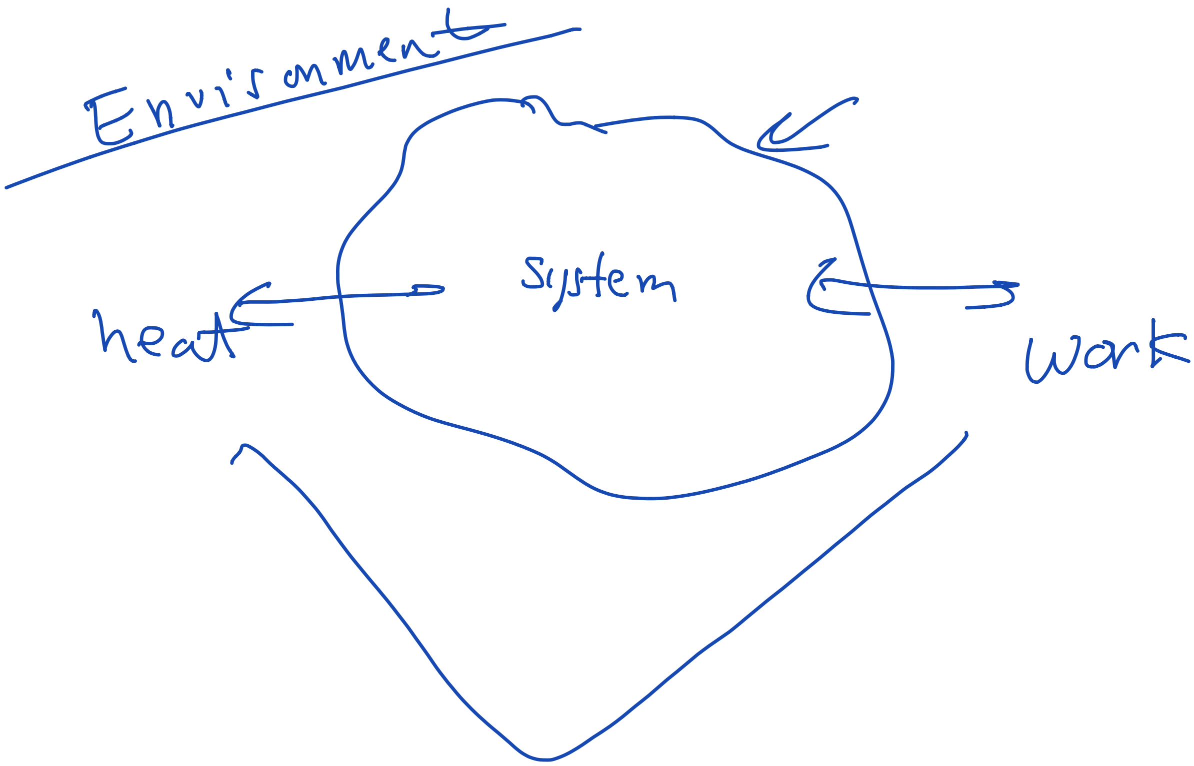
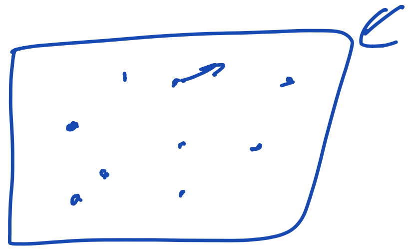


interactions lead to changes of system from Equil State 1

↳ Equil State 2

Equil. States of a system:

$O(10^{23})$ particles



positions of each particle

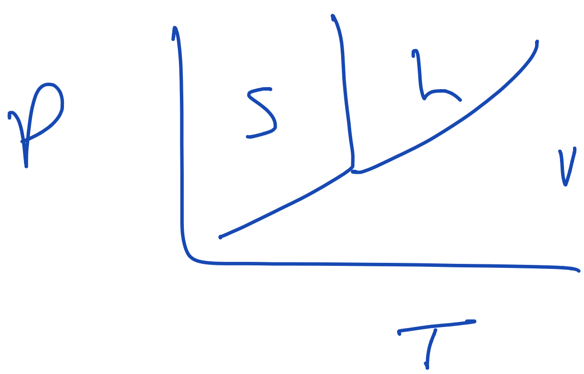
velocity

10^{23}

T, P, n, V ← macroscopic variables

Equilibrium States

2 macroscopic properties + n ← to specify an equili. state



H_2O

State Functions

T, P, V state fns.

Equations of State (E.O.S)

$$T(P,V) = \_\_\_\_$$

$$P(V,T) = \_\_\_\_$$

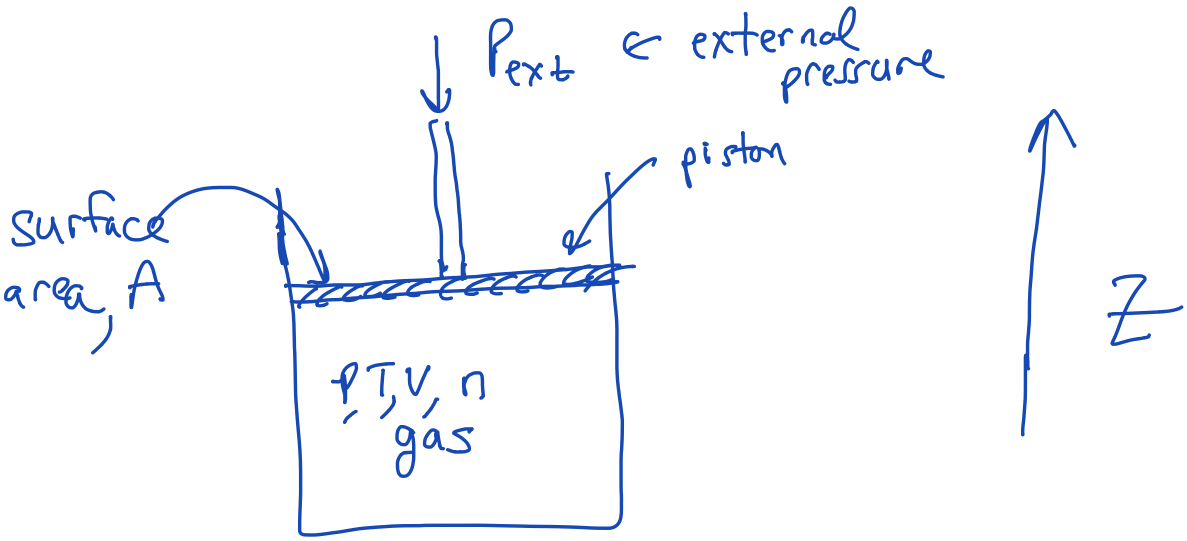
$$V(T,P) = \_\_\_\_$$

$$\oint dT = 0$$

Not a State Function

→ Work

piston assembly



Question: what work is done when volume of system changes from $V_1 \rightarrow V_2$?

not a state function !!!

$$đw = -\bar{F}_{ext} \cdot d\bar{z}$$

← dot product

$$\boxed{đw = -F_{ext}\, dz}$$

$$\bar{F} \cdot \bar{r} = F_x r_x + F_y r_y + F_z r_z$$

F_x, F_y, F_z ; r_x, r_y, r_z

$$đw = -F_{ext}\, dz$$

$$= -P_{ext} A\, dz$$

$$= -P_{ext} (A\, dz)$$

$$= -P_{ext}\, dV$$

$$\boxed{đw = -P_{ext}\, dV}$$ ✱✱✱

sign conventions

$+đw \Leftarrow$ work done on system

$-đw \Leftarrow$ work done by system