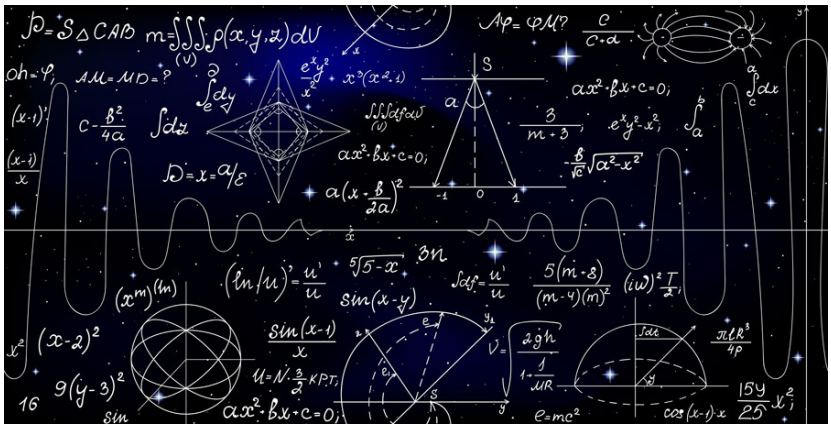
Physics
Science

Key Instructional Activities

The Physics Georgia Standards of Excellence are designed to continue the student investigations of the physical sciences that began in grades K-8, and provide students the necessary skills to be proficient in physics. These standards include more abstract concepts such as nuclear decay processes, interactions of matter and energy, velocity, acceleration, force, energy, momentum, properties and interactions of matter, electromagnetic and mechanical waves, and electricity, magnetism and their interactions. Students investigate physics concepts through experiences in laboratories and field work using the science and engineering practices of asking questions and defining problems, developing and using models, planning and carrying out investigations, analyzing and interpreting data, using mathematics and computational thinking, constructing explanations and designing solutions, engaging in argument from evidence, and obtaining, evaluating, and communicating information.



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

Physics Course Overview

Unit 1: One-Dimensional Motion

Expected Dates: Beginning of School Year to Beginning of September

Students will plan and carry out an investigation of one-dimensional motion to calculate average and instantaneous speed and velocity.
1) Analyze one-dimensional problems involving changes of direction, using algebraic signs to represent vector direction. 2) Apply one-dimensional kinematic equations to situations with no acceleration, and positive, or negative constant acceleration. Students will analyze and interpret data using created or obtained motion graphs to illustrate the relationships among position, velocity, and acceleration, as functions of time. Students will ask questions to compare and contrast scalar and vector quantities.

Unit 2: Newton's Laws of Motion and Free Body Diagrams

Expected Dates: Beginning of September to Beginning of October

Students will construct an explanation based on evidence using Newton's Laws of how forces affect the acceleration of a body. 1) Explain and predict the motion of a body in absence of a force and when forces are applied using Newton's 1st Law (principle of inertia).
2) Calculate the acceleration for an object using Newton's 2nd Law, including situations where multiple forces act together. 3) Identify the pair of equal and opposite forces between two interacting bodies and relate their magnitudes and directions using Newton's 3rd Law.
Students will develop and use a model of a Free Body Diagram to represent the forces acting on an object (both equilibrium and non-equilibrium). Students will use mathematical representations to calculate magnitudes and vector components for typical forces including gravitational force, normal force, friction forces, tension forces, and spring forces.

Unit 3: Two-Dimensional Motion

Expected Dates: Beginning of October to Mid-October

Students will analyze and interpret data of two-dimensional motion with constant acceleration.
1) Resolve position, velocity, or acceleration vectors into components (x and y, horizontal and vertical). 2) Add vectors graphically and mathematically by adding components.
3) Interpret problems to show that objects moving in two dimensions have independent motions along each coordinate axis. 4) Design an experiment to investigate the projectile motion of an object by collecting and analyzing data using kinematic equations. 5) Predict and describe how changes to initial conditions affect the resulting motion. 6) Calculate range and time in the air for a horizontally launched projectile.

