

Iowa Science Standards

K-12 Parent Guide

How are the standards organized?

The Iowa Core Science Standards are arranged grade-by-grade for kindergarten through 8th grade. For high school, the standards are arranged by discipline – life science, physical science, earth/space science, and engineering and tech. The Iowa Core Science Standards set appropriate expectations for what students need to learn, but not how to teach.

Kindergarten

Learners build on their early experiences of observing the world around them as they begin to formulate answers to questions such as “Where do animals live and why do they live there? What is the weather like today and how is it different from yesterday?” Kindergarten students will use their senses to make observations, ask and answer questions, develop models, and plan and conduct investigations. Students in kindergarten will identify patterns and cause and effect relationships as they explore the world around them.

Examples of Your Child’s Work at School:

- Ask and answer questions related to the natural world.
- Use observations to identify patterns and variations in local weather.
- Observe plants and animals, determine what all animals, including humans, need to survive and identify examples of how plants and animals meet their needs through interacting with or changing their environments.
- Experiment with pushing and pulling various objects and investigate the answer to “What happens if you push or pull an object harder?”

How to Help Your Child at Home:

- As you go about your daily activities and during play, encourage your child to ask questions, make observations, and identify patterns.
- Encourage your child to play with a variety of safe objects/toys and to discover what happens when he/she pushes and pulls those objects.
- Keep track of local weather conditions, identify patterns, and discuss your family’s plan for staying safe in severe weather.
- Have your child help with taking care of a family pet or inside or outside plants and observe nature while out on walks or while visiting parks or zoos. Talk about what the pet and plant need to survive compared to what your child needs to survive.



1st Grade

In first grade, students have more fluency with language, number sense and inquiry skills. Students focus on using patterns to predict events. They begin to develop answers to questions such as: “What happens when materials vibrate? What would we see in a room with no light? What are some ways plants and animals meet their needs so they can survive and grow? What objects can we see in the sky?” First grade students will conduct investigations and use models to help make predictions about the natural and designed world.

Examples of Your Child’s Work at School:

- Explore how differing amounts of light and the ability to see objects are related.
- Plan and conduct investigations to discover how sound is produced.
- Use drawings or other models to show how young plants and animals are like, but not exactly the same as, their parents.
- Observe the external parts of plants and animals and make predictions about how plants and animals use those parts to help meet their needs.
- Use observations from looking at the sky during the day and at night and identify patterns from sunrise/sunset data to make predictions.

How to Help Your Child at Home:

- Encourage your child to ask questions about events in the natural world.
- Go outside in your neighborhood or at local parks or trails and take a “listening walk” and ask your child to identify different ways animals use sound to communicate.
- Encourage your child to come up with examples of how humans have used technology to communicate through light and sound (i.e. traffic signals, cellular phones).
- Observe animals, including humans, taking care of their young and identify things the parents do to help the young survive
- Go outside during the day and at night and observe the sky. Help your child discover when or if he/she can see the sun, the moon, and the stars.



2nd Grade

Learners grow in their ability to understand about larger systems and the parts that make them up. They begin to formulate answers to questions such as “How are materials similar and different from one another? How do the properties of the materials relate to their use? What do plants need to grow?” Investigations of how parts relate to the whole provide a key basis for understanding systems in later grades. Second grade students will record observations and data, will use a variety of informational texts to gather information, and will engage in scientific thinking as they begin to understand larger systems and the parts that make up the systems.

Examples of Your Child’s Work at School:

- Conduct investigations to classify materials based on similar properties and functions.
- Test different materials to collect and then analyze data for the purpose of determining which materials are the best for a specific function.
- Investigate how the environment in which the plants and animals live help provide the food, water, and shelter the organisms need to survive.
- Use information to model the features of Earth’s surface and begin to answer the questions “how does land change and what are things that cause it to change?”

How to Help Your Child at Home:

- Encourage your child to use building blocks, construction sets, and other toys to create larger structures from smaller pieces.
- Do arts and craft projects to create something new from smaller pieces. Talk about why certain materials might be better for specific projects and why.
- When outdoors, spend time observing the plants and animals in the area. Discuss ways plants and animals interact with their environment to meet their needs (i.e. squirrels dig holes to hide food). Visit zoos, aquariums, nature centers, or botanical centers and spend time observing how the plants and animals interact with their environments.
- When traveling, look for and discuss various landforms and talk about how they may have formed.



3rd Grade

In third grade, students use their advancing understanding and skills to study the interactions in earth systems, environments, humans, and the designed world. They begin to formulate answers to questions such as: “How do equal and unequal forces on an object affect the object? How can the impact of weather-related hazards be reduced? How do organisms vary in their traits? What happens to organisms when their environment changes? How can magnets be used?” Third grade students use and develop models and organize data when investigating how different entities and systems interact and influence behaviors, reactions, and traits of various organisms.

