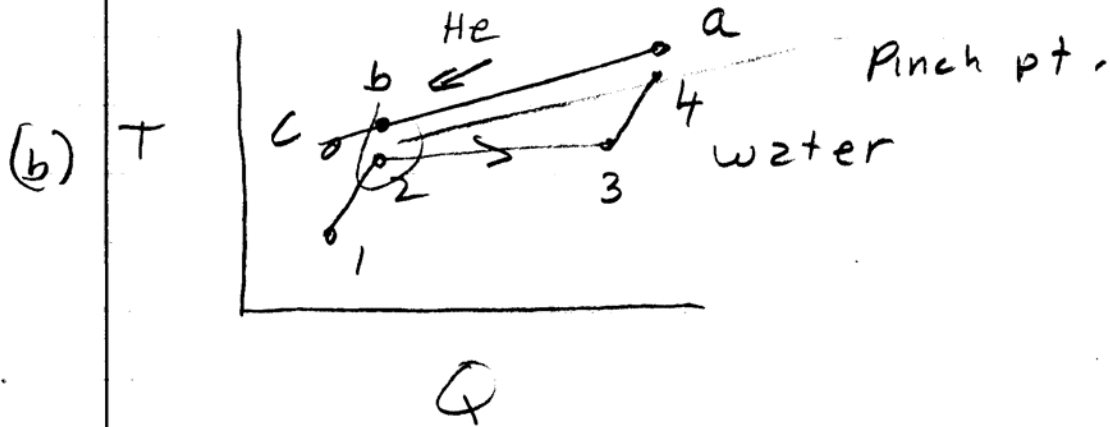
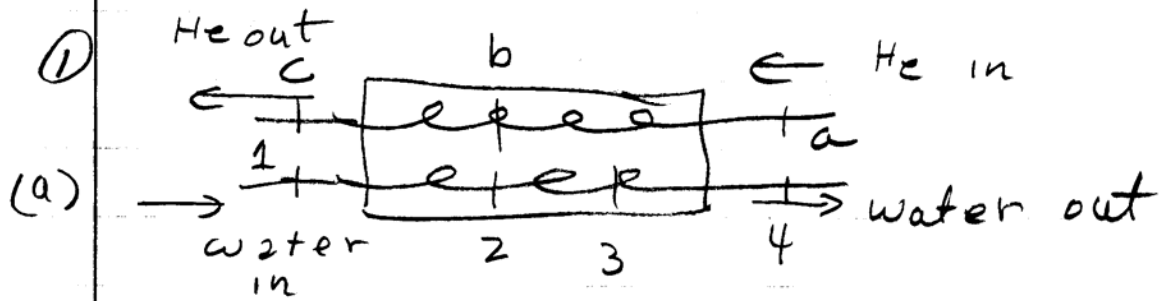


