

此科考試可攜帶簡易型計算機

1. The electric heating systems used in many houses consist of a simple duct with resistance heaters. Air is heated as it flows over resistance wires. Consider a 15 kW electric heating system. Air enters the heating section at 100 kPa and 17 °C with a volume flow rate of 150 m³/min. If heat is lost from the air in the duct to the surroundings at a rate of 200 W, determine the exit temperature of air. (20 分)
2. What is the dew-point temperature? (10 分)
3. A 75 kg copper block initially at 110°C is dropped into an insulated tank that contains 160L of water at 15°C. Determine the final equilibrium temperature and the total entropy change for this process. (Properties The density and specific heat of water at 25°C are $\rho = 997 \text{ kg/m}^3$ and $c_p = 4.18 \text{ kJ/kg}\cdot^\circ\text{C}$. The specific heat of copper at 27°C is $c_p = 0.386 \text{ kJ/kg}\cdot^\circ\text{C}$) (20 分)
4. What is the difference between the critical point and the triple point? (10 分)
5. What is the difference between a refrigerator and a heat pump? (10 分)
6. A refrigerator used for cooling food in a grocery store is to produce a 10000kJ/h cooling effect, and it has a coefficient of performance (COP) of 1.35. How many kilowatts of power will this refrigerator require to operate? (15 分)
7. Plot the T-S diagram of the Carnot cycle and indicate the areas that represent the heat supplied Q_H , heat rejected Q_L , and the net work output $W_{\text{net,out}}$ on the diagram. (15 分)