

Additional Teacher Background

Chapter 5, Lesson 9, p. 451

The additional teacher background in Chapter 2 on evaporation and condensation discussed the concept that it takes energy to break bonds and that energy is released when bonds are formed. In the context of evaporation, “breaking bonds” refers to overcoming the attractions between water molecules as they change from a liquid to a gas. In the context of condensation, “making bonds” refers to the attractions of water vapor molecules bringing them together as they change from a gas to a liquid.

It was also explained that the energy “used” in breaking bonds is actually an *energy conversion* from kinetic to potential energy. The energy “released” in making bonds is an energy conversion from potential to kinetic energy.

Since evaporation is only a bond-breaking process, it only uses energy, resulting in a temperature decrease. Therefore, evaporation is endothermic. Since condensation is only a bond-making process, it only releases energy, resulting in a temperature increase. Therefore, condensation is exothermic.

But the process of dissolving involves both bond-making and bond-breaking. In the context of dissolving, “making bonds” refers to water molecules attracting and bonding to the ions or molecules of the solute. “Breaking bonds” refers to the action of the water molecules in separating the ions or molecules of the solute from one another as they go into solution. The energy conversions in bond-making and bond-breaking in dissolving are the same as in evaporation and condensation. Energy is released as water molecules bond to the solute and energy is used as the ions or molecules of the solute are separated.

The dissolving process is exothermic if more energy is released when water molecules bond to the ions or molecules of the solute than is used to break the bonds holding the solute together.

The dissolving process is endothermic if less energy is released when water molecules bond to the ions or molecules of the solute than is used to break the bonds holding the solute together.