淡江大學 96 學年度碩士班招生考試試題

系別：化學工程與材料工程學系　　　科目：化 工 熱 力 學

本試題雙面印製

Problem One (15 points)

A power plant generates steam at 312 $^{\circ}$C and discards heat to a river at 22 $^{\circ}$C. Calculate the maximum possible thermal efficiency of the power plant.

Problem Two (35 points)

One kmol of an ideal gas is taken through a four-step cyclic process as displayed on the PV diagram below. The gas is subjected successively to an isothermal expansion at 600 K from 5 to 4 bar (A to B), an adiabatic expansion to 3 bar (B to C), a constant-pressure cooling (C to D), and constant-volume heating (D to A). All processes are assumed reversible. For these processes, it is reasonable to assume C_p is constant and equal to 30 kJkmol^{-1}K^{-1}. Calculate Q, W, Δu, and Δh for each step and for the entire process.
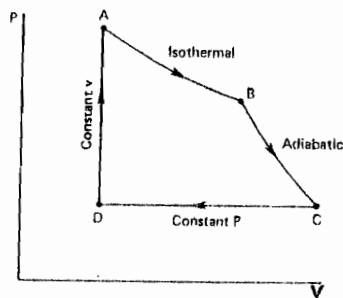
Problem Three (25 points)

It is possible to cool liquid water below its freezing point of 273.15 K without the formation of ice if care is taken to prevent nucleation. A kilogram of subcooled liquid water at 263.15 K is contained in a well-insulated vessel. Nucleation is induced by the introduction of a speck of dust, and a spontaneous crystallization ensues. Given that the final state is a mixture of liquid water and ice at 273.15 K, calculate the entropy change of the water, the surroundings, and the total entropy change. C_p is assumed constant and equal to 4.185 kJkg^{-1}K^{-1}. Heat of fusion for water is 334 kJkg^{-1}. The process is assumed adiabatic.

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准帶項目請打「V」	
V	簡單型計算機

本試題共 2 頁

Problem Four (25 points)

With respect to the phase diagram for $BeO-Y_2O_3$ shown below, a composition is made up with 80 mol % BeO and held at 2000 °C. (i) How much solid is present? (ii) What is the composition of the solid? (iii) How much liquid is present? (iv) What is the composition of the liquid?

The material is cooled to 1400 °C. (i) What phases are present? (ii) What are the compositions of the phases? (iii) What are the proportions of each phase present?