國立臺灣大學99學年度碩士班招生考試試題

科目：單元操作

題號：356

1. A liquid food at 30℃ is pumped at a rate of 2000 kg/h through a heater, where it is heated to 70℃ by hot water which enters the heater at 95℃ and leaves at 85℃. The average heat capacity of the liquid food is 4.06 kJ/kg.K, and that for water is 4.20 kJ/kg.K. Calculate the hot water flow rate (kg/h) and the amount of heat (kW) added to the liquid food. (20 points)

2. Water enters a boiler at 18.3℃ and 137.9 kPa through a pipe at an average velocity of 1.52 m/s. Exit steam at a height of 15.2 m above the liquid inlet leaves at 137.9 kPa, 148.9℃, and 9.14 m/s in the outlet line. How much heat (J) must be added for producing 1 kg mass of steam during steady state operation. (25 points)

3. An electric wire having a diameter of 1.5 mm and covered with a plastic insulation with thermal conductivity 0.4 W/m.K and thickness 2.5 mm. The wire is exposed to air at 27℃, and convective coefficient on the outside of plastic insulation is 20 $W/m^2.K$. If the wire surface temperature is constant at 127℃, what is the heat loss per meter of wire length. (20 points)

4. Please draw the following diagrams (20 points)
   (a) Mollier diagram for steam (enthalpy/entropy diagram)
   (b) Pschrometric chart for air (humidity chart)

5. Please describe a refrigeration cycle using P-H diagram (pressure-enthalpy diagram) of a refrigerant. (15 points)

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