93學年度國立成功大學研究所招生考試	工程科學學系	丁組 戊組	熱力學	試題	共 一 頁 第 一 頁

1. What is a pure substance? (3%) What is the triple point on a pressure-temperature diagram of a pure substance? (3%) Draw qualitatively a temperature-volume diagram for water (a pure substance) for three constant pressures, 0.1 MPa, 1 MPa, 10 MPa, showing compressed liquid , saturated-liquid line, vaporization process, saturated-vapor line, and superheated vapor.。(16%)

2. Explain, briefly but clearly, the concepts of the first law and Bernoulli equation for a uniform-state, uniform-flow process, and state briefly the differences between these two concepts。(12%)

3. A simple pendulum is placed in a heat-insulated, rigid container. At $t = 0$ the pendulum is allowed to begin to oscillate from an initial displacement. What is the change of entropy of the system between the initial state and the final state, i.e., the state after motion has subsided? (12%)

4. Air is compressed in a reversible process in a cylinder from 100 kPa, $20°C$, to 500 kPa. During the compression process the relation between pressure and volume is $PV^{1.3}$=constant. Calculate the work and heat transfer per kilogram for this process. Given R=0.287 $\frac{kJ}{kgK}$。(12%)

5. Prove that the efficiency of a Carnot cycle depends only on the temperature of low-temperature reservoir (T_L) and high-temperature reservoir (T_H) in a functional relation of the form $\frac{f(T_L)}{f(T_H)}$。 Then show that, under what proposition (assumption), a Celsius or a Fahrenheit thermodynamic temperature scales can be established。(17%)

6. (a) Show that the second law of thermodynamics leads to a property of a system called "entropy" Hint: you may want to first prove the inequality of Clausius。(10%)
(b) Derive a entropy change relation of an ideal gas under the assumption of constant specific heat using the result obtained in part (a)。(5%)
(c) Derive the pressure-volume relation for a reversible adiabatic process involving an ideal gas with constant specific heat。(5%)
(d) Show that $(\frac{\partial p}{\partial \rho})_S = \gamma(\frac{\partial p}{\partial \rho})_T$ for a perfect gas, where γ is the ratio of specific heats C_P/C_V。(5%)