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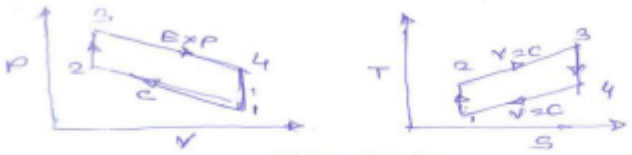
In an Ideal ottocycle the air at the beginning of isentropic compression is at 1.01325 bar and……

Question:
In an Ideal ottocycle the air at the beginning of isentropic compression is at 1.01325 bar and
20°C. The compression ratio is 8. If the heat added during constant volume process is
250 kJ/kg. Determine :
a) Maximum temperature in the cycle b) Air standard efficiency
c) Work done per cycle
d) Heat rejected

Answer:

Q.2. (a)



Given data Otto cycle

$P_1 = 1.01825$ bar

$T_1 = 20^\circ C + 273 = 293$ K

$r = \left(\frac{V_1}{V_2}\right) = 8$.

$Q_A = 250$ kJ/kg

considering process 1-2, $PV^\gamma = C$

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

$$T_2 = T_1 (r)^{\gamma-1}$$

$$= 293 (8)^{1.4-1}$$

$\therefore T_2 = 673.13$ K

Heat added is given by

$Q_A = C_v (T_3 - T_2)$

$250 = 0.71 (T_3 - 673.13)$

$\therefore$ $\boxed{T_3 = 1025.24^\circ K}$ — max temp in cycle. (a)

ASE. $\eta = 1 - \frac{1}{(r)^{\gamma-1}} = 1 - \frac{1}{(8)^{1.4-1}}$

$\eta = 0.5647 = 56.47\%$,

$\boxed{\eta = 56.57\%}$ (b)

$\eta = \frac{W.D}{\text{Heat supplied}}$

$0.5647 \times 250 = W.D$.

$\boxed{W.D = 141.175 \text{ kJ/kg}}$ (c)

W.D = Heat added − Heat Rejected

$141.175 = 250 -$ Heat Rejected

Heat Rejected $= 250 - 141.175$

$\boxed{\text{Heat Rejected} = 250 - 141.175 = 108.82 \text{ kJ/kg K}}$