CHAPTER 2
THE CHEMICAL CONTEXT OF LIFE

Learning objectives

Elements and compounds
1. Distinguish between an element and a compound.
2. Identify the four elements that make up 96% of living matter.
3. Define the term trace element and give an example.

Atoms and molecules
4. Draw and label a simplified model of an atom.
5. Distinguish between each of the following pairs of terms:
   a. Neutron and proton
   b. Atomic number and mass number
   c. Atomic weight and mass number
6. Explain how the atomic number and mass number of an atom can be used to determine the number of neutrons.
7. Explain how two isotopes of an element are similar. Explain how they are different.
8. Describe a biological application that uses radioactive isotopes.

Electron distribution and chemical properties
9. Define the terms energy and potential energy. Explain why electrons in the first electron shell have less potential energy than electrons in higher electron shells.
10. Distinguish between nonpolar covalent, polar covalent and ionic bonds.
11. Distinguish between hydrogen bonds and van der Waals interactions.
12. Give an example that illustrates how a molecule’s shape can determine its biological function.
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.

The Solvent of Life
5. Distinguish between a solute, a solvent and a solution.
6. Distinguish between hydrophobic and hydrophilic substances.
7. Explain and be able to calculate molar solution.

The Dissociation of Water Molecules
8. Name the products of the dissociation of water and give their concentration in pure water.
9. Define acid, base, buffer and pH.
10. Explain how acids and bases may directly or indirectly alter the hydrogen ion concentration of a solution.
11. Using the bicarbonate buffer system as an example, explain how buffers work.