1. (4) 2.296 mol of CsCl is dissolved in 450.0 mL of water, and this solution is diluted with water to a volume of 1.000 L at 20.0°C and 1 atm. The density of the final solution is 1.2885 g/cm³. What is the molarity of CsCl in the final solution?

\[
\text{Molarity} = \frac{\text{mol solute}}{\text{L soln}} \Rightarrow 2.296 \text{ mol}\frac{\text{L}}{}\]

2. (8) At 25.0°C and 1.00 atm, a 0.5000-mol/kg aqueous solution of NaCl has \( V_{\text{NaCl}} = 18.63 \text{ cm}^3/\text{mol} \) and \( V_{\text{H}_2\text{O}} = 18.062 \text{ cm}^3/\text{mol} \). Find the volume at 25.0°C and 1.00 atm of a solution prepared by dissolving 1.0000 mol of NaCl in 2000.0 g of H₂O (\( M = 18.015 \)).

\[
V = n_A V_A + n_B V_B = 1.0000 \text{ mol} x 18.63 \text{ cm}^3/\text{mol} + \frac{2000.0 \text{ g}}{18.015 \text{ g/mol}} x 18.062 \text{ cm}^3/\text{mol} = 2023.85 \text{ mL}
\]

3. (16) The molar enthalpy of mixing for forming solid solutions of NaCl and NaBr at 25°C as a function of the mole fraction \( x \) of NaBr is given by \( \Delta H_{\text{mix},m} (\text{kJ/mol}) = a x + b x^2 + c x^3 \), where \( a, b, \) and \( c \) are numerical constants.

(a) Obtain an expression for \( \Delta H \) for mixing 1.000 mol NaCl with 3.000 mol NaBr.

(b) Obtain an expression for the differential heat of solution of NaBr, as a function of \( a, b, \) and \( x \).

\[
\begin{align*}
(\text{a}) & \quad \Delta H_{\text{mix}} = n \cdot \Delta H_{\text{mix},m} (x) \quad \Rightarrow \quad \Delta H_{\text{mix}} = 4.000 \text{ mL} \left[ a (0.75) + b (0.75)^2 + c (0.75)^3 \right] \\
(\text{b}) & \quad \Delta H_{\text{diff}, A} = \left( \frac{\partial}{\partial n_A} \Delta H_{\text{mix}} \right)_{n_B, p, T} = \frac{\partial}{\partial n_A} (n \Delta H_{\text{mix},m} (x)) \\
& \quad = \Delta H_{\text{mix},m} (x) + n \frac{\partial}{\partial n_A} (\Delta H_{\text{mix},m} (x)) \\
& \quad = \Delta H_{\text{mix},m} + n \cdot \frac{d \Delta H_{\text{mix},m}}{dn_A} \cdot \frac{dx}{dn_A} \\
& \quad \frac{dx}{dn_A} = \frac{1}{n} - \frac{n_B}{n^2} = \frac{MB}{n^2} = \frac{XB}{n} = \left( \frac{1-x}{n} \right)
\end{align*}
\]

\[
\begin{align*}
\Delta H_{\text{diff}, A} &= (ax + bx^2 + cx^3) + n x (a + 2bx + 3cx^2) x (\frac{1-x}{n}) \\
&= ax + bx^2 + cx^3 + a + 2bx + 3cx^2 - ax - 2bx^2 - 3cx^3 \\
&= a + 2bx + x^2 (3c - b) + x^3 (-2c)
\end{align*}
\]