Process 2-3

> Heat is supplied at constant temperature $T_2 = T_3$

> Volume increases from V_2 to V_3 and entropy S_2 to S_3.

> pressure drops from P_2 to P_3.

Heat supplied $Qs_{2-3} = T_2 . ds = T_3 ds$ $\left[\because ds = \frac{dQ}{T} \right.$ $T_2 = T_3$

$dQ = T.ds$

Process 3-4

> Air is expanded Isentropically from 3-4.

> pressure and temperature decreases from P_3 to P_4 & T_3 to T_4

> Entropy remains Constant.

Process 4-1

> Heat is rejected Isothermally

> Heat rejected $= T_2 ds - T_1 ds$

$W = (T_2 - T_1) ds$

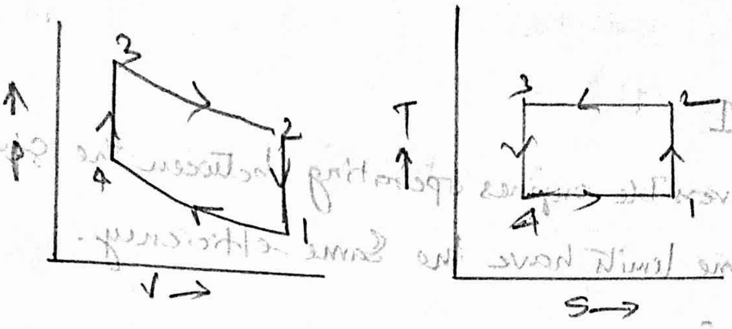
Efficiency of Carnot Cycle $= \eta = \frac{W}{Qs} = \frac{(T_2 - T_1).ds}{T_2 . ds}$

$\eta_{Carnot} = \frac{T_2 - T_1}{T_2} = \frac{T_H - T_L}{T_H}$

[Reversible Engine gives maximum efficiency than than any other engine]

Reversed Carnot Cycle

The Cycle Consists of two Isothermal and two Isentropic process. The cycle is used to extract heat from cold body and rejects it into hot body.



process 1-2 : Isentropic Compression in Compressor

2-3 : Isothermal Heat rejection to a hot body

3-4 : Isentropic expansion in a expansion valve

4-1 : Isothermal heat rejection from a cold body.

Heat Extraction (2-3)

$E = T_1 ds = T_4 ds$

heat rejected during 4-1

$Q_R = T_2 ds = T_3 ds$

Work input $W = Q_R - E$

$T_2 \cdot ds - T_1 \cdot ds = (T_2 - T_1) ds$ [Produces cooling effect]

Coefficient of performance is the ratio of heat extracted to the work input.

$$COP = \frac{\text{Heat extraction}}{\text{Work input}} = \frac{E}{W} = \frac{T_1 ds}{(T_2 - T_1) ds}$$

$$COP = \frac{T_1}{T_2 - T_1} = \frac{T_L}{T_H - T_L} \rightarrow \text{[Refrigerators]}$$

Heat pump//

$$COP = \frac{\text{Heat rejected}}{\text{Work input}} = \frac{T_2 ds}{(T_2 - T_1) ds} = \frac{T_2}{T_2 - T_1}$$

$T_1 = T_L$, $T_2 = T_H$

equal to the highest and lowest temperature of the fluid in the original engine.

Corollary 5

Whenever a system undergoes a cycle, $\oint \frac{dQ}{T}$ will be zero if the cycle is reversible and it is negative if the cycle is irreversible that is $\oint \frac{dQ}{T} \leq 0$.

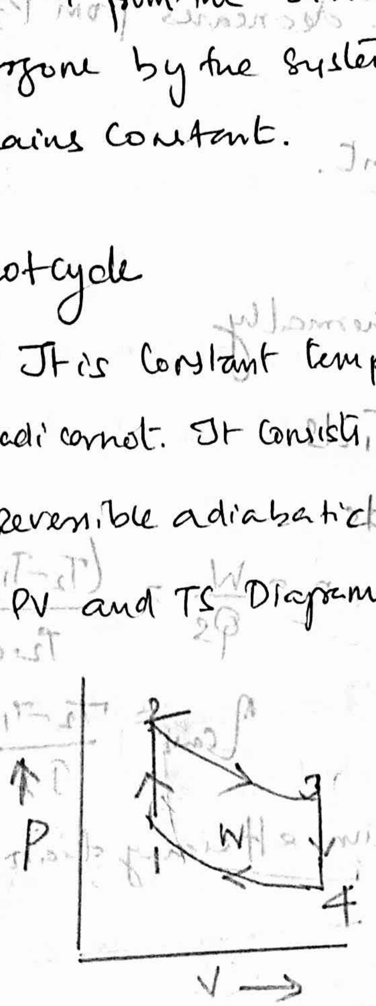
Corollary 6

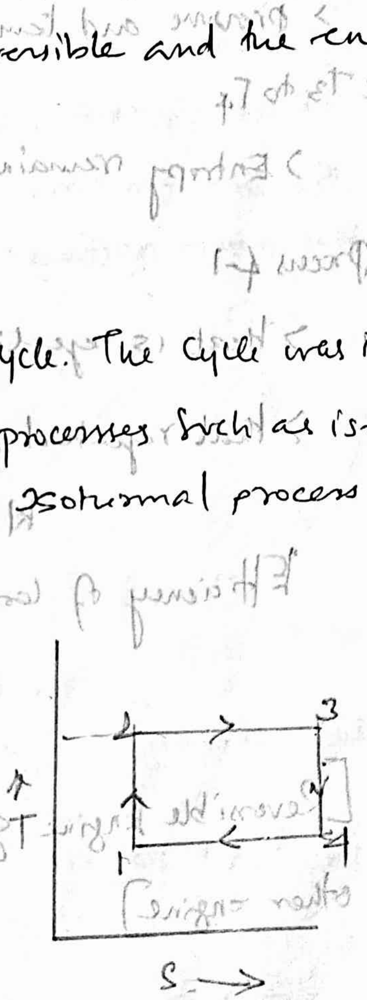
The entropy of any closed system which is thermally isolated from the surroundings remains constant. The process undergone by the system is reversible and the entropy remains constant.

Carnot cycle

It is constant temperature cycle. The cycle was introduced by Sadi Carnot. It consists of four processes such as isentropic or reversible adiabatic and two isothermal process

The PV and TS Diagrams are





Process 1-2

> Air is compressed isentropically

> Pressure and temperature increases from P_1 to P_2 and T_1 to T_2, Volume decreases from V_1 to V_2.

> No heat is added or rejected.