

國立中央大學八十八學年度碩士班研究生入學試題卷

所別: 大氣物理研究所 不分組 科目: 熱力學 共 1 頁 第 1 頁

- 10% 1. (a) Please state the Maxwell's relations in Thermodynamics which describe the hydrostatic properties of a pure substance. (b) Explain the physical meaning of the Maxwell's relation. (c) Make one example of the application of the Maxwell relations.
- 30% 2. (a) Please draw a phase diagram (PT diagram, pressure-temperature diagram) for H_2O . (b) Illustrate the regions of different phases and the phase change curves. (c) Explain the physical meaning of "Critical point", "Triple point" and "Normal melting point". (d) Explain the difference between gas and vapor. (e) Please describe three possible processes which can change an unsaturated vapor into liquid, draw the correspondent lines of these three processes on the phase diagram.
- 20% 3. (a) On a TS (temperature-entropy) diagram please draw the curves of four reversible processes: Isotherm for isothermal process, Isobar for isobaric process, Isochor for isochoric process and Isentrope for isentropic (adiabatic) process. (b) Why the slope of Isochor is different the slope of the Isobar at the same temperature. (c) Please draw the Carnot cycle on both PV (pressure-volume) diagram and TS diagram. (d) Please use the TS diagram to calculate the thermal efficiency of Carnot cycle.
- 10% 4. (a) In the tropics, the water near the surface is warmer than the deep water. Would an engine operating between these two levels violate the second law? Why? (b) State the Kelvin-Planck statement of the second law of thermodynamics.
- 20% 5. (a) If a sealed balloon which containing some air inside was expanding while it was near a heater, assuming this balloon and the air inside the balloon as a system, will the internal energy of this system increase? (b) If a sealed solid sturdy box which also containing some air inside was being heated in the same way but the volume of the box was not changed, will the internal energy of this solid box increase? (c) Can you explain your answer by the First law of thermodynamics? (d) Please state the possible methods to decrease the internal energy of a hydrostatic system.
- 10% 6. Describe the three different processes of heat transfer.

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