



Chemistry Exam Snapshot

Time Allowed:	240 minutes	
Format:	Multiple-choice	
Number of Questions:	125	
On-Screen Exhibits: (available as relevant)	Scientific calculator; Formula sheet; Periodic Table; Standard Reduction Potentials	
Passing Score:	Proficient: 285 Distinguished: 357	(The number of questions answered correctly is converted to a scaled score ranging from 0 to 500.)
Exam Summary:	Content Domains	Approximate Percentage of Examination
	General Science Knowledge	4%
	Scientific Investigation	7%
	Atomic Structure, Periodicity, and Matter	26%
	Chemical Naming and Structure	14%
	Reactions and Reactivity	26%
	Gas Laws and Solutions	18%
	Organic Chemistry	5%

About This Exam

The American Board for Certification of Teacher Excellence believes that highly skilled chemistry teachers should possess a comprehensive body of scientific knowledge that is research-based and promotes student achievement. The chemistry exam is a rigorous assessment of a candidate's knowledge and application of general chemistry. The topics assessed are characteristically covered in introductory college-level chemistry courses, although some more advanced questions are included, as teachers must hold a more sophisticated understanding of chemistry content than that presented to their students.



General Science Knowledge

- General science knowledge in the subjects of biology, Earth science, and physics

Scientific Investigation

- Scientific method
- Accuracy, precision, and error
- Scientific notation and significant digits
- Procedures for the safe handling of laboratory materials

Atomic Structure, Periodicity, and Matter

Atomic Structure and Theory

- Development of atomic theory
- Contributions of Dalton, Thomson, Bohr, Lavoisier, Pasteur, and Pauling

Periodic Table

- Development of the Periodic Table
- Periodic trends in ionization energy, electron affinity, electronegativity, atomic radius, and ionic radius
- Properties of metals, nonmetals, semi-metals, and hydrides

Quantum Mechanics

- Bohr hydrogen atom
- Heisenberg uncertainty principle
- Quantum numbers to describe an electron in an orbital
- Aufbau principle, the Pauli exclusion principle, and Hund's rule
- Electron configurations and orbital diagrams
- Size, shape, energy, quantity, and spatial orientation of s, p, d, and f orbitals

Atomic Structure, Periodicity, and Matter (...continued)

Nuclear Chemistry

- Conversion of nuclear energy into electrical energy
- Nuclear fission and fusion
- Properties of α , β , and γ emission in radioactive decay

Chemical Naming and Structure

Molecular Bonding and Structure

- Electron-dot Lewis structures of molecules and polyatomic ions
- Ionic, polar covalent, and non-polar covalent bonds
- Hybridizations for molecular geometry
- VSEPR theory

Chemical Naming and Formulas

- Monatomic and polyatomic ions, ionic compounds, binary molecular compounds, hydrates, and common acids and bases
- IUPAC names of the alkanes C1 to C10
- Mass percent composition, the empirical formula, and the molecular formula of a compound
- Compounds as basic, acidic, or amphoteric oxides, peroxides, or superoxides

Reactions and Reactivity

Chemical Reactions and Stoichiometry

- Types and products of chemical reactions
- Balanced molecular, ionic, and net ionic equations for chemical reactions
- The mole concept
- Quantitative relationships in chemical reactions involving solids, liquids, or gases



Chemistry Exam Snapshot

Reactions and Reactivity (...continued)

- Percent yield, limiting reactants, and excess reactants in chemical reactions

Kinetics

- Chemical reaction rates and factors affecting chemical reaction rates
- Order of a reaction and the rate constant
- Half-life and rate constant
- Reaction intermediates and the experimental rate law

Electrochemistry

- Chemical equations for oxidation-reduction reactions
- Direction of electron flow between the anode and cathode
- Standard reduction potentials, the voltaic cell, and emf
- Cell potential, electric work, and free energy

Thermodynamics and Equilibrium

- Conservation of energy
- Closed systems, open systems, surroundings, and the universe
- Internal energy, heat, and work to and from the system and surroundings
- Hess's law and enthalpy, entropy, and free energy
- Dynamic equilibrium and changes in equilibrium

Gas Laws and Solutions

Gas Laws

- Kinetic molecular theory
- Graham's law and Dalton's law of partial pressures

Gas Laws and Solutions (...continued)

- Charles's, Boyle's and Gay-Lussac's laws
- The ideal gas law

Solution Chemistry

- Solutions, colloids, and suspensions
- Interparticle interactions
- Colligative properties, theoretical freezing point and boiling point of a solution, and molar mass of a solute
- Henry's law and Raoult's law
- K_{sp} values, solution volume, and concentration data

Acids and Bases

- Arrhenius, Brønsted-Lowry, and Lewis definitions of acids and bases
- Origin of the pH scale and its relationship to H_3O^+ concentration
- Relative strength of acids or bases
- Conjugate acid-base pairs in a chemical equation
- The relationship of pK_a , pK_b , K_a , K_b , K_{eq} , K_p , K_c and K_w .

Organic Chemistry

- Condensed and line structures of organic molecules
- IUPAC naming system for alkanes, cycloalkanes, alkenes, alkynes, and aromatics and their structures
- Functional groups and chemical structures and properties of molecules
- Structures of polymers