

17.7: Colligative Properties of Electrolyte Solutions

Using the rule "like dissolves like" with the formation of ionic solutions, we must first assess two things: 1) the strength of the ion-dipole forces of attraction between water and the ionic compound and 2) the strength of the interionic bond of the ionic compound.

For an ionic compound to form a solution, the ion-dipole forces between water and ionic compound must be greater than the interionic bonds. Therefore, to form a compound: ion-dipole forces > interionic bonds

When the ionic compound is surrounded by water, the water dipoles surround the crystal's clustered structure. The water's negative ends of the dipole will be attracted to the positive dipoles of the ion and the positive ends of the water's dipole will be attracted to the negative dipoles of the ion. If the force of this attraction is stronger than the interionic bonds, the crystal's interionic bonds will be broken, then surrounded by the water molecules or hydrated.

There is a 3-step process that we can use to approach the energy involved in ionic solution formation. 1) Breaking apart the ionic compound is endothermic and requires energy. 2) Hydrating cation is exothermic and therefore releases energy. 3) Hydrating the anion is exothermic and also releases energy. The sum of these 3 steps will then give us the enthalpy of the solution.

✓ Example 17.7.1: CaCl₂



$\text{CaCl}_2(\text{s}) + \text{H}_2\text{O} \rightarrow \text{Ca}^{2+}(\text{aq}) + \text{Cl}_2(\text{aq})$ energy > 0 The dissolution is endothermic because in the formation of ionic solutions, you must take into account entropy in addition to the enthalpy of the solution to determine whether it will occur spontaneously.

References

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