Examples of Your Child’s Work at School:

- Plan and conduct investigations to provide evidence of the effects of balanced and unbalanced forces on the motion or to predict future motion.
- Develop models of the life cycles of various plants and animals to identify commonalities and differences.
- Explore how plants, animals, and environments of the past are similar to or different from current plants, animals and environments.
- Organize and use data to describe typical weather conditions expected during a particular season and to describe climates in different regions of the world.

How to Help Your Child at Home:

- Keep track of temperature and rainfall over several seasons to identify and describe patterns.
- If you travel to other places around the country/world, help your child identify similarities and differences in climate.
- Provide a variety of magnets for your child to use in exploration. Ask your child to identify if the strength of a magnet is always related to the size of the magnet.
- Utilize programs offered by your county nature center. Visit zoos and parks and use hiking, biking and cross-country trails. Observe groups of animals and discuss how the group works together to help all members survive. Identify as many different plants and animals as possible and encourage your child to discover more information about plants or animals he/she is particularly interested in.



4th Grade

Students in fourth grade will use quantitative and qualitative data to formulate arguments about evidence, develop models, analyze and interpret data from maps, and construct explanations related to the transfer of matter and energy on earth, in physical interactions, and in organisms. Students will engage in learning activities and investigations designed to formulate answers to questions such as “What are waves and what are some things they can do? What is energy and how is it related to motion?”

Examples of Your Child’s Work at School:

- Describe how the internal and external structures of different plants and animals function to support survival, growth, behavior, and reproduction.
- Plan and conduct investigations to explore how light and sight are related.
- Design a device that uses an electrical current to produce motion, sound, light or heat.
- Explore wave properties and discover how waves can cause objects to move.
- Use patterns of rock formations and fossils to construct an explanation of how environments change over time.
- Make observations or take measurements to determine the effects of weathering and erosion on shaping the land.

How to Help Your Child at Home:

- Have your child collect items found in nature such as rocks, leaves, insects, plants, or seeds. Encourage your child to develop questions about those items and help him/her find answers to those questions either through investigations, by reading nonfiction texts, or by asking appropriate experts.
- Utilize programs offered by your county nature center to identify rock formations and fossils.
- Take a nature walk through your neighborhood, visit parks and hiking, biking, and cross-country trails. Observe how animals use their senses to respond to information from their environment.
- Identify examples of how water, ice, wind, and vegetation have changed or can change the land. Ask your child to consider what things humans have done to lessen the impact of those changes.



5th Grade

In fifth grade students formulate answers to questions such as: “When matter changes, does its weight change? Can new substances be created by combining other substances? How does matter cycle through ecosystems? How do shadows or relative lengths of day and night change from day to day? How does the appearance of some stars change in different seasons?” By studying systems, your child will learn that objects and organisms do not exist in isolation and are connected to, interact with, and are influenced by each other.

Examples of Your Child’s Work at School:

- Use and represent data to study the relationships between objects in the solar system and the impact of those relationships on patterns of events as seen from Earth.
- Develop models to describe how matter and energy cycle through plants and animals, and the ecosystems within which they live.
- Apply math skills and understanding of scale to measure volume and recognize the need for units that express quantities of weight, time, temperature, and other variables during investigations of properties and interactions of matter
- Independently maintain science journals to record observations, thoughts, ideas, and models by creating diagrams, representing data and observations with plots and tables, and support these with written text.

How to Help Your Child at Home:

- Encourage observations of the sun, moon, and stars at home in the evenings and mornings along with electronic apps to learn about and study the motions of the stars over the course of a year.
- Provide supervised opportunities in the kitchen to measure, observe and talk about changes in matter related to cooking.
- Encourage your child to find leaves and plants in your neighborhood and help him/her use field guides to identify some common trees and plants.
- Collect data and monitor use of energy and water at home.



6th Grade

In 6th grade students' engage in the core science ideas of *Structure of matter and chemical reactions*, *Structure and function of living things*, *Earth materials and systems*, and *Engineering Design*. Activities include, but are not limited to, using models, providing arguments with evidence, obtaining and analyzing data about relationships and interactions among observable components of different systems.

Examples of Your Child's Work at School:

- Analyze and interpret data on the properties of substances.
- Develop a model to describe the cycling of Earth's materials and the flow of energy that drives this process.
- Analyze and interpret data on natural hazards to forecast future catastrophic events and inform the development of technologies to mitigate their effects.
- Define the criteria and constraints of a design problem to ensure a successful solution.

How to Help Your Child at Home:

- Encourage finding answers to questions through research and experimentation.
- Join club or group that offers activities like robotics or computer programming.
- Provide opportunities to observe and talk about changes in matter related to cooking.
- Visit local observatories and planetariums with your child.
- Encourage the playing of "maker" games or apps such as Minecraft that develop engineering and collaboration skills.



7th Grade

In 7th grade students' engage in Science and Engineering Practices and apply Crosscutting Concepts to deepen their understanding of science. Core ideas included in 7th grade are *Motion and Stability: Forces and Interactions, Energy, Earth's Place in the Universe, Organisms and Heredity, Ecosystems, and Engineering Design*. Your child will have multiple opportunities to demonstrate science learning. Including, but not limited to, using models, providing evidence to support arguments, obtaining and analyzing data about relationships and interactions among observable components of different systems.

