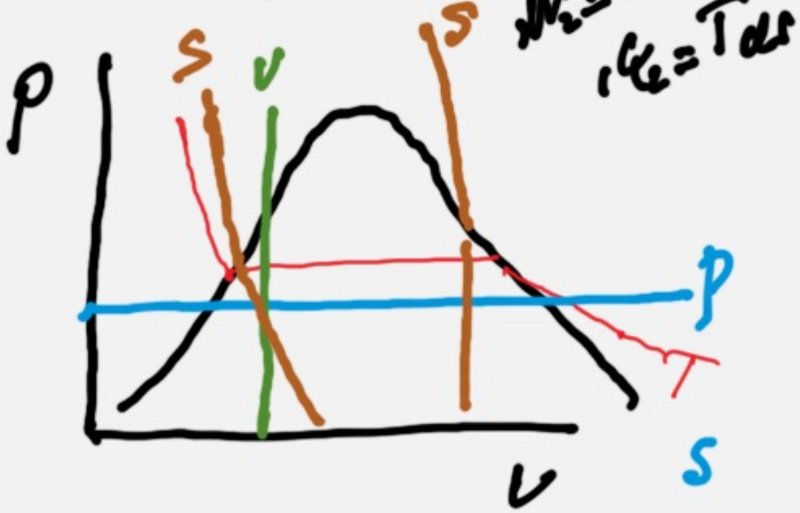
adiabatic and reversible processes are isentropic

For reversible isothermal processes, C.M.

$$S_2 - S_1 = \frac{{}_1Q_2}{T} \qquad {}_1Q_2 = T(S_2 - S_1)$$

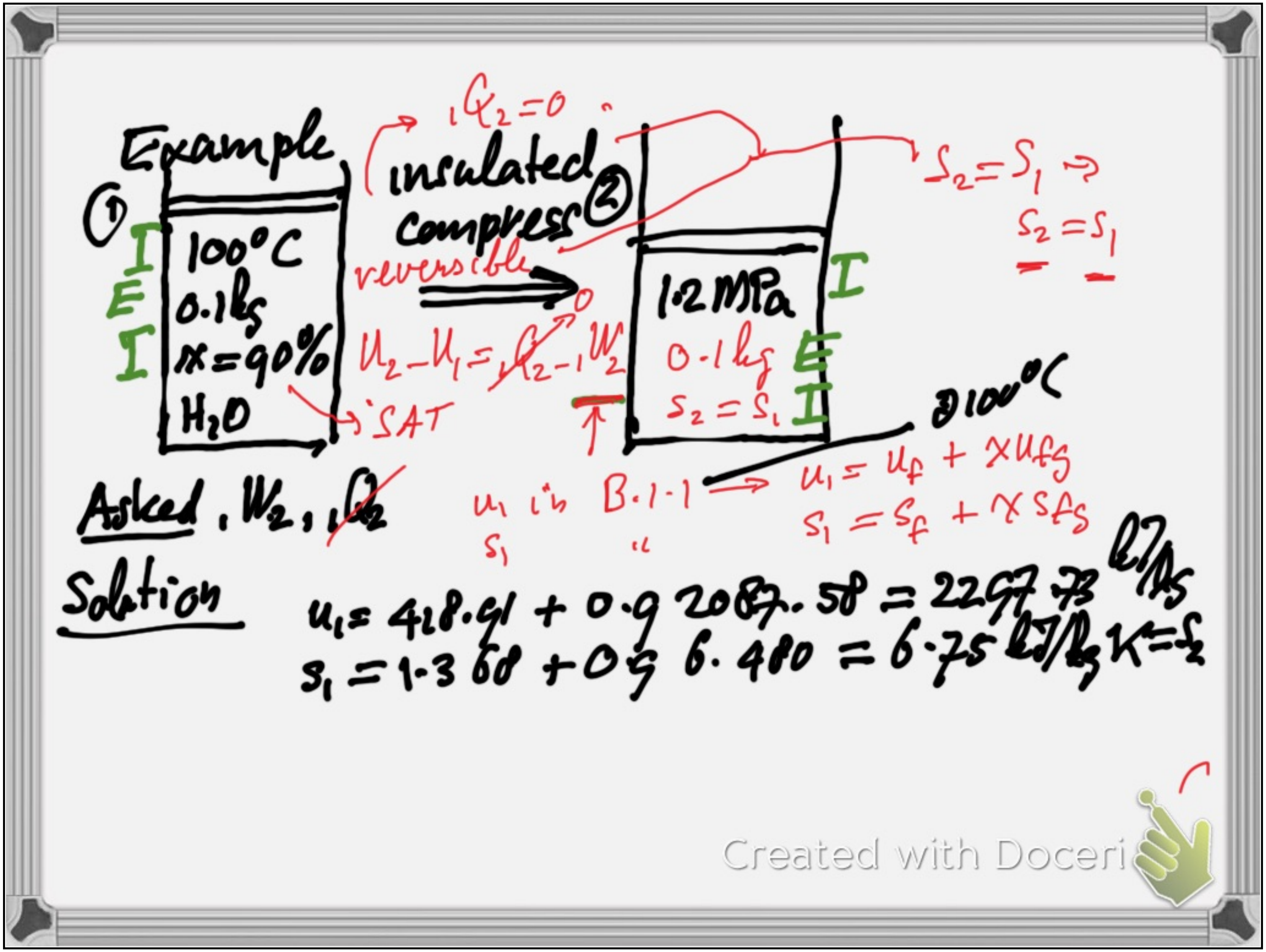
For an adiabatic system, entropy must stay the same, (reversible) or increase (irreversible).

