$\underline{\underline{C_p(T)}}$ $\quad$ $\underline{\underline{C_v(T)}}$

Handbook page 5-5

Table 5.6

Heat $\quad$ Work

$đq$ $\quad$ $đw$

$\oint đq \neq 0$ $\quad$ $\oint đw \neq 0$

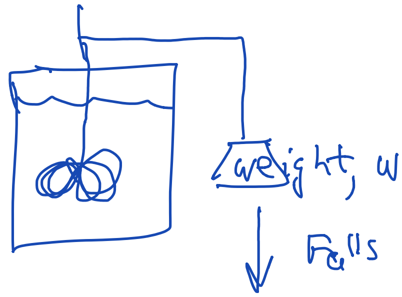
<u>path dependent</u>

J. P. Joule

Initial Equilibrium State T_1

$\downarrow$

Final Eq State T_2



T_1

T_2

$T_1 \longrightarrow T_2$

combination of q (heat) and w (work)

heat ↘ $T_{intermediate}$ ↗ work

$$= \oint đq + \oint đw$$

$$0 = \oint (đq + đw)$$

$$0 = \oint đ(\underbrace{q + w}_{\text{state function}})$$

state function !!!/!!

define a state function U !!!

1st "Law" of Thermo

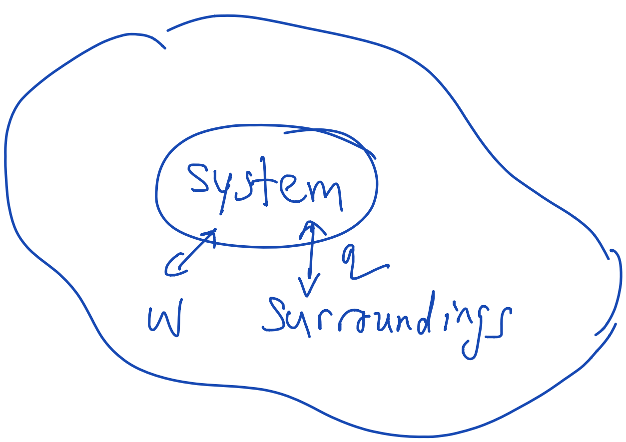
$$U = q + w$$

internal energy

$$dU = \bar{d}q + \bar{d}w$$

$$\oint \bar{d}(q+w) = 0$$

internal "energy" of the H_2O



$$dU = \bar{d}q + \bar{d}w$$

$$\bar{d}q_{sys} = -\bar{d}q_{surr}$$

$$\bar{d}w_{sys} = -\bar{d}w_{surr}$$

$$dU_{TOTAL} = dU_{sys} + dU_{surr}$$

$$= đq_{sys} + đw_{sys} + đq_{surr} + đw_{surr}$$

$$dU_{TOTAL} = dU_{sys} + dU_{surr} = 0$$

Conservation of Energy

"Break Even "Law""

$$dU = đq + đw$$

$$= đq - P_{ext}\, dV$$

Reversibility

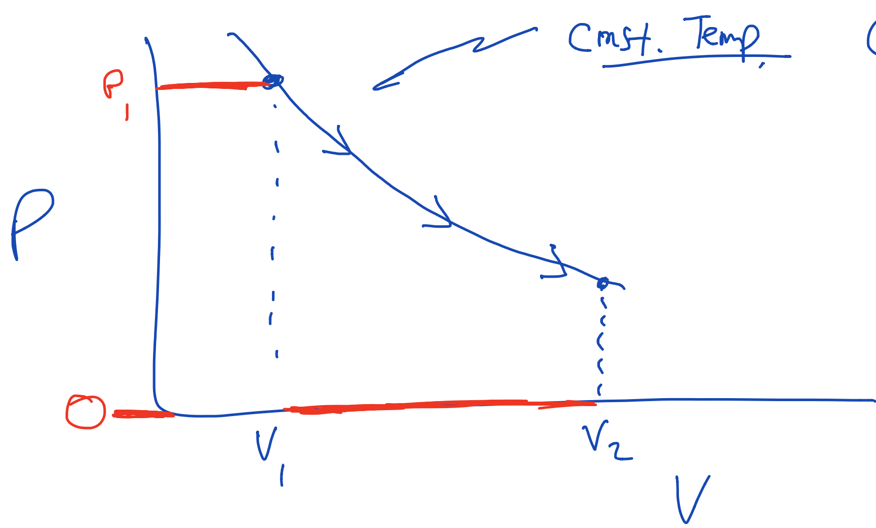
$$A + B \rightleftharpoons C + D$$

T, P constant

Phase Equilibrium

Ice ⇌ H_2O

Consider an Iso T process



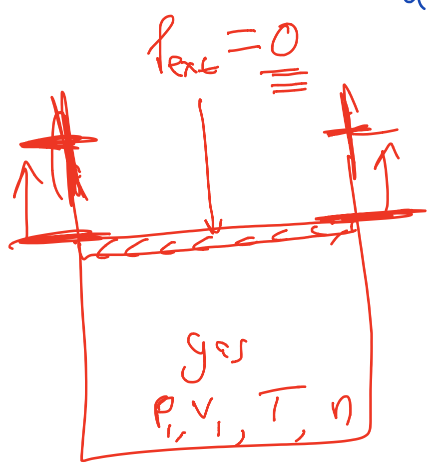
I.G. EOS

$\rightarrow pV = nRT$

$$p = nRT \frac{1}{V}$$

$$đw = -P_{ext}\, dV$$

system will do work

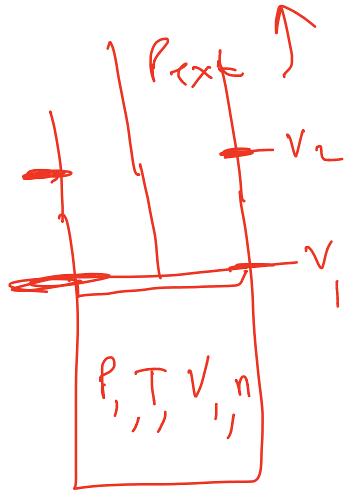


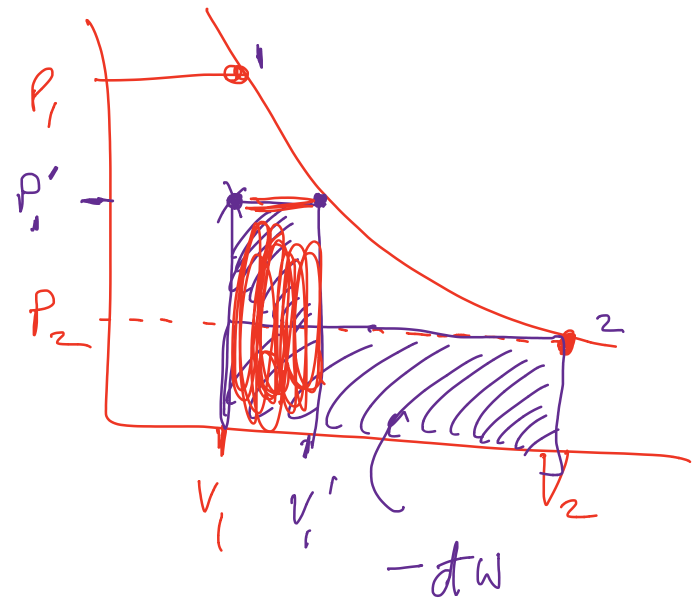
$P_1 \neq 0$

$P_1 > 0$

$P_{ext} < P_1$

$P_{ext} \neq 0$





add another intermediate pressure Get **more work**