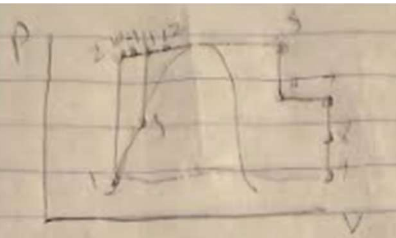
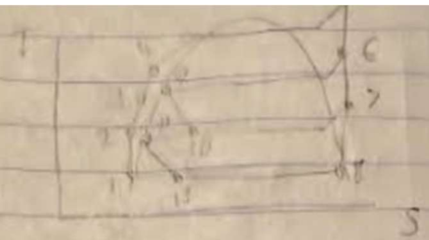
57





(1) (2) (3) (4) (5) (6) (7) (8) (9) (10) (11) (12)

$P_1 = 20$ kPa $P_2 = 5000$ kPa $P_4 = 5000$ ...

$h_1 = 251$ kJ/kg

$h_2 = h_1 + v_0(P_2 - P_1) \rightarrow 251 + 0.00102(5000 - 20) = 256.08$ kJ/kg

$h_3 = h_{11} = h_{12} = 533$ kJ/kg

$h_4 = h_9 = h_{10} = 830$ kJ/kg

$z = \frac{(h_3 - h_2) + y(h_{11} - h_{10})}{h_7 - h_{11}} \rightarrow \frac{(533 - 256.08) + 0.1446(533 - 830)}{2918 - 533}$

$z = 0.098$

$m_w = \frac{m_s((1-y-z)h_8 + (y+z)h_{12} - h_1)}{c_{pw}\Delta T} \rightarrow \frac{75((1 - .1446 - .098)2477 (.14...}{4.18 \cdot 10}$

$m_w = 3147.5$ kg/s

$w_T = h_5 - yh_6 - zh_7 - (1-y-z)h_8 \rightarrow 3900 - .1446(3406) - .098(2918) - (1...$

$w_T = 1245.4$ kJ/kg

$w_{net} = 1245.4 - (.00102(5000 - 20)) = 1240.3$ kJ/kg

$W_{net} = m w_{net} \rightarrow 75 \cdot 1240.3 = 93022.8$ kW

$Q_{in} = m(h_5 - h_4) = 75(3900 - 830) = 230250$ kW

$\eta = \frac{93{,}022.8}{230250} \cdot 100 = 40.4\%$

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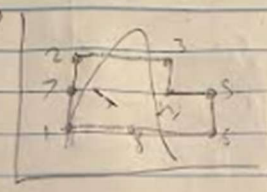

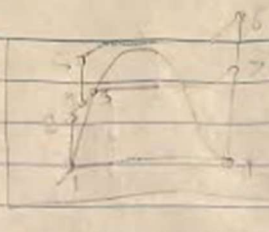

① $P_1 = 10 kPa$ ② $P_2 = 1200 kPa$ ③ ④ ⑤ ⑥ ⑦ ⑧ ⑨ $P_6 = 4000 kPa$

$h_1 = 191.81 kJ/kg \quad v_1 = 0.00101 m^3/kg$

$w = v_1(P_2 - P_1) \rightarrow .00101(1200 - 10) = 1.2 kJ/kg$

$h_2 = h_1 + w = 191.81 + 1.2 = 193.01 kJ/kg$

$h_3 = 798.33 kJ/kg$

$h_4 = \frac{m_2 h_2 + m_3 h_3}{m_4} \rightarrow \frac{22.5 \cdot 193.01 + 7.5 \cdot 798.33}{30} = 344.34 kJ/kg$

$v_4 = 0.001031 m^3/kg$

$v = v_4(P_5 - P_4) \rightarrow 0.001031(4000 - 1200) = 2.89 kJ/kg$

$h_5 = h_4 + v \Rightarrow 344.34 + 2.89 = 347.22 kJ/kg$

$P_6 = 4 MPa, \; T_6 = 500°C \rightarrow h_6 = 3446 kJ/kg$

$P_7 = 1.2 MPa \rightarrow h_7 = 3080.4 kJ/kg$

$P_8 = 10 MPa \rightarrow h_8 = 2246.9 kJ/kg$

$W_{Tur} = m_6(h_6 - h_7) + m_8(h_7 - h_8) \rightarrow 55(3446 - 3080.4) + (.75 \cdot 55)(3080.4 - 22$
$= 54494 kW$

$W_{pm} = m(w) + m_8(w) = 208.3 kW$

$W_{net} = 54494 - 208.3 = 54285 kW$

$Q_m = m_6(h_6 - h_5) = 55(3446 - 347.22) = 170435 kW$

$\eta = \frac{54285}{170435} \cdot 100 = 31.9\%$

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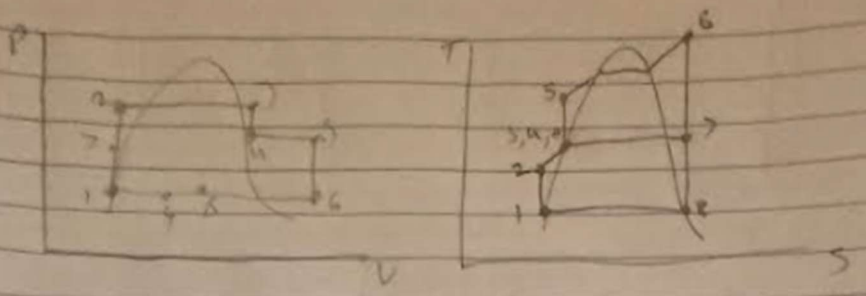

① $P_1 = 10kPa$ ② $P_2 = 1.6MPa$ ③ $P_3 = 1.6MPa$ ④ $P_4 = 1.6MPa$ ⑤ ⑥ $T_6 = 900°C$ ⑦ $P_7 = 1.6MPa$ ⑧ $P_8 = 10kPa$ ⑨ $x_9 = 1.0$

$h_1 = 191.81\ kJ/kg$ $v_1 = 0.00101\ m^3/kg$

$h_2 = h_1 + v_1(P_2 - P_1) = 193.41\ kJ/kg$

$h_3 = h_4 = h_5 = 854.44\ kJ/kg$ $v_4 = 0.00155\ m^3/kg$

$h_5 = h_4 + v_4(P_5 - P_4) = 862.02\ kJ/kg$

$h_6 = 3118.8\ kJ/kg$

$h_7 = 2730\ kJ/kg$

$h_8 = 1990.2\ kJ/kg$

$W_T = (h_6 - h_7) + (1 - y_1)(h_7 - h_8) = 869.7\ kJ/kg$

$W_P = (1 - y_1) \cdot v_1(P_2 - P_1) + v_4(P_5 - P_4) = 9.62\ kJ/kg$

$W_{net} = 869.7 - 9.62 = 860.1\ kJ/kg$

$\dot{P} = \dot{m} W_{net} \rightarrow \frac{25 \cdot 10^3}{860.1} = 29.1\ kg/s$