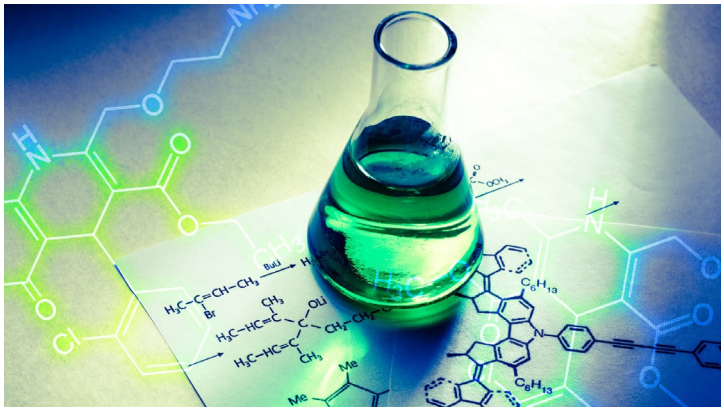
Chemistry
Science

Key Instructional Activities

The Chemistry Georgia Standards of Excellence are designed to continue student investigations of the physical sciences that began in grades K-8 and provide students the necessary skills to be proficient in chemistry. These standards include more abstract concepts such as the structure of atoms, structure and properties of matter, the conservation and interaction of energy and matter, and the use of Kinetic Molecular Theory to model atomic and molecular motion in chemical and physical processes. Students investigate chemistry concepts through experiences in laboratories and field work using the process of inquiry.

Chemistry students use the periodic table to help with the identification of elements with particular properties, recognize patterns that lead to explain chemical reactivity and bond formation. They use the IUPAC nomenclature in order to predict chemical names for ionic (binary and ternary), acidic, and inorganic covalent compounds, and conduct experiments to manipulate factors that affect chemical reactions.



The Science Georgia Standards of Excellence drive instruction. Hands-on, student-centered, and inquiry-based approaches should be the emphasis of instruction. The standards are a required minimum set of expectations that show proficiency in science.

HOUSTON COUNTY BOARD OF EDUCATION
HIGH-ACHIEVING STUDENTS

What resources are available for students and parents?

- ✓ Online Science Textbook
- ✓ Parent Portal
- ✓ Overview of Units and Pacing

Chemistry Course Overview

Unit 1: Atomic Structure

Expected Dates: Beginning of School Year to Mid-August

Students will be able to evaluate merits and limitations of different models of the atom in relation to relative size, charge, and position of protons, neutrons, and electrons in the atom. Students will be able to construct an argument to support the claim that the proton (and not the neutron or electron) defines the element's identity. Students will be able to construct an explanation that relates the relative abundance of isotopes of a particular element to the atomic mass of the element.

Unit 2: Nuclear Fusion

Expected Dates: Mid-August to the End of August

Students will construct an explanation based on scientific evidence of the production of elements heavier than hydrogen by nuclear fusion.

Unit 3: Light Emission

Expected Dates: Mid-August to the End of August

Students will construct an explanation of light emission and the movement of electrons to identify elements.

Unit 4: Electron Configuration and Periodicity

Expected Dates: End of August to Mid-September

Students will use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms (i.e. including atomic radii, ionization energy, and electronegativity). Students will develop and use models, including electron configuration of atoms and ions, to predict an element's chemical properties.

Unit 5: Chemical Bonding and Energy

Expected Dates: Third Week of September

Students will develop and use models to evaluate bonding configurations from nonpolar covalent to ionic bonding.

Unit: 6 Chemical Formulas and Nomenclature

Expected Dates: Mid-September to End of September

Students will ask questions about chemical names to identify patterns in IUPAC nomenclature in order to predict chemical names for ionic (binary and ternary), acidic, and inorganic covalent compounds. Students will develop and use bonding models to predict chemical formulas including ionic (binary and ternary), acidic, and inorganic covalent compounds.

Unit 7: Molecular Forces and Properties of Matter

Expected Dates: End of September to Mid-October

Students will plan and carry out an investigation to gather evidence to compare the physical and chemical properties at the macroscopic scale to infer the strength of intermolecular and intramolecular forces. Students will construct an argument by applying principles of inter- and intra- molecular forces to identify substances based on chemical and physical properties. Students will construct an explanation about the importance of molecular-level structure in the functioning of designed materials.

Unit 8: Chemical Reactions and Equations

Expected Dates: End of October to Mid-November

Students will use mathematics and computational thinking to balance chemical reactions (i.e., synthesis, decomposition, single replacement, double replacement, and combustion) and construct an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. Students will plan and carry out an investigation to determine that a new chemical has been formed by identifying indicators of a chemical reaction (e.g., precipitate formation, gas evolution, color change, water production, and changes in energy to the system).

Unit 9: Molar Relationships

Expected Dates: Beginning of December to Mid-December

Students will use mathematics and computational thinking to apply concepts of the mole and Avogadro's number to conceptualize and calculate: 1) percent composition, 2) empirical/molecular formulas, 3) mass, moles, and molecules relationships, 4) molar volumes of gases.

