

Chapter 2  
**Atoms, Ions, and Molecules: The Building Blocks of Matter**  
Learning Objectives

8.12.2022

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To satisfy the minimum requirements for this course, you should be able to:

1. **Understand fundamental principles of atomic structure and composition.**
  - define atomic structure in terms of number of protons ( $p^+$ ), neutrons ( $n^0$ ), and electrons ( $e^-$ ).
  - recognize and define terms: nucleon, isotope, nuclide, atomic number ( $Z$ ), mass number ( $A$ ) and atomic mass unit ( $u$ ).
2. **Describe the organization of the periodic table** and be able to:
  - write the symbol and charge for an atom or ion, having been given the number of protons and electrons, and perform the reverse operation
  - write the symbol for an isotope given its atomic number and the number of neutrons in the nucleus
  - define terms: group (or family) and period
  - identify an element as a metal, nonmetal, or metalloid
  - identify the following important groups: 1 (alkali metals); 2 (alkaline earth metals); 17 (halogens); 18 (noble gases)
  - predict the charge of monoatomic ions based on the periodic table
3. **Understand how empirical and molecular formulas are used to express the chemical composition of substances** and be able to:
  - explain the differences between molecular compounds and ionic compounds
  - define terms: cation and anion
4. **Perform calculations involving the masses of atoms and molecules.** Examples include:
  - use Avogadro's number,  $N_A$ , to relate moles to number of particles
  - calculate the average atomic mass of an element given masses and abundances of its stable isotopes.
  - calculate the molecular mass or formula mass (in amu) and molar mass (in g/mol) of a substance from its chemical formula
  - interconvert number of molecules, number of moles, number of atoms and mass of a substance

**Note - Section 2.6 (Mass Spectrometry) is not assigned.**