If a 2.35 m $Ca(NO_3)_2$ (aq) solution has a density of 1.08 g/mL, what is the molarity of the solution? Ca = 40.078 N = 14.0079 O = 15.9994

2.35 mol $Ca(NO_3)_2$ in 1000 g H_2O

mass of solute = $2.35\ mol\ Ca(NO_3)_2 \times \frac{164.09\ g}{1\ mol}$

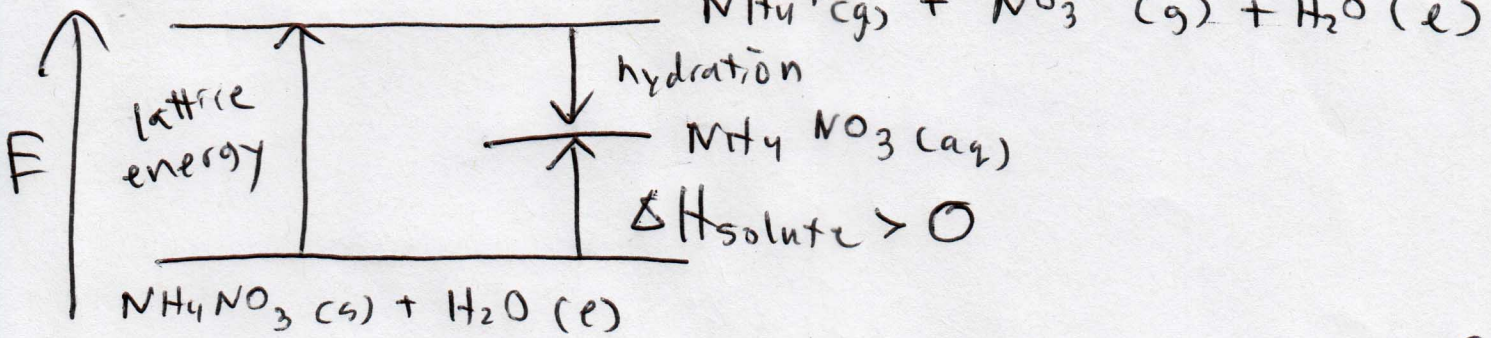
= 385 g $Ca(NO_3)_2$ + 1000 g H_2O = 1385 g solution

$D = M/V \quad M = D \cdot V \quad V = M/D$

$= 1385\ g / 1.08\ g/mL = 1280\ mL$ solution

$M = \frac{\text{moles solute}}{\text{L solution}} = 2.35\ mol / 1.280\ L = 1.83\ M$

Energy changes in sol'n



When ammonium nitrate dissolves, the temperature of the solution drops because more energy is necessary to separate the ions (lattice energy) than the energy released by the ions being surrounded by water (hydration)

ΔS → entropy → the tendency of matter and energy to become homogenous within a system (spread out, create disorder).

Increasing entropy is energetically favorable; creating order (decreasing entropy) is energetically unfavorable.

Free energy ⟶ The effective energy available to a reaction when taking entropy into consideration.

$$\Delta G = \Delta H - T\Delta S$$

$$\Delta G = -RT \ln K$$

Ammonium nitrate is able to form a solution even though the process is endothermic because of the large positive entropy change that also occurs.

Electrolytes - compounds that dissociate in solution

bond-breaking

Weak electrolyte – a compound that only minimally dissociates when it dissolves

Strong electrolyte – a compound that fully or extensively dissociates in solution

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Colligative properties are changes in the physical properties of a solvent due to the number of soluble particles in solution.

$$\Delta T_{BP} = K_B \cdot m \cdot i$$

m ← molality of the solution

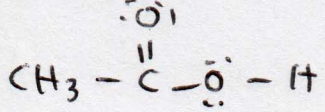
i ← ionization factor *

K_B → boiling point elevation constant

↳ depends on the solvent

* reflects the # of particles a solute dissociates into in solution

examples. 1.0M acetic acid 1.0M NaCl 1.0M $CaCl_2$



$i \approx 1$ $i \simeq 2$ $i \simeq 3$