

國立臺北科技大學九十七學年度碩士班招生考試

系所組別：1203 製造科技研究所不分組

第二節 熱力學 (選考) 試題

填准考證號碼

第一頁 共一頁

--	--	--	--	--	--	--	--	--	--

注意事項：

1. 本試題共五題，配分共 100 分。
2. 請標明大題、子題編號作答，不必抄題。
3. 全部答案均須在答案卷之答案欄內作答，否則不予計分。

(一) Air enters an adiabatic turbine steadily at 1 MPa and 800°C and leaves at 100 kPa. The flowrate is 0.2 kg/s. If the isentropic efficiency of the turbine is 90%, determine (a) the power produced. (b) the rate of entropy generation during this process. Assume air molecular weight $M=28.97$, specific heat at constant volume $C_v=0.7176$ kJ/kgK. (20%)

每小題 10 分，合計 20 分。

(二) In a closed system air 100 kPa and 27°C is compressed polytropically from a volume of 0.060 m³ to a volume of 0.030 m³ with a polytropic exponent of 1.3. Compute (a) the work. (b) the heat transfer. (c) the change in enthalpy. (d) the entropy generation. Assume air molecular weight $M=28.97$, specific heat at constant volume $C_v=0.7176$ kJ/kgK. (20%)

每小題 5 分，合計 20 分。

(三) A pressure cooker is a pot that cooks food much faster than ordinary pots by maintaining a higher pressure and temperature during cooking. The pressure inside the pot is controlled by a pressure regulator (the petcock) that keeps the pressure at a constant level by periodically allowing some steam escape, thus preventing any excess pressure buildup. A 4-L pressure cooker has an operating pressure of 175 kPa. Initially, one-half of the volume is filled with liquid and the other half with vapor. If it is desired that the pressure cooker not run out of liquid water for 1 h, determine the highest rate of heat transfer allowed. steam table 175 kPa: $v_f=0.001057$ m³/kg, $v_g=1.0037$ m³/kg; $u_f=486.82$ kJ/kg, $u_g=2524.5$ kJ/kg; $h_f=487.01$ kJ/kg, $h_g=2700.2$ kJ/kg (20%)

(四) Consider a building whose annual air conditioning load is estimated to be 120,000 kWh in an area where the unit cost of electricity is \$ 0.10/kWh. Two air conditioners are considered for the building. Air conditioner A has a seasonal average COP of 3.2 and costs \$ 5500 to purchase and install. Air conditioner B has a seasonal average COP of 5.0 and costs \$ 7000 to purchase and install. All else being equal, determine which air conditioner is a better buy. (20%)

(五) Derive expressions for the change in enthalpy and the heat transfer for a gas whose equation of state is $P(v-b)=RT$ for an isothermal process. (20%)