

Chapter 3

Water and the Fitness of the Environment

PowerPoint® Lecture Presentations for

Biology

Eighth Edition

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Overview: The Molecule That Supports All of Life

Why dedicate a Chapter to water?

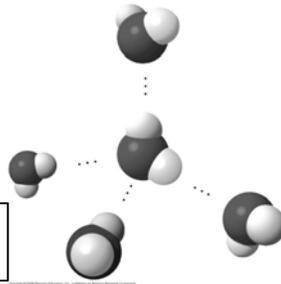
Importance of Water:

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Concept 3.1: The polarity of water molecules results in hydrogen bonding

Label the water image with the following:

- a.) Hydrogen atoms
- b.) Oxygen atoms
- c.) Hydrogen bonds
- d.) Covalent bonds
- e.) partial +, partial -



The water molecule is a **polar molecule**, which means _____ ?

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Concept 3.2: Four emergent properties of water contribute to Earth's fitness for life

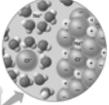
Because of hydrogen bonding, water exhibits 4 important properties:

- A. Cohesion/Adhesion
- B. Ability to moderate temperature
- C. Insulation of bodies of water by Floating Ice
- D. Versatility as a solvent

Match the properties with photos on the next slide

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Match the picture with the property of water displayed

A. 

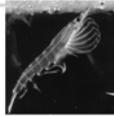
B. 

C. 

D. 

E. 

F. 

G. 

The Solvent of Life

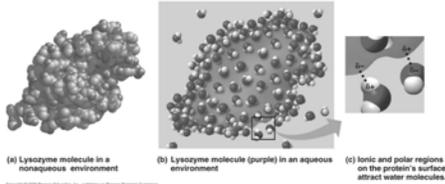
- A **solution** is _____
- A **solvent** is _____
- The **solute** is _____
- An **aqueous solution** is _____
 - a. Dissolving agent
 - b. Water is the solvent
 - c. Homogenous mixture of substances
 - d. The substance that is dissolved

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Which of the following explains what is happening when sodium chloride dissolves in water?

- a. More hydrogen bonds are forming between water molecules.
- b. Sodium and chloride atoms are separating from one another.
- c. Hydration shells are forming around the sodium and chloride ions.
- d. Covalent bonds are breaking and re-forming.
- e. Nonpolar substances are mixing with polar substances.

- Water can also dissolve compounds made of nonionic polar molecules
- Even large polar molecules such as proteins can dissolve in water if they have ionic and polar regions



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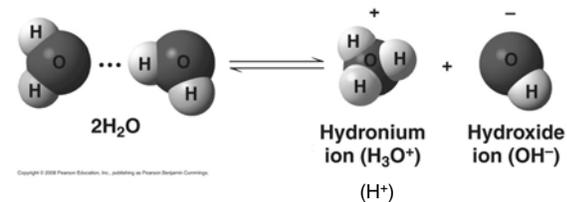
Hydrophilic and Hydrophobic Substances

- A **hydrophilic** substance is _____
- A **hydrophobic** substance is _____

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Concept 3.3: Acidic and basic conditions affect living organisms

- Water is in a state of dynamic equilibrium in which water molecules dissociate at the same rate at which they are being reformed

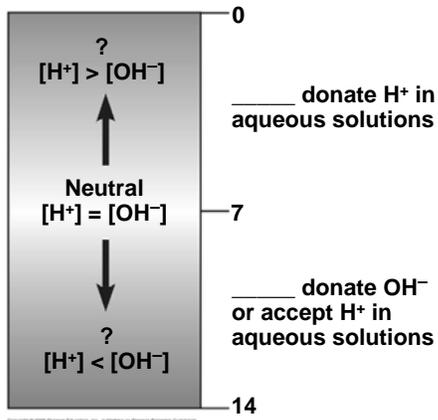


Effects of Changes in pH

- Concentrations of H^+ and OH^- are equal in pure water
- Adding certain solutes, called acids and bases, modifies the concentrations of H^+ and OH^-
- Biologists use something called the pH scale to describe whether a solution is acidic or basic

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Fig. 3-UN5

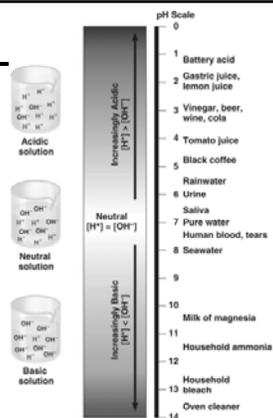


The pH Scale

- In any aqueous solution at 25°C the product of H^+ and OH^- is constant and can be written as $[H^+][OH^-] = 10^{-14}$
- The **pH** of a solution is defined by the negative logarithm of H^+ concentration, written as $pH = -\log [H^+]$
- For a neutral aqueous solution $[H^+]$ is $10^{-7} = -(-7) = 7$

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- Acidic solutions have pH values less than 7
- Basic solutions have pH values greater than 7
- Most biological fluids have pH values in the range of 6 to 8
- Internal pH of most cells is close to 7



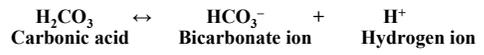
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Buffers

- **Buffers** are substances that minimize changes in concentrations of H^+ and OH^- in a solution
- Most buffers consist of an acid-base pair that reversibly combines with H^+
- What is one important buffer in the human body?

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The chemical equilibrium between carbonic acid and bicarbonate acts as a pH regulator in our blood. As the blood pH begins to rise, what will happen?



- a. reaction proceeds to the right; more carbonic acid dissociates
- b. reaction proceeds to the right; more carbonic acid forms
- c. reaction proceeds to the left; more carbonic acid dissociates
- d. reaction proceeds to the left; more carbonic acid forms
