

work done during the cycle of steam
 $= \text{area } abefd = \text{area } oabn + \text{area } nbem - \text{Area } odfn$
 $= P_1 V_1 + (U_1 - U_2) - P_3 V_2$

heat supplied $= h_1 - h_3$

The modified Rankine $\eta = \frac{P_1 V_1 + (U_1 - U_2) - P_3 V_2}{h_1 - h_3}$

Q12 write a short note on

M1 1. Boiler Accessories: see @

2. Gibbs and Helmholtz Functions: This law concerning changes in energy and entropy. The thermodynamic potentials are

1- Enthalpy $H = U + PV$ 2- Gibbs fun $G = H - TS$

3- Helmholtz free energy $F = U - TS$

As per Clausius inequality,

$$ds \geq \frac{dq}{T}$$

$$\geq \frac{du + pdv}{T}$$

$$\Rightarrow ds - \frac{du + pdv}{T} \geq 0 \Rightarrow Tds - du - dw \geq 0$$

$$\Rightarrow -dF - dw \geq 0 \Rightarrow -(F_p - F_r) - W \geq 0$$

for a process without work.

$$F_R \geq F_P$$

This shows that As per the second law a workless isothermal reaction is not feasible unless the Helmholtz fun. of the greater than or equal to the Helmholtz fun. of products.

Similarly for a flow reaction Gibbs fun.

$$G_R \geq G_P$$

Q13 Give the constructions details of the Locomotive boiler-2

M1) Locomotive boiler is a fire tube boiler. It is made of cylindrical shell. It is fitted with fire box at one end and smoke box at the other end. coal is burnt on grate in fire box and fire gases pass through number of small fire tubes surrounded by water in the shell.

