

CHAPTER 3

WATER AND THE FITNESS OF THE ENVIRONMENT

Learning objectives

The Properties of Water

1. With the use of a diagram or diagrams, explain why water molecules are:
 - a. polar
 - b. capable of hydrogen bonding with 4 neighboring water molecules
2. List four characteristics of water that are emergent properties resulting from hydrogen bonding.
3. Define **cohesion** and **adhesion**. Explain how water's cohesion and adhesion contribute to the movement of water from the roots to the leaves of a tree.
4. Distinguish between **heat** and **temperature**, using examples to clarify your definitions.
5. Explain the following observations by referring to the properties of water:
 - Coastal areas have milder climates than adjacent inland areas.
 - Ocean temperatures fluctuate much less than temperatures on land.
 - Insects like water striders can walk on the surface of a pond without breaking the surface.
 - If you slightly overfill a water glass, the water will form a convex surface above the top of the glass.
 - If you place a paper towel so that it touches spilled water, the towel will draw in the water.
 - Ice floats on water.
 - Humans sweat and dogs pant to cool themselves on hot days.

The Solvent of Life

6. Distinguish between a **solute**, a **solvent** and a **solution**.
7. Distinguish between **hydrophobic** and **hydrophilic** substances.
8. Explain how you would make up a one molar (1M) solution of ethyl alcohol.

The Dissociation of Water Molecules

9. Name the products of the dissociation of water and give their concentration in pure water.
10. Define **acid**, **base**, and **pH**.
11. Explain how acids and bases may directly or indirectly alter the hydrogen ion concentration of a solution.
12. Using the bicarbonate buffer system as an example, explain how buffers work.
13. Briefly explain how the burning of fossil fuels may affect:
 - a. Acid precipitation
 - b. Ocean acidification