Tables, now including specific entropy s.



$$s = s_f + x(\underbrace{s_g - s_f}_{s_{fg}})$$

Example


Example
(1)
100°C
0.1 kg
x = 90%
H2O
SAT
1Q2 = 0
insulated
compress
reversible
(2)
1.2 MPa
0.1 kg
s2 = s1
S2 = S1
S2 = S1
U2 − U1 = 1Q2 − 1W2
@100°C
u1 = uf + x ufg
s1 = sf + x sfg
u1 in B.1.1
s1 "
Asked, 1W2, 1Q2
Solution
u1 = 418.91 + 0.9 2087.58 = 2297.73 kJ/kg
s1 = 1.3068 + 0.9 6.0480 = 6.75 kJ/kg K = s2
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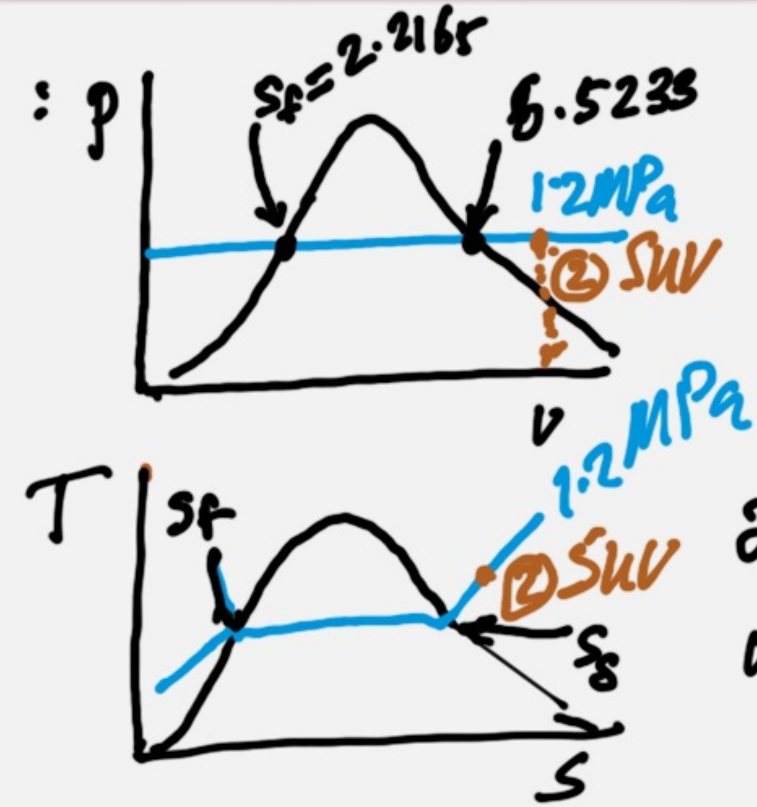