# MES101 Quiz 1 Solutions



(c)  $T_b = T_2 + 50 = 407 \text{ } ^\circ\text{C}$

(d) Energy balance on right hand side of heat exchanger SSSF

$$0 = \dot{Q} - \dot{W} + \sum m_i h_i$$

$$m_a = m_b = m_c = m_{He}$$

$$m_1 = m_2 = m_3 = m_4 = m_w$$

$$m_{He} (h_a - h_b) + m_w (h_2 - h_4) = 0$$

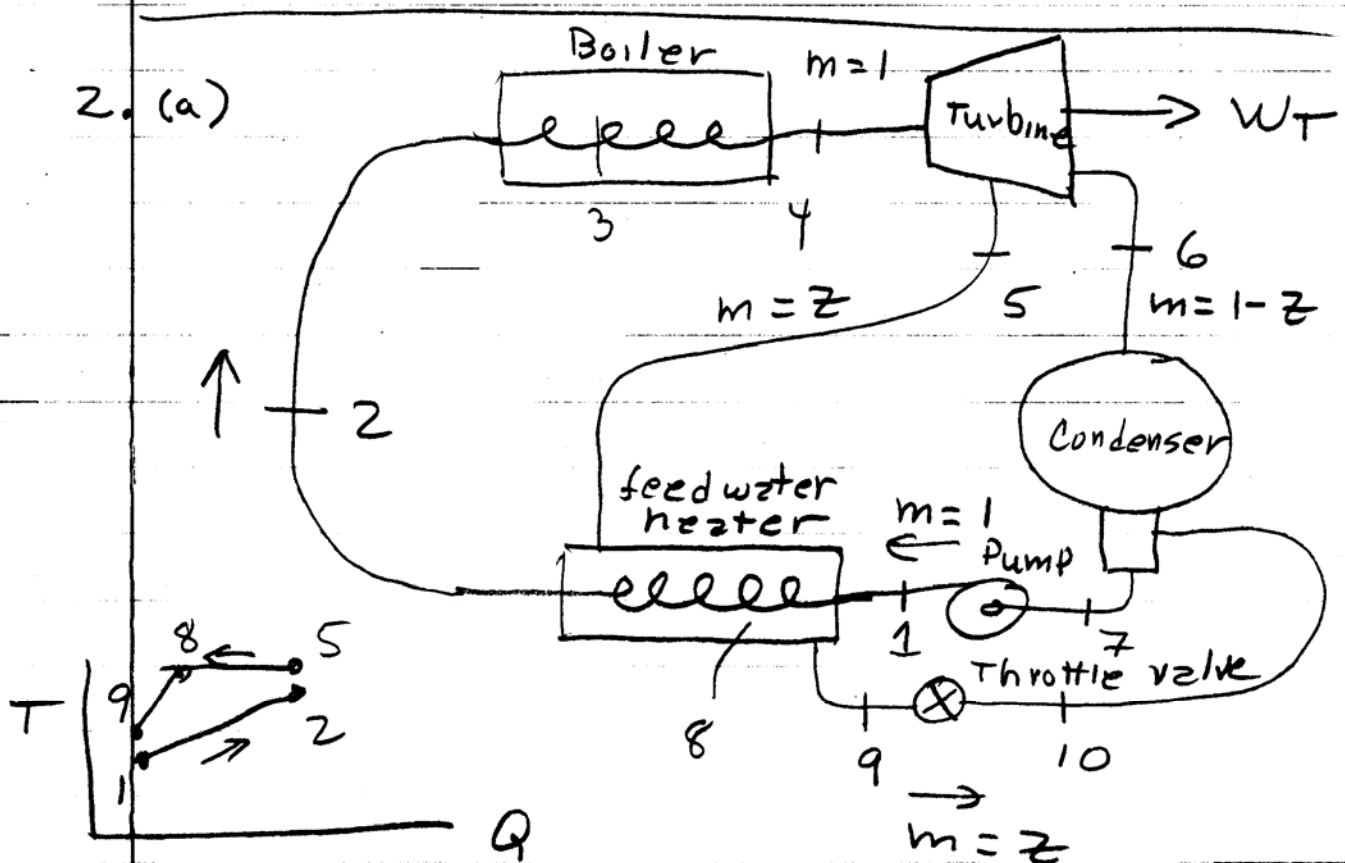
$$h_a - h_b = c_{p,He} (T_a - T_b)$$

$$\frac{m_{He}}{m_w} = \frac{(h_4 - h_2)}{c_{p,He} (T_a - T_b)} = 2.06$$

(e) Energy balance on entire heat exchanger.

$$\frac{m_{He}}{m_w} = \frac{(h_4 - h_1)}{C_{p_{He}} (T_a - T_c)}$$

$$T_c = T_a - \frac{(h_4 - h_1)}{C_{p_{He}} \frac{m_{He}}{m_w}} = 346 \text{ } ^\circ\text{C}$$



