

國立臺北科技大學九十五學年度碩士班招生考試

系所組別：1330 車輛工程系碩士班丙組

第一節 熱力學 試題

填 准 考 證 號 碼

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注意事項：

1. 本試題共 4 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。

1. 0.05 m^3 of a gas at 6.9 bar expands reversibly in a cylinder behind a piston according to the law $pv^{1.2} = \text{constant}$, until the volume is 0.08 m^3 . Calculate the work done by the gas and sketch the process on a p-v diagram. (20%)
2. In an air compressor, the pressure at inlet and outlet are 1 bar and 5 bar respectively. The temperature of the air at inlet is 15°C and the volume at the beginning of compression is 3 times that at the end of compression. Calculate the temperature of the air at outlet and the increase of internal energy per kg of air. The C_v of air is $0.718 \text{ kJ/kg}\cdot^\circ\text{K}$. (15%)
3. In an air standard Otto cycle, the maximum and minimum temperatures are 1400°C and 15°C . The heat supplied per kg of air is 800 kJ. Calculate the compression ratio and cycle efficiency. Calculate also the ratio of maximum to minimum pressures in the cycle. The C_v of air is $0.718 \text{ kJ/kg}\cdot^\circ\text{K}$. The specific heat ratio of air is $k = C_p/C_v = 1.4$. (35%)
4. The air in a cylinder fitted with a piston is saturated with water vapor. The volume is 0.3 m^3 , the pressure is 3.5 bar, and the temperature is 60.1°C .

The mixture is compressed to a 5.5 bar, the temperature remaining constant. Calculate: (i) the masses of air and vapor present initially; (ii) the mass of vapor condensed on compression. The gas constant of air is $R=287 \text{ J/kg}\cdot\text{K}$. The specific volume of steam at 60.1°C is $7.648 \text{ m}^3/\text{kg}$. (30%)