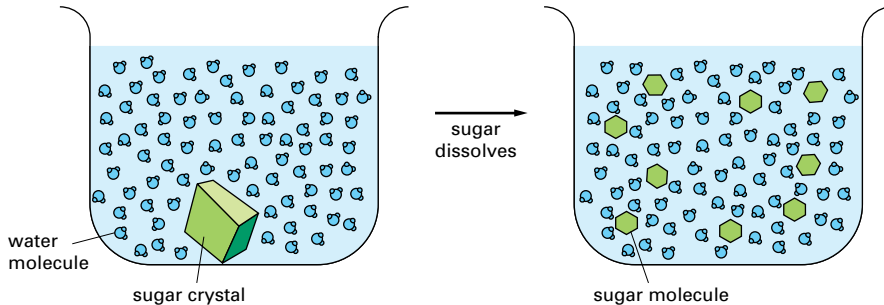


WATER AS A SOLVENT

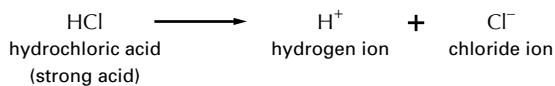
Many substances, such as household sugar, **dissolve** in water. That is, their molecules separate from each other, each becoming surrounded by water molecules.



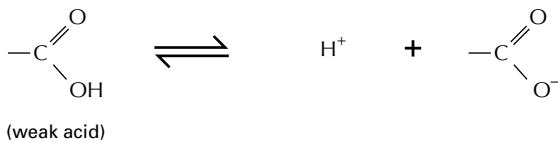
When a substance dissolves in a liquid, the mixture is termed a **solution**. The dissolved substance (in this case sugar) is the **solute**, and the liquid that does the dissolving (in this case water) is the **solvent**. Water is an excellent solvent for many substances because of its polar bonds.

ACIDS

Substances that release hydrogen ions into solution are called **acids**.



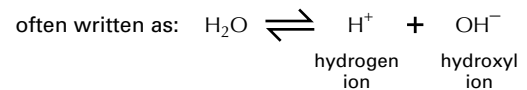
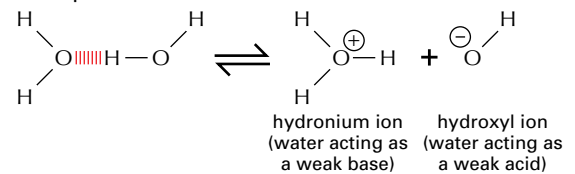
Many of the acids important in the cell are only partially dissociated, and they are therefore **weak acids**—for example, the carboxyl group ($-\text{COOH}$), which dissociates to give a hydrogen ion in solution



Note that this is a reversible reaction.

HYDROGEN ION EXCHANGE

Positively charged hydrogen ions (H^+) can spontaneously move from one water molecule to another, thereby creating two ionic species.



Since the process is rapidly reversible, hydrogen ions are continually shuttling between water molecules. Pure water contains a steady-state concentration of hydrogen ions and hydroxyl ions (both 10^{-7} M).

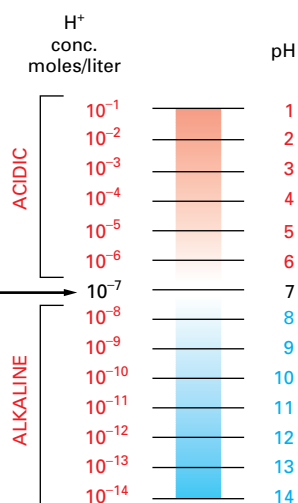
pH

The acidity of a solution is defined by the concentration of H^+ ions it possesses. For convenience we use the pH scale, where

$$\text{pH} = -\log_{10}[\text{H}^+]$$

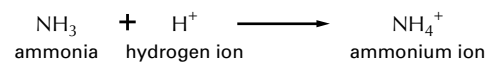
For pure water

$$[\text{H}^+] = 10^{-7} \text{ moles/liter}$$

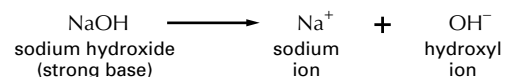


BASES

Substances that reduce the number of hydrogen ions in solution are called **bases**. Some bases, such as ammonia, combine directly with hydrogen ions.



Other bases, such as sodium hydroxide, reduce the number of H^+ ions indirectly, by making OH^- ions that then combine directly with H^+ ions to make H_2O .



Many bases found in cells are partially dissociated and are termed **weak bases**. This is true of compounds that contain an amino group ($-\text{NH}_2$), which has a weak tendency to reversibly accept an H^+ ion from water, increasing the quantity of free OH^- ions.

