

逢甲大學 95 學年度轉學生招生考試試題

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| 科目 | 熱力學 | 適用系別 | 機電系三年級 | 時間 | 80 分鐘 |
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1. A 3.27-m^3 tank contains 100 kg of nitrogen at 225 K. Determine the pressure in the tank, using (a) the ideal-gas equation of state, (b) the van der Waals equation of state.

$$(P + a/\bar{v}^2)(\bar{v} - b) = R_u T$$

For nitrogen $R_u=8.314 \text{ kJ}/(\text{kmol}\cdot\text{K})$, $a=136.6 \text{ kPa}(\text{m}^3/\text{kmol})^2$, $b=0.0386 \text{ m}^3/\text{kmol}$ (20%)

2. A piston-cylinder device contains 0.7 m^3 of air at 350 kPa and 370°C . Air is now allowed to cool at constant pressure until the temperature drops to 60°C . Assuming constant specific heats, determine the amount of work.

For air $C_p=1.005 \text{ kJ}/(\text{kg}\cdot\text{K})$, $C_v=0.718 \text{ kJ}/(\text{kg}\cdot\text{K})$. (15%)

3. Air flows steadily through an adiabatic turbine, entering at 1.0 MPa, 500°C , and 100 m/s and leaving at 140 kPa, 150°C , and 215 m/s. Determine the work output per kilogram of air.

Assuming constant specific heats for air $C_p=1.005 \text{ kJ}/(\text{kg}\cdot\text{K})$, $C_v=0.718 \text{ kJ}/(\text{kg}\cdot\text{K})$. (15%)

4. A frictionless piston-cylinder device contains a saturated liquid-vapor mixture of water at 100°C . During a constant-pressure process, 650 kJ of heat is transferred to the surrounding air at 25°C . As a result, part of the water vapor contained in the cylinder condenses. Determine (a) the entropy change of the water and (b) the total entropy generation during this heat transfer process. (20%)

5. A Carnot heat engine receives 700 kJ of heat from a source of unknown temperature and rejects 200 kJ of it to a sink at 27°C . Determine (a) the temperature of the source and (b) the thermal efficiency of the heat engine. (15%)

6. A heat engine that receives heat from a furnace at 1200°C and rejects waste heat to a river at 20°C has a thermal efficiency of 30 percent. Determine the second-law efficiency of this power plant. (15%)