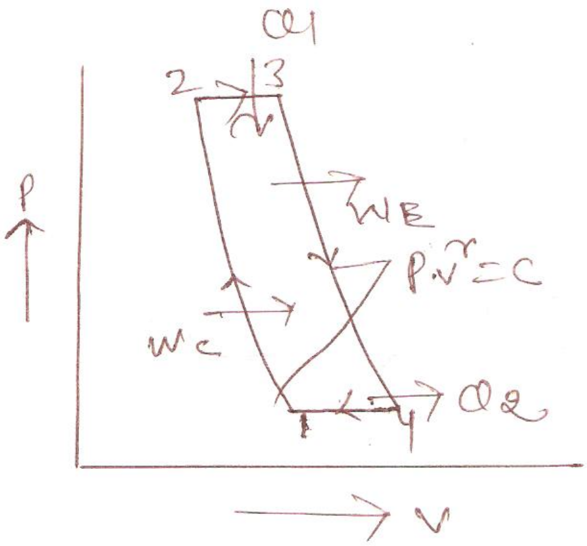
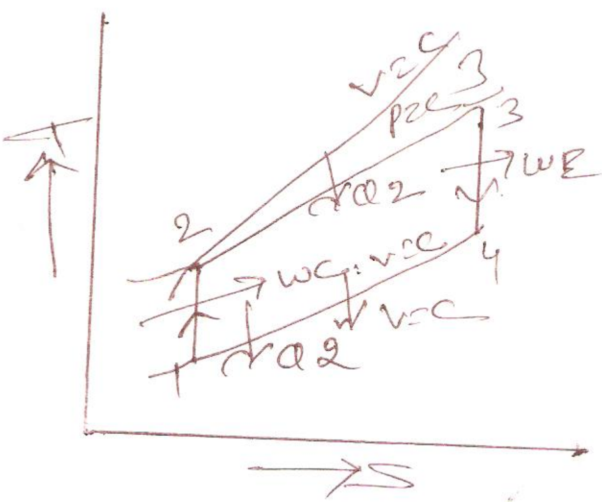
DIESEL CYCLE

This cycle was introduced by Dr R. Diesel in 1897. It differ from otto cycle in that heat rejected at constant pressure instead of at constant volume. Fig a and B shows the P-v and T, S diagram of this cycle.

This cycle have the following operation.

(I) 1-2 Adiabatic compression.
(ii) 2-3 Addition of heat at constant pressure
(iii) 3-4 Adiabatic Expansion
(iv) 4-1 Rejection of heat at constant volume





Heat supplied $= Q_1 = Q_{2-3} = mc_P(T_3-T_2)$

Heat Rejected $Q_2 = Q_{4-4} = Mc_v(T_4-T_1)$

efficiency $= \eta = 1-\frac{Q_2}{Q_1} = 1-\frac{mc_v(T_4-T_1)}{mc_p(T_3-T_2)}$

$$\eta = 1-\frac{T_4-T_1}{\gamma(T_3-T_2)}$$

compression ratio $r_K = \frac{V_1}{V_2} = \frac{v_1}{v_2}$

expansion ratio $r_e = \frac{V_4}{V_3} = \frac{v_4}{v_3}$

Cut off ratio $r_c = \frac{V_3}{V_2} = \frac{v_3}{v_2}$

$r_K = r_c \cdot r_e$

Process 3-4

$$\frac{T_4}{T_3} = \left(\frac{v_3}{v_4}\right)^{\gamma-1} = \frac{1}{r_e^{\gamma-1}}$$

$$T_4 = \frac{T_3 r_c^{\gamma-1}}{r_K^{\gamma-1}}$$

$$\frac{T_2}{T_3} = \frac{P_2 V_2}{P_3 v_3} = \frac{V_2}{v_3} = \frac{1}{r_c}$$

$$T_2 = T_3 \cdot \frac{1}{r_c}$$

Process 1-2

$$\frac{T_1}{T_2} = \left(\frac{v_2}{v_1}\right)^{\gamma-1} = \frac{1}{r_K^{\gamma-1}}$$

$$T_1 = T_2 \cdot \frac{1}{r_K^{\gamma-1}} = \frac{T_3}{r_c} \cdot \frac{1}{r_K^{\gamma-1}}$$

$$\eta = \frac{\frac{T_3 \cdot r_c^{\gamma-1}}{r_K^{\gamma-1}} - \frac{T_3}{r_c} \cdot \frac{1}{r_K^{\gamma-1}}}{\gamma\left(T_3 - T_3 \cdot \frac{1}{r_c}\right)}$$

$$\eta_{Diesel} = 1 - \frac{1}{\gamma} \cdot \frac{1}{r_K^{\gamma-1}} \cdot \frac{r_c^{\gamma}-1}{r_c - 1}$$