1)   The molar analysis of a gas mixture at 30°C, 2 bar is 40% N_2, 50% CO_2, 10% CH_4.
Determine
   (a) the analysis in terms of mass fractions.
   (b) the partial pressure of each component, in bar.
   (c) the volume occupied by 10 kg of mixture, in m^3.

2)   Air at 77°C, 1 bar, and a molar flow rate of 0.1 kmol/s enters an insulated mixing chamber operating at steady state and mixes with water vapor entering at 277°C, 1 bar, and a molar flow rate of 0.3 kmol/s. The mixture exits at 1 bar. Kinetic and potential energy effects can be ignored. For the chamber, determine
   (a) the temperature of the exiting mixture, in °C.
   (b) the rate of entropy production, in kW/K.

4)   Liquid water at 50°C enters a forced draft cooling tower operating at steady state. Cooled water exits the tower with a mass flow rate of 80 kg/min. No makeup water is provided. A fan located within the tower draws in atmospheric air at 17°C, 0.098 MPa, 60% relative humidity with a volumetric flow rate of 110 m^3/min. Saturated air exits the tower at 30°C, 0.098 MPa. The power input to the fan is 8 kW. Ignoring kinetic and potential energy effects, determine
   (a) the mass flow rate of the liquid stream entering, in kg/min.
   (b) the temperature of the cooled liquid stream exiting, in °C.