Vapor Power Cycles - I

Cycle → Initial & final same.

Heat cannot be converted to work 100%.

Heat to work → heat engine cycle.

Work to heat → heat pump / ref.

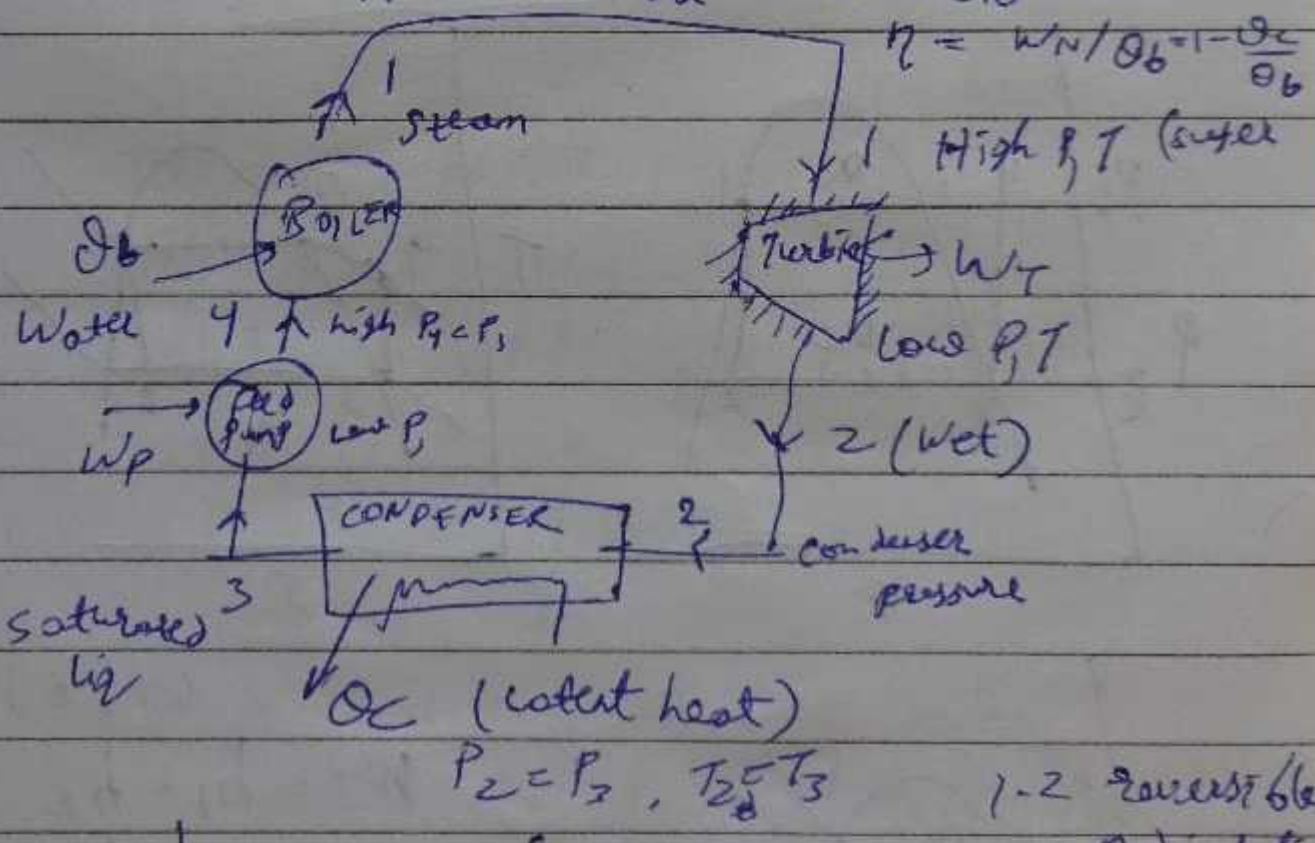
Power cycles - Vapor (liq + vap)
Gas (only gas)