Unit 10: Stoichiometry and Limiting Reactants

Expected Dates: Beginning of January to End of January

Students will use mathematics and computational thinking to identify and solve different types of reaction stoichiometry problems (i.e., mass to moles, mass to mass, moles to moles, and percent yield) using significant figures. Students will plan and carry out an investigation to demonstrate the conceptual principle of limiting reactants.

Unit 11: Factors Affecting Chemical Reactions

Expected Dates: First Week of February

Students will plan and carry out an investigation to provide evidence of the effects of changing concentration, temperature, and pressure on chemical reactions.

Unit 12: Collision Theory, Transition State Theory, Activation Energy and Catalysts

Expected Dates: Second Week of February to Mid-February

Students will construct an argument using collision theory and transition state theory to explain the role of activation energy in chemical reactions. Students will construct an explanation of the effects of a catalyst on chemical reactions and apply it to everyday examples.

Unit 13: Chemical Systems and Equilibrium

Expected Dates: Mid-February to End of February

Students will refine the design of a chemical system by altering the conditions that would change forward and reverse reaction rates and the amount of products at equilibrium.

Unit 14: Enthalpy, Heat Change and Hess' Law

Expected Dates: End of February to Mid-March

Students will plan and carry out an investigation to calculate the amount of heat absorbed or released by chemical or physical processes. Students will develop a model to illustrate the release or absorption of energy (endothermic or exothermic) from a chemical reaction system depends upon the changes in total bond energy.

Unit 15: Heat Curve and Phase Changes

Expected Dates: Third Week of March

Students will construct an explanation using a heating curve as evidence of the effects of energy and intermolecular forces on phase changes.

Unit 16: Gases

Expected Dates: End of March to First Week of April

Students will develop and use models to quantitatively, conceptually, and graphically represent the relationships between pressure, volume, temperature, and number of moles of a gas.

Unit 17: Process and rate of Dissolving

Expected Dates: Second Week in April to Mid-April

Students will develop a model to illustrate the process of dissolving in terms of solvation versus dissociation. Students will plan and carry out an investigation to evaluate the factors that affect the rate at which a solute dissolves in a specific solvent.

Unit 18: Solution Concentration

Expected Dates: Second Week in April to Mid-April

Students will use mathematics and computational thinking to evaluate commercial products in terms of their concentrations (i.e., molarity and percent by mass). Students will communicate scientific and technical information on how to prepare and properly label solutions of specified molar concentration.

Unit 19 Colligative Properties

Expected Dates: End of April to Beginning of May

Students will develop and use a model to explain the effects of a solute on boiling point and freezing point.

Unit 20: Nature of Acids and Bases

Expected Dates: First Week of May

Students will use mathematics and computational thinking to compare, contrast, and evaluate the nature of acids and bases in terms of percent dissociation, hydronium ion concentration, and pH. Students will ask questions to evaluate merits and limitations of the Arrhenius and Bronsted-Lowry models of acid and bases.

Unit 21: Acid-Base Neutralization

Expected Dates: Second Week of May

Students will plan and carry out an investigation to explore acid-base neutralization.

Helpful Tips for Parents and Guardians

Believe that every child can be successful in science.

Science has led to the discovery of everything from gravity to medicine. Science is a way of understanding the world, a perspective, and a pattern of thinking that begins in the very early years. That is why parent involvement is so important in a child's science education.

Tips to Help Children Learn Science

Explore, explore, explore. See science everywhere. Always encourage your child to question their surroundings, and then discuss. Parents can take opportunities to ask, "What would happen if …?" questions or present brainteasers to encourage children to be inquisitive and seek out answers.

Lead family discussions on science-related topics. Dinnertime might be an ideal time for your family to have discussions about news stories that are science based, like space shuttle missions, severe weather conditions, or new medical breakthroughs. Over time, children will develop a better understanding of science and how it affects many facets of our lives. Movies and TV shows with science-related storylines are also great topics for discussion.

Encourage girls and boys equally. Many fathers might be inclined to fix a problem for a daughter without challenging her to find the solution on her own. Many girls are left out of challenging activities simply because of their gender. Be aware that both girls and boys need to be encouraged and exposed to a variety of subjects at a very early age.

Do science together. Children, especially elementary-age children, learn better by investigating and experimenting. Simple investigations done together in the home can bolster what your child is learning in the classroom. Check with your child's teacher on what your child is currently learning in class and what activities you can explore at home. There are also many books on the market and numerous websites that present ideas for investigations.

In addition to exploring and communicating as a family, it is important to invest in your child's willingness to learn. There are many programs available that are fun and interactive, helping them build a solid foundation in science.

From life sciences to environmental science, physical science to earth science, when children express interests in these subjects, encourage them and learn with them.

How You Can Support Your Child's Success?

Although Georgia's approach to teaching and learning K-12 science is different than the past, you can still actively support your child's success in the classroom.

1. Speak to your child's teacher(s) about how these important changes affect your school.
2. Ask your child's teacher thoughtful questions based on the information provided in this brochure.
3. Learn how you can help the teacher(s) reinforce classroom instruction at home.
4. Visit www.georgiastandards.org for more information.