

Introduction to Indiana's Academic Standards for Science – 2010

Indiana's Academic Standards for Science were last revised in 2000. This new document, Indiana's Academic Standards for Science – 2010, reflects the ever-changing science content and the underlying premise that science education should be an inquiry-based, hands-on experience. These standards were adopted by the Indiana State Board of Education in April, 2010, and will be implemented in the 2011-12 school year.

Indiana's Academic Standards for Science – 2010 reflect a few significant changes that are worth noting. Primarily, there are fewer standards and each grade level focuses on the big ideas for each of these sub-disciplines: physical science; earth science; life science; and science, technology and engineering. The overarching organization of the standards has also changed; they are divided into two sections: Process Standards and Content Standards, which are described in greater detail below.

Process Standards

The Process Standards are the processes and skills that students are expected to learn and be able to do within the context of the science content. The separation of the Process Standards from the Content Standards is intentional; in doing so we want to make explicit the idea that what students are doing while they are learning science is extremely important. The Process Standards reflect the way in which students are learning and doing science and are designed to work in tandem with the science content, resulting in robust instructional practice.

The Process Standards are organized in the following grade bands: K-2, 3-5, 6-8. Within each grade band, the Process Standards address a particular topic or topics. Kindergarten introduces The Nature of Science, while grades 1 through 5, reflect two parts: The Nature of Science and The Design Process. In grades 6 through 8, Reading for Literacy in Science and Writing for Literacy in Science have been added to emphasize these processes in science. For high school, the Process Standards include Reading and Writing for Literacy in Science as well as The Nature of Science.

As noted in the previous paragraph, grades 6 through 8 and high school content courses will include Reading and Writing for Literacy in Science. It is important to note that these Process Standards emerged with the adoption of the Common Core State Standards in the area of Reading and Writing for Literacy in Science. The Literacy Standards establish that instruction in reading, writing, speaking, listening, and language is a shared responsibility. The Literacy Standards are predicated on teachers in the content areas using their unique disciplinary expertise to help students meet the particular challenges of reading, writing, speaking, listening, and language in their respective fields. It is important to note that the literacy standards are meant to complement rather than supplant content standards in the disciplines.

Part of the motivation behind the disciplinary approach to literacy promulgated by the Literacy Standards is extensive research establishing the need for college- and career-ready students

to be proficient in reading complex informational text independently in a variety of content areas. Most of the required reading in college and workforce training programs is informational in structure and challenging in content. Postsecondary education programs typically provide students with both a higher volume of such reading than is generally required in K-12 schools and comparatively little scaffolding.

The Literacy Standards make clear that significant reading of informational texts should also take place outside ELA classrooms in order for students to be ready for college and careers. Future assessments will apply the sum of all the reading students do in a grade, not just their reading in the ELA context. The Literacy Standards demand that a great deal of reading should occur in all disciplines.

The Literacy Standards also cultivate the development of three mutually reinforcing writing capacities: writing to persuade, to explain, and to convey real or imagined experience. College and career readiness requires that writing focus significantly on writing to argue and to inform or explain.

The Literacy Standards use grade level bands to present the standards. Teachers teaching at the beginning of the grade band may need to provide scaffolding for students to be successful, where teachers teaching at the end of the grade band should expect students to demonstrate the standards independently.

Content Standards

In grades 1 through 8, the Content Standards are organized in four distinct areas: 1) physical science; 2) earth science; 3) life science; and 4) science, technology and engineering. Kindergarten has only the first three areas: physical, earth and life science. In each of these areas there is at least one core standard, which serves as the big idea at that grade level for that content area. For the high school science courses, the content standards are organized around the core ideas in each particular course, which are represented by the core standard. The core standard is not meant to stand alone or be used as an individual standard, but instead is meant to help teachers organize their instruction around the “big ideas” in that content area and for grades K-8, at that particular grade level. Beneath each core standard are indicators which serve as the more detailed expectations within each of the content areas.

Finally, in the development of these revised science standards, careful attention was paid to how ideas are articulated across the grade levels so that content and skills that students will need to succeed in a particular sub-discipline are introduced in an appropriate manner in the early elementary grades and then progressed as students move towards high school.

Grade 2

Students in second grade study changes in physical properties of materials and the affect of force on the motion of an object. They investigate patterns in the weather, in the position of the sun and the moon in the sky during the day and in the shape of the moon over the course of about a month. Students study the life cycles of plants and animals and compare the different body plans. Students investigate simple tools and how they can be used to meet human needs. Within this study students employ the key principles of the nature of science and the design process.

