



Brown University Department of Chemistry

Learning Outcomes



Core Principles of Chemistry

- Knowledge of atomic structure and periodic properties
- Knowledge of how physics principles explain properties of electrons, atoms and molecules
- Knowledge of and ability to apply/use bonding models to understand/predict shape, reactivity and electron distribution
- Understand and apply models of structural dynamics (e.g., conformations)
- Understand and apply models of chemical dynamics (e.g., energy surfaces)
- Understanding chemical change (e.g., equilibrium; metabolism)
- Use quantitative methods to probe chemical change (evidence)
- Understand and apply the interactions of electromagnetic radiation with matter
- Understand the principles and applications of catalysis (e.g. industry; life sciences; technology)

Quantitative and Qualitative Reasoning Skills

- Accurately collect and interpret numerical data
- Select appropriate mathematical routines to solve problems
- Solve problems using extrapolation, approximation (order of magnitude), and rational estimation
- Appropriately apply precision, accuracy, and statistical validity principles to solve problems
- Analyze data to identify patterns or relationships
- Solve problems applying qualitative, pattern recognition and logical disciplinary thinking

Scientific Inquiry Skills

- Proficiency in the scientific method (formulating and refining tests of scientific questions and producing appropriate hypotheses and conclusions)
- Identify assumptions and offer alternative hypotheses
- Understand the limits of experimental investigations
- Apply current scientific knowledge to create new knowledge within and amongst the subfields of chemistry
- Learn across disciplinary boundaries
- Recognize the soundness and/or validity of a solution in a given context
- Develop the ability to assess one's approach (and modify as needed)
- Evaluate and learn from the scientific literature and the scientific community
- Employ modern library search tools and databases
- Recognize the importance of metacognition in scientific inquiry
- Perform and interpret molecular modeling and/or chemical computations using standard software
- Learn ethical practices, including intellectual property, citation and proper scientific conduct



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Laboratory Skills

- Accurately collect and interpret numerical data
- Know, understand and apply safety protocols in the use of chemicals in laboratory work
- Understand the physical principles behind common laboratory instruments and their uses and limitations
- Use modern laboratory instruments and choose the appropriate instruments and conditions for a given analysis
- Use computers for data acquisition and analysis
- Synthesize, separate, purify and characterize compounds, using modern methodologies and instrumentation
- Perform qualitative and/or quantitative evaluation of laboratory processes and products

Communication

- Write and present scientific data (reports, posters, etc.) using appropriate scientific language
- Develop and demonstrate effective oral communication of scientific information as appropriate for specific audiences
- Learn to articulate ideas for a general audience
- Use scientific inquiry skills and communication skills to produce literature reviews and research proposals
- Learn ethical practices, including intellectual property and proper scientific conduct
- Learn proper citation and summary practice
- Engage in scholarly discussion and/or debate
- Work effectively in small groups or teams

Liberal Learning

- Identify impacts of chemistry on daily life
- Learn across disciplinary boundaries (application of chemistry to other disciplines and the use of knowledge from other disciplines in solving chemistry problems)
- Use teams, the scientific community, and interdisciplinary research to address societal problems
- Develop knowledge and skills that are foundational to or have applicability to other disciplines
- Connect course experience to potential future careers

Metacognition

- Distinguish what is known and unknown
- Identify one's approach to learning and modify it as needed
- Identify assumptions and offer alternative hypotheses