Examples of Your Child's Work at School:

- Construct a scientific explanation based on evidence for the role of photosynthesis in the cycling of matter and flow of energy into and out of organisms.
- Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.
- Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
- Develop and use a model to describe the role of gravity in the motions within galaxies and the solar system.
- Plan an investigation to determine the relationships among energy transfer, type of matter, mass, and change in the energy of the particles as measured by the temperature.

How to Help Your Child at Home:

- Encourage observations of the sun, moon, and stars at home.
- Encourage finding answers to questions through research and experimentation.
- Help your child plant a garden or grow plants in a pot.
- Encourage the playing of "maker" games and apps such as Minecraft that develop engineering and collaboration skills.
- Help your child to collect data and monitor use of energy and water at home.
- Utilize programs offered by your area nature center or recreation area.
- Join a club or group that offers activities such as robotics and computer programming.



8th Grade

In 8th grade students' engage in Science and Engineering Practices and apply Crosscutting Concepts to deepen their understanding of science. Core ideas included in 8th grade are, *Matter and Interactions, Motion and Stability: Forces and Interactions, Energy and Waves, Ecosystems, Biological Evolution: Unity and Diversity, Earth's systems/Earth and Human Activity, and Engineering Design*. Your child will have multiple opportunities to demonstrate science learning. Including, but not limited to, using models, providing evidence to support arguments, obtaining and analyzing data about relationships and interactions among observable components of different systems.

Examples of Your Child's Work at School:

- Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.
- Evaluate competing design solutions for maintaining biodiversity in ecosystems.
- Gather and synthesize information about the technologies that have changed the way humans influence inheritance of desired traits in organisms.
- Develop a model to describe the cycling of water through Earth's systems driven by energy from the sun and the force of gravity.
- Construct an argument supported by evidence for how increases in human population and per-capita consumption of natural resources impact Earth's systems.

How to Help Your Child at Home:

- Encourage finding answers to questions through research and experimentation.
- Help your child create and test a Rube Goldberg device to solve a problem.
- Join a group or club that offers activities such as robotics and computer programming.
- Provide opportunities to observe and talk about changes in matter related to cooking.
- Encourage and help design, create and maintain a terrarium to observe the interactions among Earth's spheres.
- Keep track of weather data at your home and compare with local news weather data.



High School

In high school, the Iowa Science standards blend core science ideas with scientific and engineering practices and crosscutting concepts to support students in developing useable knowledge to explain ideas across all the science disciplines: life, earth, and physical. These standards include the most fundamental scientific concepts but are intended to leave room for expanded study in upper-level high school courses.

High school students will be expected to use data and evidence as the foundation for developing claims. At the high school level students are expected to engage with major global issues at the interface of science, technology, society and the environment, and to use the analytical and strategic thinking that prior training and increased maturity make possible. They will need to be able to examine, review, and evaluate their own knowledge and ideas and critique those of others.

Over the course of their high school studies, students will become increasingly proficient at posing questions that request relevant empirical evidence; that seek to refine a model, an explanation, or an engineering problem; or that challenge the premise of an argument or the suitability of a design.

Examples of Your Child's Work at School:

- Your child will take coursework in the life, physical, and earth science disciplines. They will have experience such as:
- Represent and explain phenomena with multiple types of models—for example, represent molecules with 3-D models or with bond diagrams.
- Obtain and evaluate evidence of the factors in an ecosystem related to survival and provide an argument for how these and other observed changes affect a species of interest.
- Use to subatomic and subcellular explanations in describing phenomena in the life and physical sciences.
- Recognize that different patterns may be observed at each of the scales at which a system is studied, for example classifications based on DNA comparisons will differ than those based on visible characteristics.
- Use mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects.
- Predict and describe system behavior using models of the concept of conservation of energy.
- Plan experimental or field-research procedures, identifying relevant independent and dependent variables, recognizing that it is not always possible to control variables and that other methods can be used in such cases.
- Ask probing questions that seek to identify the premises of an argument, request further elaboration, refine a research question or engineering problem, or challenge the interpretation of a data set—for example: How do you know? What evidence supports that argument?
- Explain how claims to knowledge are judged by the scientific community today and articulate the merits and limitations of peer review and the need for independent replication of critical investigations.



- Engage in a critical reading of primary scientific literature (adapted for classroom use) or of media reports of science in order to communicate understanding, ask questions, and discuss the validity and reliability of data, hypotheses, and conclusions using appropriate scientific vocabulary, tables, diagrams, graphs and mathematical expressions. (Earth and Space)

How to Help Your Child at Home:

- Encourage participation in science summer camps and post-secondary options.
- If your child expresses an interest in a specific science area, encourage them to talk to their teachers and counselors about internships, college and career opportunities available to them during high school.
- Encourage participation in their school's science organizations and STEM- related competitions.
- Share and critically discuss current science events, articles, and new reports.