Process Standards

The Nature of Science

Students gain scientific knowledge by observing the natural and constructed world, performing and evaluating investigations and communicating their findings. The following principles should guide student work and be integrated into the curriculum along with the content standards on a daily basis.

- Use a scientific notebook to record predictions, questions and observations about data with pictures, numbers or in words.
- Conduct investigations that may happen over time as a class, in small groups, or independently.
- Generate questions and make observations about natural processes.
- Make predictions based on observations.
- Discuss observations with peers and be able to support your conclusion with evidence.
- Make and use simple equipment and tools to gather data and extend the senses.
- Recognize a fair test.

The Design Process

As citizens of the constructed world, students will participate in the design process. Students will learn to use materials and tools safely and employ the basic principles of the engineering design process in order to find solutions to problems.

- Identify a need or problem to be solved.
- Document the design throughout the entire design process.
- Brainstorm potential solutions.
- Select a solution to the need or problem.
- Select the materials to develop a solution.
- Create the solution.
- Evaluate and test how well the solution meets the goal.
- Communicate the solution with drawings or prototypes.
- Communicate how to improve the solution.

Content Standards

Standard 1: Physical Science

Core Standard:

Observe and describe that the properties of materials can change, but not all materials respond in the same way to the same action. (2.1.1, 2.1.1, 2.1.3)

Core Standard:

Observe and describe the motion of an object and how it changes when a force is applied to it. (2.1.4, 2.1.5, 2.1.6, 2.1.7)

- 2.1.1. Observe, describe and measure ways in which the properties of a sample of water (including volume) change or stay the same as the water is heated and cooled and then transformed into different states.
- 2.1.2. Predict the result of combining solids and liquids in pairs. Mix; observe, gather, record and discuss evidence of whether the result may have different properties than the original materials.
- 2.1.3. Predict and experiment with methods (e.g. sieving, evaporation) to separate solids and liquids based on their physical properties.
- 2.1.4 Observe, sketch, demonstrate and compare how objects can move in different ways (e.g., straight, zig-zag, back-and-forth, rolling, fast and slow).
- 2.1.5 Describe the position or motion of an object relative to a point of reference (e.g., background, another object).
- 2.1.6 Observe, demonstrate, sketch and compare how applied force (i.e., push or pull) changes the motion of objects.
- 2.1.7 Investigate the motion of objects when they are acted upon at a distance by forces like gravity and magnetism.

Standard 2: Earth Science

Core Standard:

Day to day and over the seasons, observe, measure, record and recognize patterns and ask questions about features of weather. (2.2.1, 2.2.2, 2.2.3, 2.2.4, 2.2.5, 2.2.6)

Core Standard:

Investigate how the position of the sun and moon and the shape of the moon change in observable patterns. (2.2.7, 2.2.8, 2.2.9)

- 2.2.1 Construct and use tools to observe and measure weather phenomena like precipitation, changes in temperature, wind speed and direction.
- 2.2.2 Experience and describe wind as the motion of the air.
- 2.2.3 Chart or graph weather observations such as cloud cover, cloud type and type of precipitation on a daily basis over a period of weeks.
- 2.2.4 Ask questions about charted observations and graphed data. Identify the day-to-day patterns and cycles of weather. Understand seasonal time scales in terms of temperature and amounts of rainfall and snowfall.
- 2.2.5 Ask questions and design class investigations on the effect of the sun heating the surface of the earth.
- 2.2.6 Learn about, report on and practice severe weather safety procedures.
- 2.2.7 Investigate how the sun appears to move through the sky during the day by observing and drawing the length and direction of shadows.
- 2.2.8 Investigate how the moon appears to move through the sky during the day by observing and drawing its location at different times.
- 2.2.9 Investigate how the shape of the moon changes from day to day in a repeating cycle that lasts about a month.

Standard 3: Life Science

Core Standard:

Observe, ask questions about and describe how organisms change their forms and behaviors during their life cycles.

- 2.3.1 Observe closely over a period of time and then record in pictures and words the changes in plants and animals throughout their life cycles-including details of their body plan, structure and timing of growth, reproduction and death.
- 2.3.2 Compare and contrast details of body plans and structures within the life cycles of plants and animals.

Standard 4: Science, Engineering and Technology

Core Standard:

Describe how technologies have been developed to meet human needs.

- 2.4.1 Identify parts of the human body that can be used as tools—like hands for grasping and teeth for cutting and chewing.
- 2.4.2 Identify technologies developed by humans to meet human needs. Investigate the limitations of technologies and how they have improved quality of life.
- 2.4.3 Identify a need and design a simple tool to meet that need.