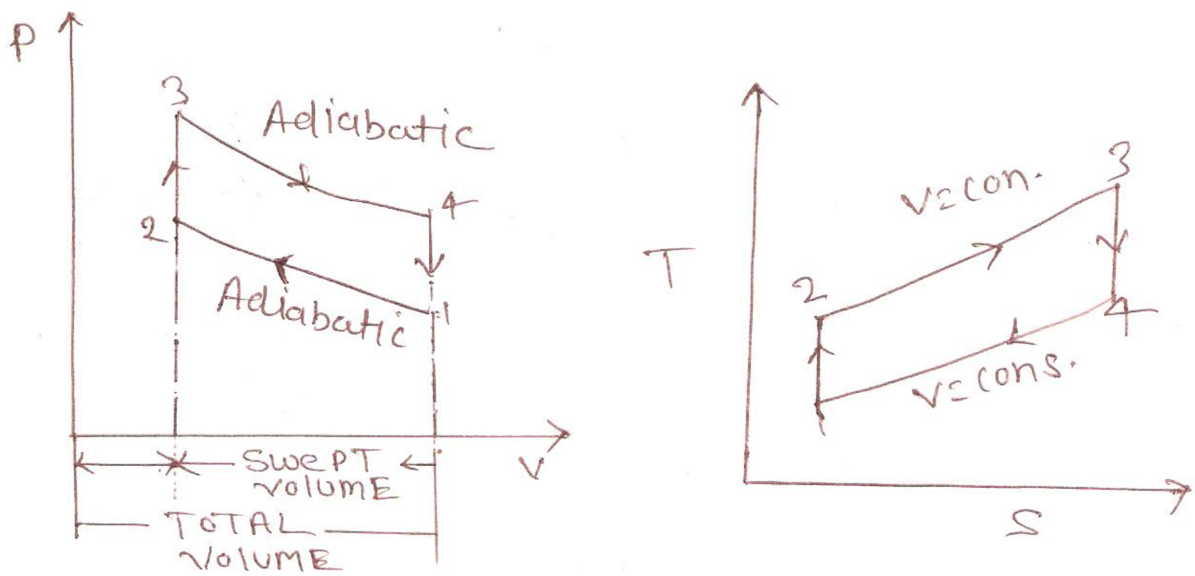
NAME - DEV
RollNo - 09ME10
ClASS - ME

ASSignMENT - THERMODYNAMICS

1 OTTO CYCLE

This cyclE is so named as gt was conceived by otto. On this cyclE Petrol, gas and many type of oil engines work. gt is the standard of comparison for internal combustion engine. Fig (a) and (b) shows th theoritical P-v diagram and T-S diagram of this cyclE respectively

* The point 1 represent the cylinder is full of air with volume V_1 Pressure P_1 and absolute tem. T_1



* Line 1-2 represent the adiabatic compression of air due to which P_1, V_1 and T_1 change to P_2, V_2, T_2 res.
* 2-3 shows the supply of heat to the air at constant volume so that P_2 and T_2 chan.
* Line 3-4 represent the adiabatic expansion of the air. During expansion P_3 V_3 and T_3 change to a final value of P_4 V_4 or V_1 and T_4
* Line 4-1 shows the rejection of heat by air

at constant volume till original state (point 1)

Heat supplied at constant volume

$$C_v (T_3 - T_2)$$

Heat rejected at constant volume $= C_v (T_4 - T_1)$

Work done, $W =$ Heat supplied − Heat rejected

$$C_v (T_3 - T_2) - C_v (T_4 - T_1)$$

efficiency $\eta = \dfrac{\text{Work done}}{\text{Heat supplied}}$

$$= \frac{C_v (T_3 - T_2) - C_v (T_4 - T_1)}{C_v (T_3 - T_2)}$$

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

Process 1−2 $\dfrac{T_2}{T_1} = \left(\dfrac{V_1}{V_2}\right)^{\gamma - 1}$

Process 3-4 $\dfrac{T_3}{T_4} = \left(\dfrac{V_4}{V_3}\right)^{\gamma - 1} = \left(\dfrac{V_1}{V_2}\right)^{\gamma - 1}$

$$\frac{T_2}{T_1} = \frac{T_3}{T_4} = \frac{T_3}{T_2} = \frac{T_4}{T_1}$$

$$\frac{T_3}{T_2} - 1 = \frac{T_4}{T_1} - 1$$

$$\frac{T_4 - T_1}{T_1 - T_2} = \frac{T_1}{T_2} = \left(\frac{V_2}{V_1}\right)^{\gamma - 1}$$

$$\eta_{otto} = 1 - \frac{T_4 - T_1}{T_4 \cdot (r)^{\gamma - 1} - T_1 (r)^{\gamma - 1}} = 1 - \frac{T_4 - T_1}{r^{(\gamma - 1)} (T_4 - T_1)}$$

$$\eta_{otto} = 1 - \frac{1}{r_k^{(\gamma - 1)}} \qquad r_k = \frac{V_1}{V_2} = \frac{v_1}{v_2}$$