Question 1

1	T	8	F
2	T	9	T
3	T	10	F
4	F	11	T
5	F	12	T
6	F	13	F
7	T		

0.1 Question 2

$$E_k = 2032 \text{ MJ}$$

Question 3

$$Q = Mc_vT_1(\frac{P_2}{P_1} - 1)$$

Question 4

$$V_{\text{liquid}} = 0.004612 \text{ m}^3$$
$$Q = 656.6 \text{ kJ}$$

Question 5

$$\eta = 0.34$$

Question 6

$$\dot{W} = \dot{M}\left[(h_1 - T_0s_1) - (h_2 - T_0s_2)\right] - T_0\dot{\mathcal{P}}_s$$

Question 7

Entropy of a simple compressible fluid is by the state principle a function of u and v (or any other 2 independent thermo variables):

$$S = s(U, V)$$

Hence the change of s is governed by the exact differential (fancy word to describe the differential of a multivariate function):

$$dS = (\frac{\partial S}{\partial U})_V dU + (\frac{\partial S}{\partial V})_U dV$$

Thus for system C we have ($dV = 0$ and $dU_A = -dU_B$)

$$dS_C = \left[(\frac{\partial S}{\partial U})_{V,A} - \frac{\partial S}{\partial U})_{V,B})\right] dU_A > 0$$

This must be greater than zero as the system is approaching equilibrium. Now using the given definition of the partial derivative

$$dS_C = (\frac{1}{T_A} - \frac{1}{T_B})dU_A > 0$$

Hence, if $dU_A > 0$, energy as heat is transferred to A and by above equation

$$(\frac{1}{T_A} - \frac{1}{T_B}) > 0$$
$$T_B > T_A$$

Q.E.D.