REFRIGERATION AND AIR CONDITIONING

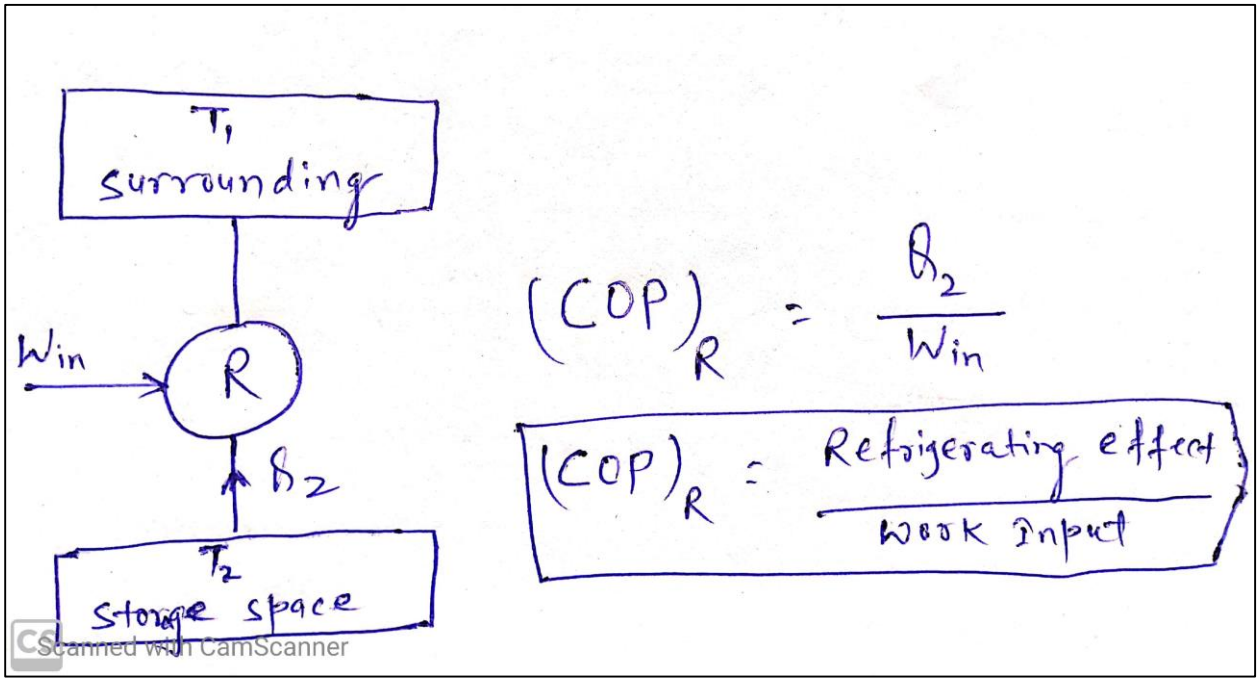
Refrigeration:

The process of decreasing the temperature of a body below that of the surroundings is called refrigeration. In order to maintain lower temperature continuously refrigeration system must run on a cycle.

Refrigerant: Refrigerant is a substance used for decreasing lower temperature of an object.

Example: Ammonia, water, air, R-11, R-12, R-134.

Refrigeration effect: It is equal to the heat given out by cold bodies, i.e. the heat received by the refrigerant in the evaporator. It is the desired effect of a refrigerator.



Significance of coefficient of performance (COP): Coefficient of performance (COP) represents running cost of system. For a given refrigeration capacity greater the COP lesser is the work input and hence lower is the running cost.

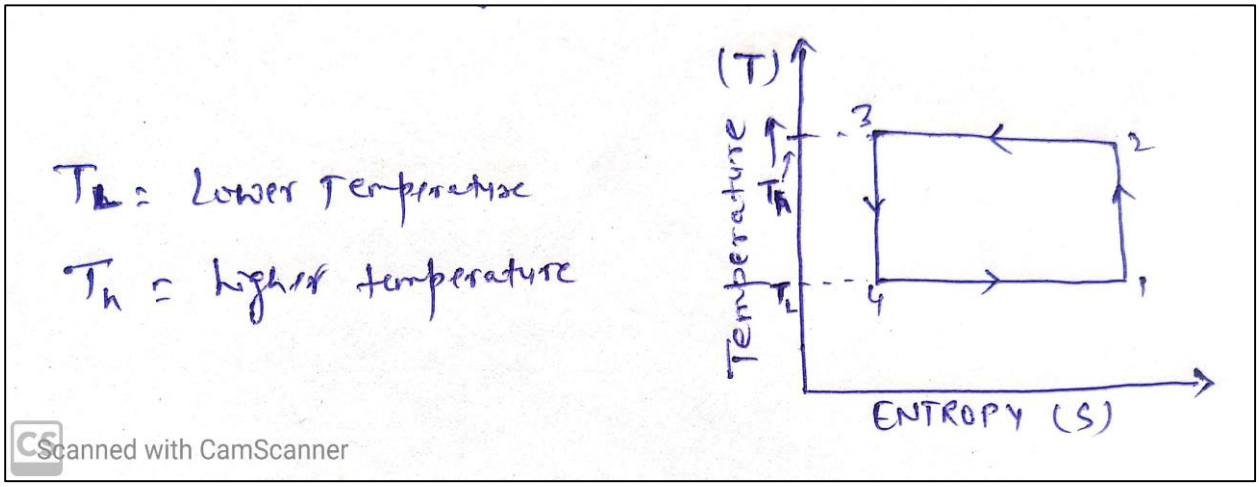
Unit of refrigeration: It is the amount of heat that is to be extracted from one tonne of water at 0^0 C in order to convert it into ice at 0^0 C in twenty four hours.

