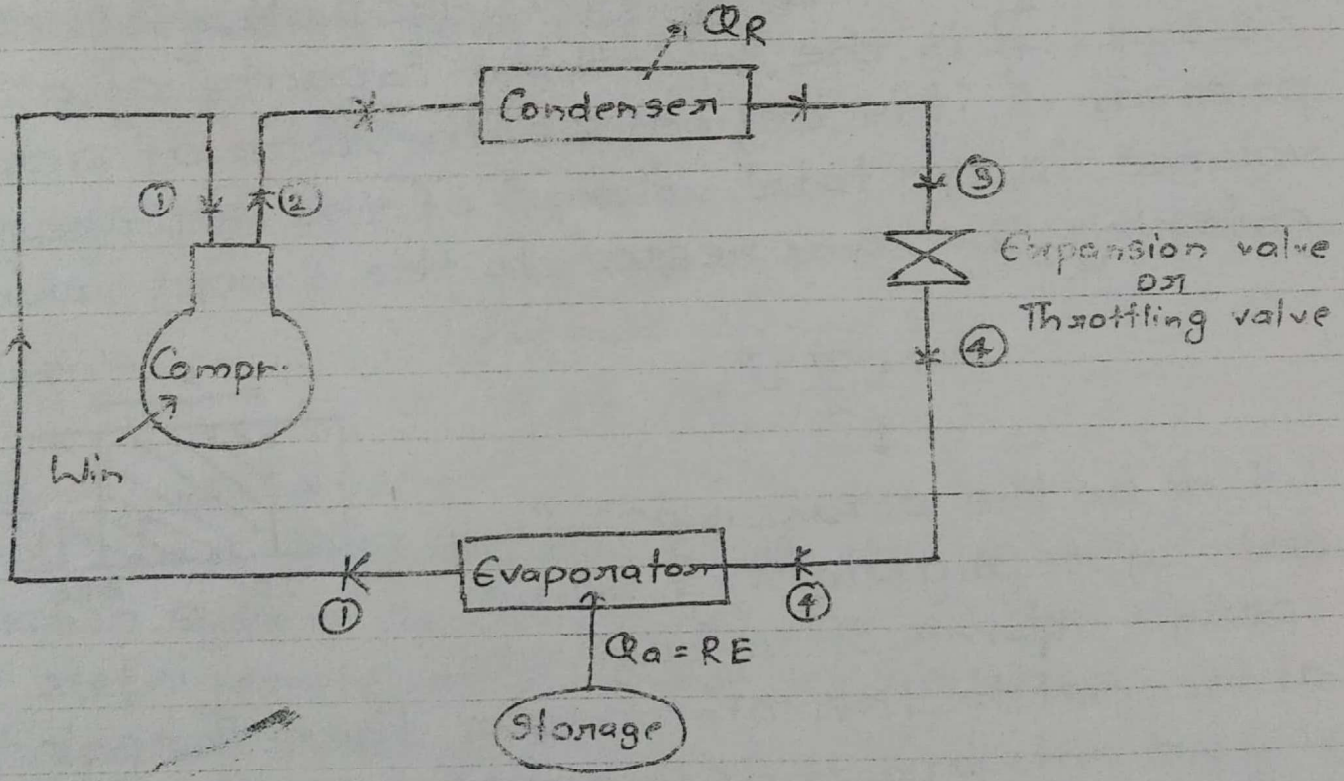
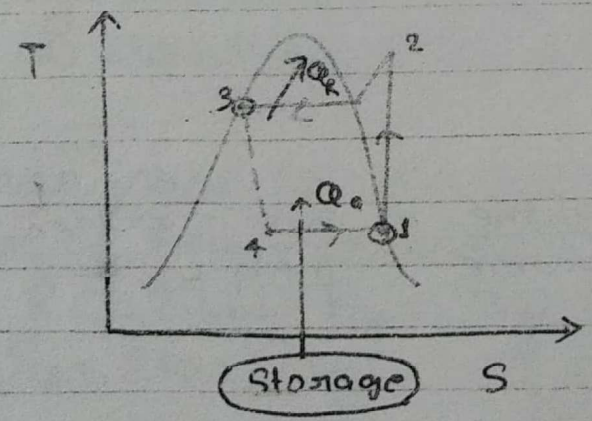
"VAPOUR COMPRESSION REFRIGERATION CYCLE"

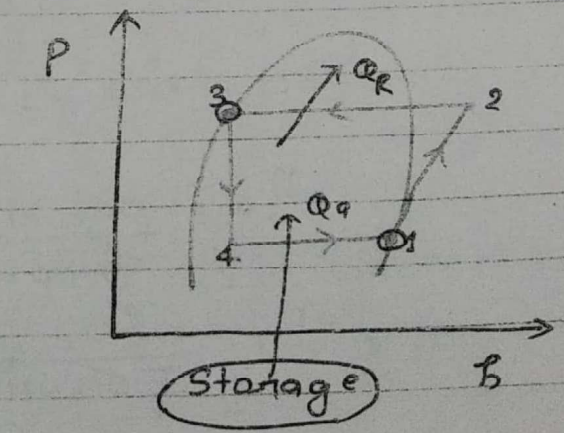
['V-C' Cycle]

Simple or Standard 'V-C' cycle :-

1-2 Reversible adiabatic (isentropic) compression
2-3 Constant pressure heat rejection
3-4 Throttling or isenthalpic expension
4-1 Constant pressure heat addition absorption







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Ntl:- 'V-C' cycle is an irreversible cycle because it consists of throttling process which is an irreversible process.

In 'V-C' cycle, each device can be treated as a steady flow device & hence SFEE can be applied (neglect KE & PE changes).

1) Compressor (1-2) -

$$h_1 + \frac{C_1^2}{2} + gz_1 + Q = h_2 + \frac{C_2^2}{2} + gz_2 + W$$

$$h_1 + Q = h_2 + W$$

(Q ↓ 0 (adiabatic))

$$W = h_1 - h_2$$

$$W = -(h_2 - h_1)$$

$$-W = h_2 - h_1$$

$\{ W_{in} = h_2 - h_1 \}$ Work input at compressor

2) Condenser (2-3) -

$$h_2 + Q = h_3 + W$$

$$Q = h_3 - h_2$$

$$Q_R = h_3 - h_2$$

$$-Q_R = h_2 - h_3$$

$\{ Q_R = h_2 - h_3 \}$ Heat rejected in condenser

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Expansion valve (3-4) :-

$$h_3 + Q = h_4 + W$$

$$\{h_3 = h_4\} \quad \text{(Throttling)}$$

iv) Evaporator (4-1) :-

$$h_4 + Q = h_1 + W$$

$$Q = h_1 - h_4$$

$$Q_a = h_1 - h_4$$

$$\{RE = h_1 - h_4\}$$

$$\{RE = h_1 - h_3\}$$

COP of 'V-C' cycle :-

$$COP = \frac{RE}{W_{in}}$$

$$COP = \frac{h_1 - h_4}{h_2 - h_1}$$

$$\left\{COP = \frac{h_1 - h_3}{h_2 - h_1}\right\}$$

Power input to the compressor :-

$$W_{in} = (h_2 - h_1)\ kJ/kg$$

$$\{P_{in} = \dot{m}(h_2 - h_1)\}$$

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