1) True / False  \( \bar{M}_i = \left( \frac{\partial (nM)}{\partial n_i} \right)_{T,P,n_{j\neq i}} \) can also be written \( \bar{M}_i = \left( \frac{\partial M}{\partial x_i} \right)_{T,P,x_{j\neq i}} \)

2) True / False  For ideal gases:  \( H = \sum y_i H_i \) where \( H_i \) is the enthalpy of pure species at some fixed reference temperature.

3) True / False  Ideal gases always form ideal mixtures.

4) True / False  In an ideal mixture, \( \bar{M}_i = M_i \) where \( M \) is any molar property.

5) A and B are ideal gases.  \( n_A \) moles of A and \( n_B \) moles of B are mixed adiabatically at some constant \( T \) and constant \( P \).  Let’s call the fraction of A in the final mixture \( x_A \).  Find the expression for the change of entropy of the process in terms of \( n_A, n_B, x_A, T, P, \) and \( R \).  Is this process reversible?

6) When we mix two unknown liquids X and Y in the amount of 100 mL of X and 50 mL of Y, we get 148 mL of solution.  What can we say about the relative magnitudes of \( V_X, V_Y, V_X, \) and \( V_Y \)?
7) For a binary system of ideal gases 1 and 2, we are given \( H = y_1H_1 + y_2H_2 + k^2y_1y_2 \), where \( k \) is a constant. We mix some amount of gas 1 and some amount of gas 2 in a flow process, all at constant \( T = 298 \, \text{K} \) and \( P = 1 \, \text{atm} \). Consider the case where no shaft work is done. To keep the mixture at 298 K and 1 atm, does heat need to be added or removed to the system? What if the final pressure is not 1 atm but 10 atm?

8) True / False The Gibbs-Duhem equation in the form of \( \sum x_i dM_i \) only applies at constant \( T \) and \( P \).

9) True / False For an ideal gas mixture, \( \sum x_i \frac{dH_i}{dx_i} - C_p \frac{dT}{dx_i} = 0 \)

10) The enthalpy diagram for a mixture of A and W is given below. Consider two processes depicted next to the diagram. In each process, 1 mol of one substance is added to 1,000 mol of the other substance. Which process, I or II, will generate more heat?