Tonne of refrigeration represents heat transfer rate.

1 T.R. = 3.5 KJ/s = 3.5 KW = 210 KJ/min

Ideal refrigeration cycle:

Reversed Carnot cycle is an ideal refrigeration cycle.



$$(\mathbf{COP})\mathbf{max} = \frac{\mathbf{T_l}}{\mathbf{T_h} - \mathbf{T_l}}$$

This is valid for reversible cycle only.

Refrigeration Capacity (RC):

m^0 = mass flow rate of refrigerant.

$$\mathbf{RC} = \mathbf{m^0} \times \mathbf{RE}$$

Where RE = Refrigeration effect

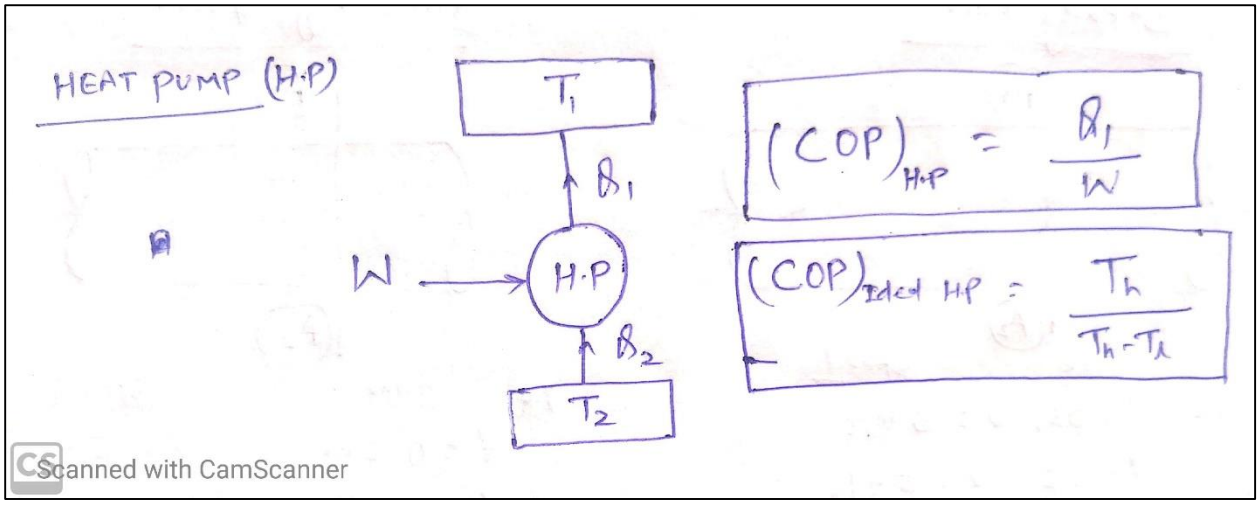
Power Input $\quad \mathbf{P_i} = \mathbf{m^0} \times \mathbf{W_{in}}$

Coefficient of performance $\quad \mathbf{COP} = \frac{\mathbf{RE}}{\mathbf{W_{in}}}$

$$\mathbf{COP} = \frac{\mathbf{RE} \times \mathbf{m^0}}{\mathbf{W_{in}} \times \mathbf{m^0}} = \frac{RC}{P_{in}}$$

$$COP = \frac{Refrigeration\ Capacity}{Power\ Input}$$

Coefficient of performance (COP) of Heat Pump:



Relation between $(COP)_{Refrigeration}$ and $(COP)_{H.P}$:

$$(COP)_{H.P} = 1 + (COP)_{Ref}$$

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