1 · Explain

   (a)　zeroth law of thermodynamics　(8%)

   (b)　Principle of the increase of entropy (7%)

   (c)　ideal gas　(7%)

   (d)　Otto cycle　(7%)

2 · (a)　State the first law of thermodynamics.(Explain in words)　(7%)

   (b)　Show that if the Kelvin-Plank statement of the second law of thermodynamics were not true, a violation of the Clausius statement would be possible.　(7%)

   (c)　Show that if the Clausius statement of the second law of thermodynamics were not true, a violation of the Kelvin-Planck statement would be possible. (7%)

3 · (a)　Derive $C_p - C_v = [V - (\partial H/\partial P)_T] (\partial P/\partial T)_v$

      C_p : heat capacity at constant pressure (P)

      C_v : heat capacity at constant Volume (V)

      T : temperature

      H : heat content　(10%)

   (b)　from (a), calculate $C_p - C_v$ for ideal gas ?　(10%)

4 · Estimate the Carnot efficiency for air near surface and at 5 km in height (make assumptions if you need)　(10%)

5 · (a) show that the Gibbs function remain constant for a reversible isothermal and isobaric process.　(10%)

   (b) Derive the Clausius Clapeyron equation for the first order phase transitions. (10%)