(一)

25%

1. Summarize similarities between heat and work.

2. Write down the first law for a control volume stated in terms of local properties.

3. What is the Carnot cycle?

4. Write down the second law for a control volume stated in terms of local fluid properties.

5. What are irreversibility, availability and reversible work?

(二)

25%

Write down the definitions of the following terms:

1. Adiabatic saturation temperature

2. Fugacity

3. Van der Waals equation of state

4. Maxwell Relations

5. Air-Standard Otto cycle and Diesel cycle

(三)

25% Consider that S and H are functions of T and P. Show that

1. $dS = \dfrac{c_p}{T} dT + \dfrac{1}{T}\left[\left(\dfrac{\partial H}{\partial P}\right)_T - V\right] dP$

2. $\dfrac{1}{T}\left[\left(\dfrac{\partial H}{\partial P}\right)_T - V\right] = -\left(\dfrac{\partial V}{\partial T}\right)_P$

3. For an ideal gas and $c_p(T) = A_0 + A_1 T + A_2 T^2$, Find the change of entropy per mole (ΔS) from (P_1, T_1) to (P_2, T_2) in terms of T and P.

(四)

25% Consider an adiabatic process for ideal gas. Show that

1. $c_p - c_v = R$

2. $PV^\gamma = $ constant, here $\gamma = \dfrac{c_p}{c_v}$