Unit :4 Circular Motion and Universal Law of Gravity

Expected Dates: Mid-October to Mid-November

Students will plan and carry out an investigation to gather evidence to identify the force or force component responsible for causing an object to move along a circular path. 1) Calculate the magnitude of a centripetal acceleration.
Students will develop and use a model to describe the mathematical relationship between mass, distance, and force as expressed by Newton's Universal Law of Gravitation.

Unit 5: Systems and Work-Kinetic Energy Theorem

Expected Dates: Mid-November to End of November

Students will ask questions to compare and contrast open and closed systems. Students will use mathematics and computational thinking to analyze, evaluate, and apply the principle of conservation of energy and the Work-Kinetic Energy Theorem. 1) Calculate the kinetic energy of an object. 2) Calculate the amount of work performed by a force on an object.

Unit 6: Power and Conservation of Energy in Closed Systems

Expected Dates: First Week of December

Students will plan and carry out an investigation demonstrating conservation and rate of transfer of energy (power) to solve problems involving closed systems.

Unit 7: Conservation of Momentum

Expected Dates: Second Week of December

Students will construct an argument supported by evidence of the use of the principle of conservation of momentum to…a) explain how the brief application of a force creates an impulse. b) describe and perform calculations involving one dimensional momentum.
c) connect the concepts of Newton's 3rd law and impulse. d) experimentally compare and contrast inelastic and elastic collisions.

Unit 8: Energy

Expected Dates: Beginning of January to Mid-January

Students will develop and use mathematical models to explain mechanical and electromagnetic waves as a propagating disturbance that transfers energy.

Unit 9: Sound

Expected Dates: Mid-January to End of January

Students will construct an argument that analyzes the production and characteristics of sounds waves.

Unit 10: Light

Expected Dates: End of January to Mid-February

Students will plan and carry out investigations to characterize the properties and behavior of electromagnetic waves. Students will plan and carry out investigations to describe common features of light in terms of color, polarization, spectral composition, and wave speed in transparent media. 1) Analyze experimentally and mathematically aspects of reflection and refraction of light waves and describe the results using optical ray diagrams. 2) Perform calculations related to reflections from plane surfaces and focusing using thin lenses. Students will plan and carry out investigations to identify the behavior of light using lenses.

Unit 11: Interference and Diffraction

Expected Dates: Mid-February to Beginning of March

Students will develop and use models to describe and calculate characteristics related to the interference and diffraction of waves (single and double slits). Students will plan and carry out investigations to describe changes in diffraction patterns associated with geometry and wavelength for mechanical and electromagnetic waves.

Unit 12: Electric Charges and Electric and Gravitational Forces

Expected Dates: Beginning of March to End of March

Students will develop and use mathematical models and generate diagrams to compare and contrast the electric and gravitational forces between two charged objects. Students will plan and carry out investigations to demonstrate and qualitatively explain charge transfer by conduction, friction, and induction. Students will construct an explanation based on evidence of the behavior of charges in terms of electric potential energy.

Unit 13: Electric Circuits and Ohm's Law
Expected Dates: Beginning of April to Mid-April
Students will plan and carry out an investigation of the relationship between voltage, current, and power for direct current circuits.

Unit 14: Electromagnetism
Expected Dates: Mid-April to End of April
Students will plan and carry out investigations to clarify the relationship between electric currents and magnetic fields.

Unit 15: Nuclear Processes
Expected Dates: Fourth Week of April
Students will develop and use models to explain, compare, and contrast nuclear processes including radioactive decay, fission, and fusion.

Unit 16: Mechanisms and Characteristics of Radioactive Decay
Expected Dates: First Week of May
Students will construct an argument to compare and contrast mechanisms and characteristics of radioactive decay.

Unit 17: Half-life and the Law of Conservation of Mass and Energy
Expected Dates: Second Week of May
Students will develop and use mathematical models and representations to calculate the amount of substance present after a given amount of time based on its half-life and relate this to the law of conservation of mass and energy.

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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.