Thermal Power Plant : $W_N = W_T - W_P$

P_4 = Boiler Pressure

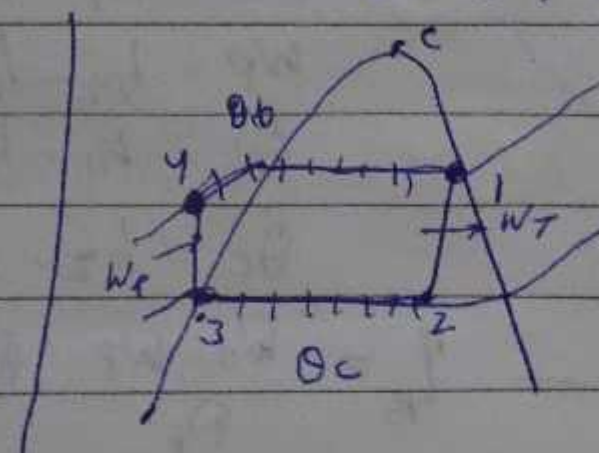
$\theta_N = \theta_b - \theta_c$

$\eta = W_N/\theta_b = 1 - \frac{\theta_c}{\theta_b}$



$P_2 = P_3$, $T_2 \overset{\sim}{=} T_3$

1-2 reversible Adiabatic (isentropic)



Rankine cycle.

(SFEE)

$$W_T = h_1 - h_2$$

$$W_P = h_4 - h_3$$

$$\theta_b = h_1 - h_4$$

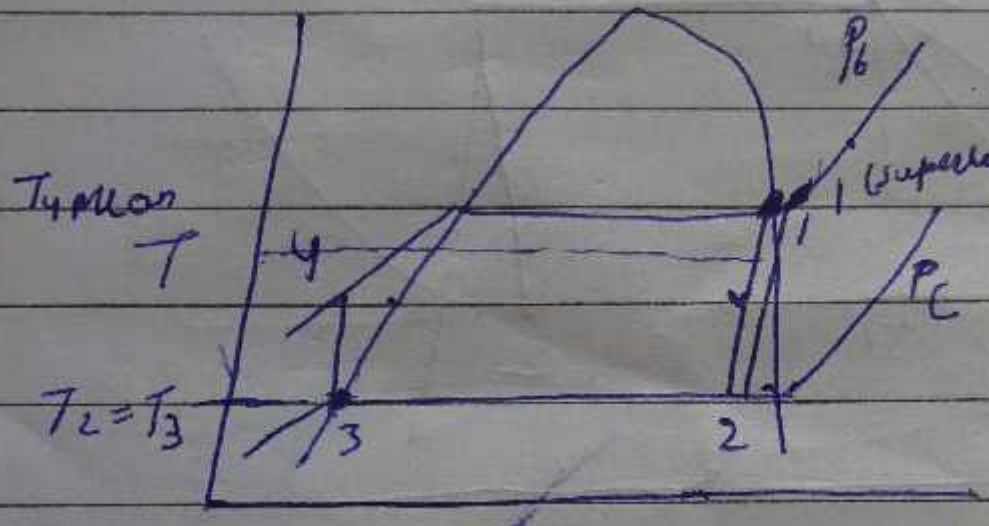
$$\theta_c = h_2 - h_3$$

$$\eta_{th} = \frac{W_T - W_P}{\theta_b} = \frac{(h_1 - h_2) - (h_4 - h_3)}{h_1 - h_4}$$

$1 - \theta_c/\theta_b$

$$\eta = 1 - \frac{(h_2 - h_3)\theta_c}{(h_1 - h_4)\theta_b} \quad \text{(rearranging)}$$

If h_1 is superheated
(P_b, T_1)



$h_1 \rightarrow$ Know P_b

h_2 can be found

$h_2 \rightarrow P_c, x_2$

$h_3 \rightarrow P_c$

h_4

$W_p = h_4 - h_3$

$$Tds = dh - vdP$$

$$dh = vdP, \quad \text{(isentropic)} \quad (3-4)$$

$$\int_3^4 dh = \int_3^4 v\,dP$$

$$h_4 - h_3 = \int_3^4 v\,dP$$

Change in v is very less for water,

$$h_4 - h_3 = v_3 (P_4 - P_3) = v_3 (P_b - P_c)$$

Compare Rankine & carnot cycle