1. Oxygen at 150 K and 41.64 atm has a tabulated specific volume of 4.684 cm^3/g and a specific internal energy of 1706 J/mol. Calculate the specific enthalpy of O_2 in this state. (Ans. 2338 J/mol)
2. The specific internal energy of helium at 300 K and 1 atm is 3800 J/mol, and the specific molar volume at the same temperature and pressure is 24.63 L/mol. Calculate the specific enthalpy of helium at this temperature and pressure, and the rate at which enthalpy is transported by a stream of helium at 300 K and 1 atm with a molar flow rate of 250 kmol/h. (Ans. 1.57×10^6 kJ/h)
3. A gas stream containing 60 wt% ethane and 40 wt% n-butane is to be heated from 150 K to 250 K at a pressure of 5 bar. Calculate the heat required per kg of the mixture. Data: $H_{ethane,\ 250\ K,\ 5\ bar}$ = 973.3 kJ/kg; $H_{butane,\ 250\ K,\ 5\ bar}$ = 237 kJ/kg; $H_{ethane,\ 150\ K,\ 5\ bar}$ = 314.3 kJ/kg; $H_{butane,\ 150\ K,\ 5\ bar}$ = 30 kJ/kg. (Ans 478 kJ/kg)
4. Saturated steam at 1 atm is discharged from a turbine at a rate of 1150 kg/h. Superheated steam at 300 ^{0}C and 1 atm is needed for a heat exchanger, to produce it the steam from the turbine is mixed with a superheated steam at 400 ^{0}C and 1 atm. The mixing unit is adiabatic. Calculate the amount of superheated steam at 300 ^{0}C produced and the required volumetric flow rate of the 400 ^{0}C steam. Data: $H_{steam,\ 100\ degC,\ 1atm}$ = 2676 kJ/kg; $H_{steam,\ 300\ degC,\ 1atm}$ = 3074 kJ/kg; $H_{steam,\ 400\ degC,\ 1atm}$ = 3278 kJ/kg; Sp. Volume of steam (400 degC, 1atm) = 3.11 m^3/kg. (Ans. 390 kg/h ;6980 m3/h)
5. You recently purchased a large plot of land in the Amazon jungle at an extremely low cost. You are quite pleased with yourself until you arrive there and find that the nearest source of electricity is 1500 miles away, a fact that your brother-in-law, the real estate agent, somehow forgot to mention. Since the local hardware store does not carry 1500-mile-long extension

cords, you decide to build a small hydroelectric generator under a 75-m high waterfall located nearby. The flow rate of the waterfall is 10^5 m^3/h, and you anticipate needing 750 kWh/wk to run your lights, air conditioner, and television. Calculate the maximum power theoretically available from the waterfall and see if it is sufficient to meet your needs. (Ans. 3.43×10^6 kW.h/wk; sufficient)

$$\frac{2.778 \times 10^{-7}\ \text{kW}\cdot\text{h}}{1\ \text{J}}$$