1. Describe the molecular basis of the Raoult’s law.
2. Consider a container of volume 10.0 dm3 that is divided into two compartments of equal size. In the left compartment there is nitrogen at 1.5 bar and 25 °C; in the right compartment there is hydrogen at the same temperature and pressure. Calculate the entropy and Gibbs energy of mixing when the partition is removed. Assume that the gases are perfect.
3. Deduce an expression for the elevation of boiling point of an ideal solution and show, subject to a series of approximations that you should specify, that the elevation is proportional to the mole fraction of the solute, Δ*T*=*K*b*x*B with *K*b=*R*(*T*b\*)2/Δvap*H*, where *T*b\* is the boiling temperature of the solvent and Δvap*H* is its enthalpy of evaporation.
4. Calculate the masses of (a) Ca(NO3)2 and, separately (b) NaCl to add to a 0.250 mol kg-1 solution of KNO3(aq) containing 800 g of solvent to raise its ionic strength to 0.450.

Useful equations

*p*A=*x*A*p*A\*

*pV*=*nRT*

d*G=p*d*V-S*d*T* for a pure substance (consequently, at constant pressure )