

本試題是否可以使用計算機:  可使用,  不可使用 (請命題老師勾選)

1. Express the first law of thermodynamics for a system undergoing a cycle. Then, express the first law for a change in two different states of a system. 8%
2. Express the first law of thermodynamics for a control volume. Then, express the first law for the steady-state, steady-flow process. 10%
3. State and briefly explain the second law of thermodynamics. 17%
4. What is the basis of the second law of thermodynamics. 5%
5. What is the Carnot cycle? Explain it. 10%
6. Explain how the concept of the Carnot cycle leads to the concept of a thermodynamic temperature scale? 16%
7. Starting from the first law of thermodynamics, carefully show that  $pv^\gamma = \text{constant}$  for all adiabatic reversible processes of ideal gases with constant specific heats.  $p$ , pressure;  $v$ , specific volume;  $\gamma$ , the ratio of the constant-pressure specific heat to the constant-volume specific heat. 18%
8. Air is compressed in a reversible polytropic process in a cylinder from 100 kPa,  $20^\circ\text{C}$ , to 500 kPa. During this compression process the relation between pressure and volume is  $PV^{1.3} = \text{constant}$ . Calculate the work and heat transfer per kilogram in this process, given  $R = 0.287 \text{ kJ/kg K}$ . 16%