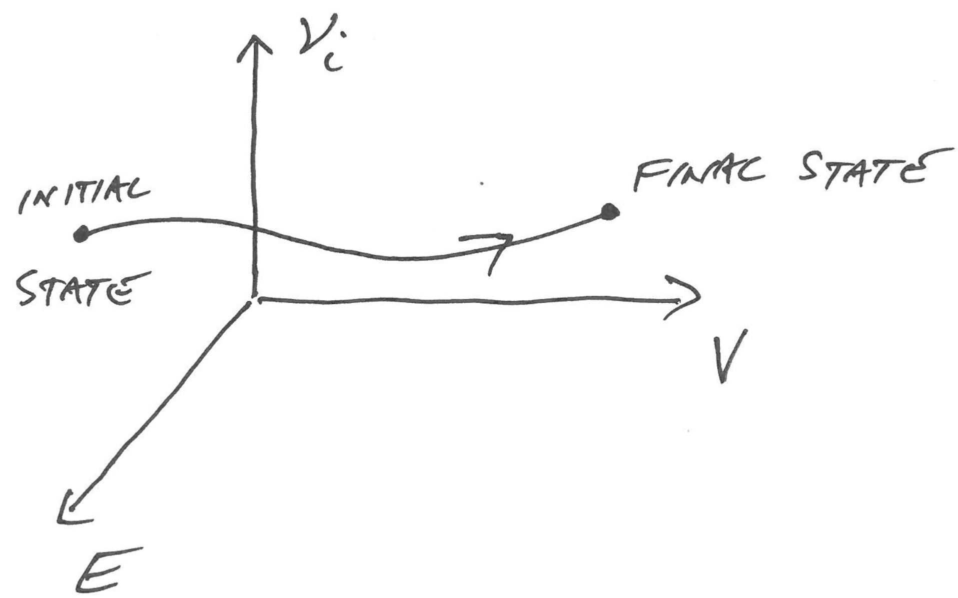
RECAP

- THE THERMODYNAMIC PARAMETERS OF A SYSTEM $p, T, V, E, \nu_i, \ldots$, USUALLY CANNOT BE DEFINED UNLESS THERMAL EQUILIBRIUM IS ESTABLISHED

- A QUASISTATIC PROCESS IS AN IMAGINARY PROCESS WHERE THE SYSTEM IS AT EQUILIBRIUM AT EACH STAGE THROUGHOUT THE PROCESS. SUCH A PROCESS CAN BE PLOTTED AS A CONTINUOUS CURVE IN PARAMETER SPACE.



THE 1ST LAW OF THERMODYNAMICS IS

$$\boxed{dE = đQ + đW}$$

THE INFINITESIMAL CHANGE OF THE INTERNAL ENERGY E OF THE SYSTEM

THE INFINITESIMAL AMOUNT OF WORK $đW$ & HEAT $đQ$ ADDED TO THE SYSTEM

EXTENSIVE VS INTENSIVE

- CONSIDER A SYSTEM IN THERMODYNAMIC EQUILIBRIUM WITH GIVEN THERMODYNAMIC PARAMETERS (SUCH AS PRESSURE, VOLUME TEMPERATURE, No° OF PARTICLES, INTERNAL ENERGY ETC.)

IF YOU ADD TOGETHER TWO IDENTICAL COPIES OF THIS SYSTEM TO OBTAIN A NEW "TOTAL" SYSTEM, THEN

THE PARAMETERS OF THE NEW TOTAL SYSTEM WHICH ARE <u>DOUBLE</u> THE SIZE OF THOSE OF ONE OF THE IDENTICAL COPIES ARE SAID TO BE <u>EXTENSIVE PARAMETERS</u> (eg E, V, ν_i),

WHEREAS THE PARAMETERS OF THE NEW TOTAL SYSTEM WHICH ARE THE <u>SAME</u> AS ONE OF THE IDENTICAL COPIES ARE SAID TO BE <u>INTENSIVE</u> PARAMETERS (eg p, T).

ENTROPY OF AN IDEAL GAS

EQs OF STATE

$$pV = \nu R T$$

$$E = \nu C_V T$$

$$C_V = \alpha R \qquad \alpha = \begin{cases} \frac{3}{2} \\ \frac{5}{2} \\ \frac{6}{2} \end{cases}$$

1ST LAW : $\text{đ}Q = dE - \text{đ}W$

QUASISTATIC : $\text{đ}Q = dE + p\,dV$

IDEAL GAS : $\text{đ}Q = \nu C_V\, dT + \dfrac{\nu R T}{V}\, dV$

$$\Rightarrow \quad \frac{\text{đ}Q}{T} = \nu C_V \frac{dT}{T} + \nu R \frac{dV}{V}$$

$$\Rightarrow \quad \boxed{\frac{\text{đ}Q}{T} = d\left(\nu C_V \ln T + \nu R \ln V + \text{CONST}\right)}$$

RHS : EXACT DIFFERENTIAL

INTRODUCE A FUNCTION S, <u>ENTROPY</u>

SUCH THAT

$$dS = \frac{đQ}{T}$$

$$\Rightarrow \quad dS = d\left(\nu C_V \ln T + \nu R \ln V + \text{CONST}\right)$$

$$\Rightarrow \quad \boxed{S = \nu C_V \ln T + \nu R \ln V + \text{CONST}}$$

<u>ENTROPY OF IDEAL GAS</u>

FROM TUTORIAL

FOR A FUNCTION f OF n INDEPENDENT VARIABLES $u_1, u_2, \ldots, u_n$

$$f = f(u_1, u_2, \ldots, u_n)$$

THEN

$$\boxed{df = \frac{\partial f}{\partial u_1} du_1 + \frac{\partial f}{\partial u_2} du_2 + \ldots + \frac{\partial f}{\partial u_n} du_n}$$