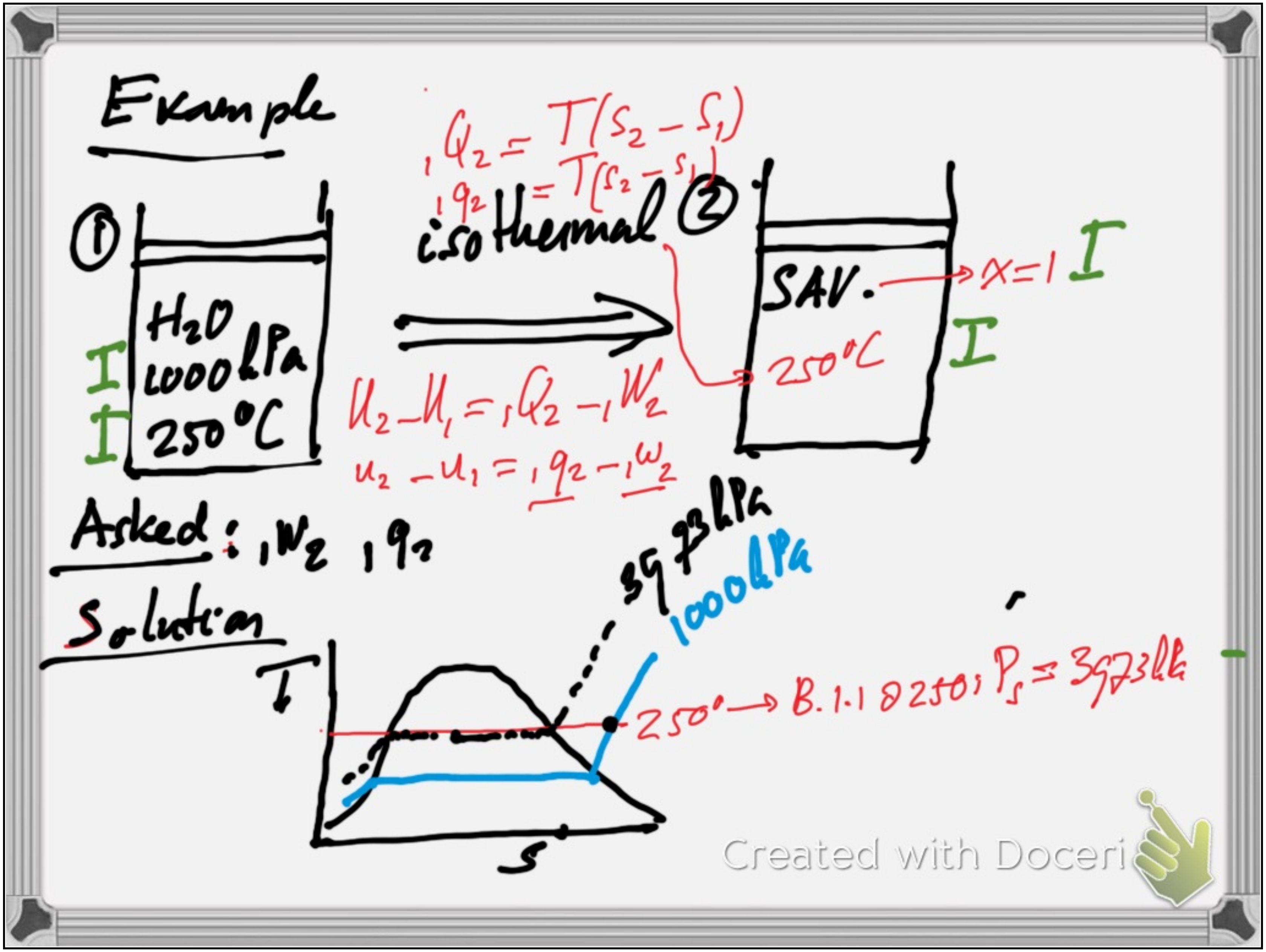
② :



$s_2 = s_1 = 6.75$

to find u_2
→ B.1.3 (SHV)
@ 1.2MPa and
interpolate $6.75 = s$


Example
$_1Q_2 = T(S_2 - S_1)$
$_1q_2 = T(s_2 - s_1)$
isothermal
①
H_2O
1000 kPa
250 °C
I
II
②
SAV.
$x=1$ I
250 °C
II
$U_2 - U_1 = {}_1Q_2 - {}_1W_2$
$u_2 - u_1 = {}_1q_2 - {}_1w_2$
Asked: $_1W_2$ $_1q_2$
Solution
T
s
3973 kPa
1000 kPa
250° → B.1.1 @ 250: P_s = 3973 kPa
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