※ 考生請注意：本試題不可使用計算機。　請於答案卷(卡)作答，於本試題紙上作答者，不予計分。

1. Please illustrate the advantages and constrains of making the assumption of ideal gas behaviors for gases making up the system to analyze. (20%)

2. By using examples, please illustrate the application and meaning of (a) thermal efficiency, (b) isentropic efficiency, (c) second law efficiency, and (d) coefficient of performance. (30%)

3. Plot the *P-v* and *T-s* diagrams of the following ideal gas power cycles:

   (a) Otto cycle　　　　(5%)

   (b) Brayton cycle　　(5%)

   (c) Stirling cycle　　(5%)

4. The *P-v-T* relation for a real gas is represented by

   $$P(v-a)=RT$$

   where R is the gas constant and *a* is a constant. Determine expressions for the property changes, Δu, Δh, and Δs, for this gas.　　(15%)

5. (1) Show that $C_p = T\left(\dfrac{\partial P}{\partial T}\right)_s \left(\dfrac{\partial v}{\partial T}\right)_P$.　　(10%)

   (2) Using the Maxwell relations and the ideal-gas equation of state, determine a relation for $\left(\dfrac{\partial s}{\partial v}\right)_T$ for an ideal gas.

   (10%)