

大同大學 九十 學年度 轉學考試 試題

考試科目：熱力學 系別：機械工程學系

級別：三年級 第 / 頁，共 / 頁

註：本次考試不可以參考自己的書籍及筆記； 不可以使用字典； 可以使用計算器。

$$\dot{m} = \rho A V$$

$$\dot{m} = \frac{A V}{\nu}$$

$$m =$$

1. (21%) A gas in a piston-cylinder assembly undergoes an expansion process for which the relationship between pressure and volume is given by $p v^n = \text{constant}$. The initial pressure is 3 bars, the initial volume is 0.1 m^3 , and the final volume is 0.2 m^3 . Determine the work for the process, in kJ, if (a) $n=1.5$, (b) $n=1.0$, and (c) $n=0$.

2. (14%) By steadily circulating a refrigerant at low temperature through passages in the walls of the freezer compartment, a refrigerator maintains the freezer compartment at -5°C when the air surrounding the refrigerator is at 22°C . The rate of heat transfer from the freezer compartment to the refrigerant is 8000 kJ/h and the power input required to operate the refrigerator is 3200 kJ/h . Determine the coefficient of performance of the refrigerator and compare with the coefficient of performance of a reversible refrigeration cycle operating between reservoirs at the same two temperatures.

$$T = -5$$

$$T = 22$$

$$Q = 8000$$

$$= 3200$$

3. (20%) A 0.8 lb bar of metal initially at 1400°F is removed from an oven and quenched by immersing it in a closed tank containing 20 lb of water initially at 70°F . Each substance can be modeled as incompressible. An appropriate constant specific heat value for the water is $C_w = 1.0 \text{ Btu/lb} \cdot ^\circ\text{F}$, and an appropriate value for the metal is $C_m = 0.1 \text{ Btu/lb} \cdot ^\circ\text{F}$. Heat transfer from the tank contents can be neglected. Determine (a) the final equilibrium temperature of the metal bar and the water, and (b) the amount of entropy produced.

$$0.286$$

$$\Delta S = R \ln \frac{T_1}{T_2} + R \ln \frac{P_1}{P_2}$$

4. (20%) Sketch flow, $p v$, and $T s$ diagrams for a simple power plant cycle. What are the four major components used in a simple power plant cycle? Define the thermal efficiency of a simple power plant cycle.

$$m =$$

$$\Delta S = C_p \ln \frac{T_1}{T_2} - R \ln \frac{v_1}{v_2}$$

5. (10%) 試以熱力學觀點，說明發生在台灣的台東或屏東一帶的焚風的原理。

6. (15%) 若乾空氣團在地面的密度為 1.18 kg/m^3 ，且溫度為 27°C 。則隨著高度每增加 1 公里 ，因絕熱膨脹而乾空氣團的溫度會下降幾度？

$$m T W = W$$

$$-2.996$$

$$-3.9198$$

$$\rho = 1.18 \text{ kg/m}^3$$

$$T = 27^\circ$$

$$q = C_v (T_2 - T_1) + \frac{1}{2} (V_2^2 - V_1^2) + g(z_e - z_i) + W$$

$$0 = 0.7165 (T_2 - 27) + 9.8 (z_e - z_i)$$

$$= 0.7165 T_2 - 19.3455 + 9.8 z_e$$