

CU-CHEM 1251 (General Chemistry I for Majors)

Course Learning Goals

BIG IDEAS

You will deepen your understanding of a wide range of concepts and learn new problem-solving skills within this course. Almost everything you learn will connect back to one or more “big ideas,” which will cycle throughout the semester.

Big Idea 1: What is the nature of matter?

Big Idea 2: How can we predict the properties of matter, and how is the periodic table helpful?

Big Idea 3: What makes chemicals react, and why do reactions go in a particular direction?

Big Idea 4: How can we quantify changes in chemical reactions?

BI 1: What is the nature of matter?

You continually interact with matter, and you already know quite a bit about states of matter and various chemical and physical properties of matter. How can the properties that we observe in our everyday lives and in the laboratory be understood and explained at the molecular level? This theme will be emphasized throughout the semester in these contexts:

- Properties of solids, liquids, gases, and mixtures (especially solutions)
- Atomic structure and properties
- Molecular structure and properties
- Weak and strong bonding
 - Covalent bonding
 - Intermolecular forces

BI 2: How can we predict the properties of matter, and how is the periodic table helpful?

So far, over 100 elements have been discovered or synthesized in laboratories. Fortunately for chemists, we don't need to memorize the properties of each individual element. Groups of elements behave similarly, and the periodic table organizes the elements in a way that allows us to make predictions about properties of each element. This theme will be emphasized throughout the semester in these contexts:

- Predicting properties of elements
- Atomic structure
- Bonding
- Ionization states

BI 3: What makes chemicals react, and why do reactions go in a particular direction?

Ever wonder why iron reacts with oxygen over time to form rust, but the opposite reaction isn't observed? How can you predict to what extent a reaction will occur, or describe how quickly it occurs? The directionality of a reaction, the speed of the reaction, and the extent to which the reaction occurs relate to three big ideas in chemistry—thermodynamics (stability of reactants and products), kinetics (speed and mechanisms for reactions), and equilibrium (reversibility of reactions). These ideas will be introduced this semester, within these contexts:

- Thermochemistry
- Types of chemical reactions
- Bonding
- Phase change equilibria
- Chemical equilibria

BI 4: How can we quantify changes in chemical reactions?

Atoms and molecules combine and react in definite proportions. Tools that allow chemists to synthesize products with minimal “leftover” reactants include balanced chemical equations and molar mass relationships. These ideas will be further developed this semester, within these contexts:

- Stoichiometry
- Reactions in the gas phase (relationships among moles, pressure, volume, and temperature)
- Bond energy; heats of formation; heats of reaction