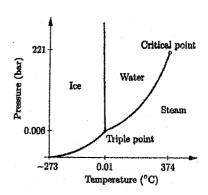
國立中央大學94學年度碩士班考試入學試題卷

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所別:大氣物理研究所碩士班 科目:熱力學

- 1) Please answer the following questions briefly. (5% each)
 - a) State the zeroth law of thermodynamics.
 - b) Express the first law of thermodynamics by an equation and also state the law in words.
 - c) Give physical definition and units for enthalpy and latent heat, respectively.
 - d) From the figure in Problem 5), explain how to obtain the saturated water vapor pressure for a given temperature.
 - e) What is an equation of state? Please distinguish between the ideal gas law and the van der Waals equation.
 - f) State the second law of thermodynamics for a non-isolated system.
- 2) Describe a Carnot cycle on a P-V diagram. On the diagram please indicate the temperature and the type of thermodynamic process for each stage in the whole cycle. (10%)
- 3) State the definition of heat capacity first, and then show that the heat capacity at constant pressure C_P exceeds the heat capacity at constant volume C_V by R (the universal gas constant) for one mole of an ideal gas (i.e., $C_P = C_V + R$). (15%)
- 4) Please show an example to explain the process of free expansion. If an ideal gas underwent a free expansion process, how much did its energy change? Is free expansion an isentropic process? Also, give the reasons to support your answer. (15%)
- 5) At the right hand side is a phase diagram for H_2O . Based on the concept of Gibbs free energy, please first derive the Clausius-Clapeyron relation (or Clapeyron relation) for the phase boundary between two phases, and then explain why the slope of the water/steam phase boundary line is positive and the slope of the ice/water phase boundary line is slightly negative. (15%)



6) From the ideal gas law and the first law of thermodynamics, please find out the work required to compress an ideal gas isothermally from volume V_i to V_f and the relation between temperature and volume if the gas is compressed adiabatically. (15%)