Chapter 2 – The Chemical Context of Life

Overview: A Chemical Connection to Biology
- Biology is a multifaceted discipline
- Living organisms are subject to basic laws of physics and chemistry
- One example is the use of biomaterials by artists to reproduce "Hirst's gardens," made of Damien Hirst

Concept 2.1: Matter consists of chemical elements in pure form and in combinations called compounds
- Organisms are composed
- Matter is anything that **takes up space** and has mass

Elements and Compounds
- Matter is made up of elements
- An **element** is a substance that cannot be broken down to other substances by chemical reactions
- A **compound** is a substance consisting of two or more elements in a fixed ratio
  - A compound has characteristics different from those of its elements

The Elements of Life
- About **96.3%** the 92 elements are essential to life
- Carbon, hydrogen, oxygen, and nitrogen make up **96%** of living matter
- Most of the remaining **3%** of calcium, phosphorus, potassium, and sulfur
  - **Trace Elements** are those required by an organism in minute quantities

Concept 2.2: An element's properties depend on the structure of its atoms
- Each element consists of unique atoms
  - An **atom** is the smallest unit of matter that still retains the properties of an element

Subatomic Particles
- Atoms are composed of subatomic particles
- Relevant subatomic particles include
  - **Neutrons** (no electrical charge)
  - **Protons** (positive charge)
  - **Electrons** (negative charge)
    - Neutrons and protons form the **atomic nucleus**
    - Electrons form a cloud around the nucleus
    - Neutron mass and proton mass are almost identical and are measured in **Daltons**

Atomic Numbers and Atomic Mass
- Atoms of the various elements differ in number of subatomic particles
- An element's **atomic number** is the number of protons in its nucleus
- An element's **mass number** is the sum of protons plus neutrons in the nucleus
- **Atomic mass**, the atom's total mass, can be approximated by the mass number

Isotopes