國立聯合大學 100 學年度碩士班考試招生

材料科學工程系(所)入學考試試題

科　目：　　普通熱力學　　　　　第 1 頁共 1 頁

1. A sealed rigid vessel has volume of 1 m^3 and contains 2 kg of water at 120°C and 200 kPa. What is the quality of the water at the given state? The specific volumes of the saturated liquid water and water vapor are 0.001061 m^3/kg and 0.88573 m^3/kg at 120 °C and 200 kPa, respectively.　(10%)

2. A 0.2 m long steel rod with 2 cm diameter is stretched in a tensile test. What is the work required to obtain a relative strain of 0.1%? The modulus of elasticity of steel is 2×10^8 kPa.　(15%)

3. A piston/cylinder device contains 0.1 m^3 oxygen at 300 kPa and 100°C. It is now compressed in a polytropic process with exponent n = 1.2 to a final pressure of 600 kPa. Find the work performed by the oxygen. (15%)

4. An ideal-gas Carnot cycle with 3kg air in a piston/cycinder setup has a high temperature of 900°C and low temperature of 100°C. During the heat addition the volume triples. Find the cycle efficiency, the amount of heat rejection and the cycle work.　(15%)

5. A mass of 2 kg liquid water was heated at 1 atm from 20 °C. to 80 °C. Determine the entropy change of the water? ($C_{p,H2O}$ = 4.18 kJ/kg-K)　(15%)

6. A mass of 1 kg of air contained in a cylinder at 1.5 MPa and 1000 K expands in a reversible isothermal process to a volume 3 times larger. Calculate the heat transfer during the process and the entropy change of the air.　(15%)

7. To prove that all reversible engines which operate between two given constant-temperature reservoirs have the same efficiency.　(15%)