(b) SSSF Balance on fwh

$$0 = \dot{Q} - \dot{W} + \sum m_i h_i$$

$$-25 + (1)(h_1 - h_2) + z(h_5 - h_9)$$

$$z = \frac{z_5 + (h_2 - h_1)}{(h_5 - h_9)} = \underline{0.324}$$

(c) SSSF  $0 = \dot{Q} - W_T + \sum m_e h_e$

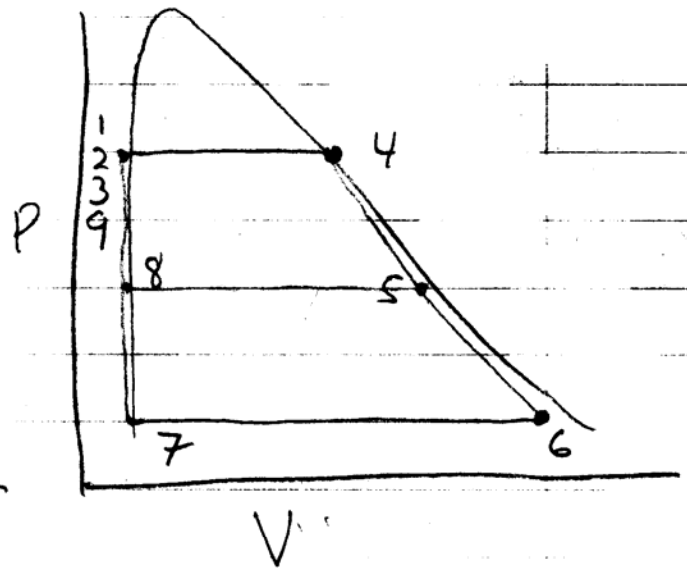
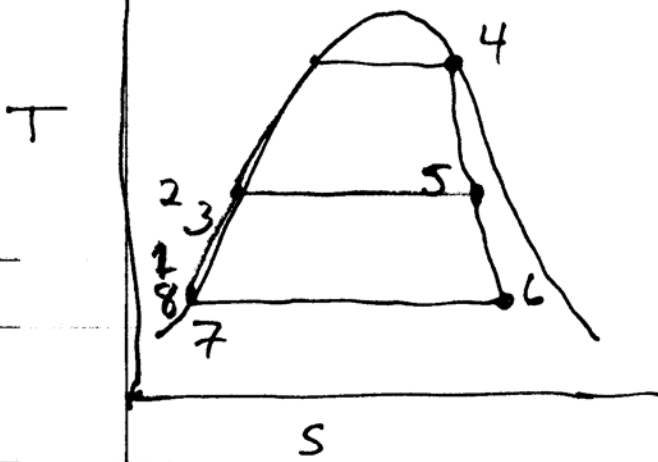
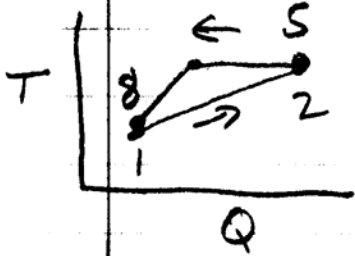
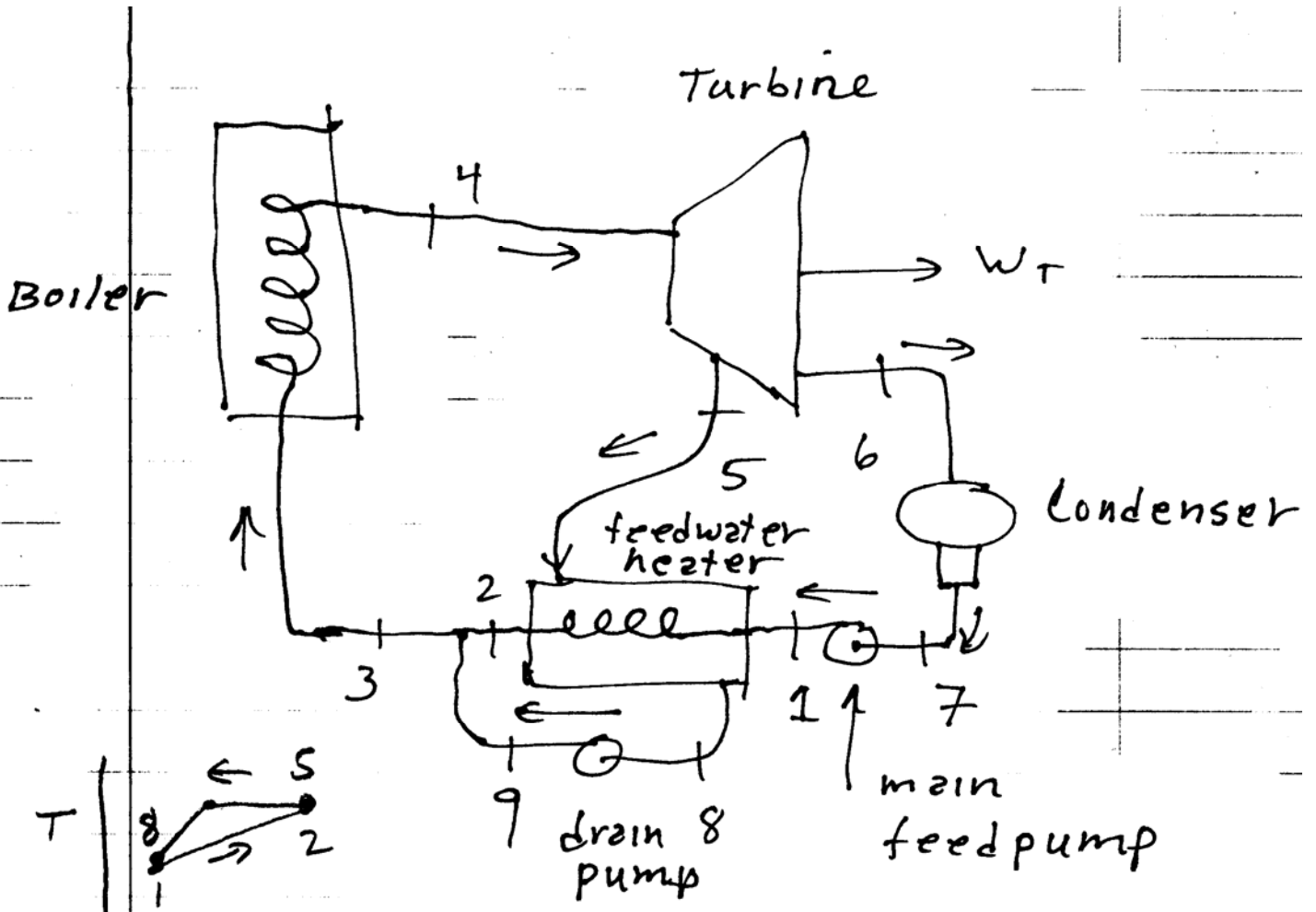
$$W_T = (1) h_4 - z h_5 - (1-z) h_6$$

$$= \underline{792 \text{ kJ}}$$

/ kg ← for m = 1

(d)  $W_P = (1)(h_7 - h_1) = \underline{-16.5 \text{ kJ}}$   
/ kg

(e)  $Q_{in} = (1)(h_4 - h_2) = \underline{1792 \text{ kJ}}$   
/ kg



3b

