Summer 2008

INDIANA'S CORE STANDARDS:

Core Academic Concepts Across the K–12 Continuum

A Companion to Indiana's Academic Standards

SCIENCE

Kindergarten – Grade 12

Indiana Department of Education
SUPPORTING STUDENT SUCCESS

Effective curriculum, instruction and assessment do not happen by accident. They are the result of many people planning together, working together and sharing responsibility for the success of all students.

A great deal of work has gone into developing resources to help educators plan curriculum, instruction and assessment. What has made the development process so successful is the grassroots involvement of people statewide. The collaborative efforts and dedication of teachers, administrators, state educational organizations, parents, business leaders, higher education faculty, Indiana Department of Education staff, Board of Education members, Indiana's Education Roundtable and the public have contributed to the creation of quality resources for our teachers.

To continue this work, Indiana has adopted *Core Standards: Core Academic Concepts Across the K-12 Continuum*. The *Core Standards*, a complement to *Indiana's Academic Standards*, explicitly highlight the "big ideas" for each grade level and content area, give proper weight to concepts central to advancement across subsequent grade levels, allow for instructionally-supportive assessments, and encourage the integration of curricula across content areas. The *Core Standards* build upon *Indiana's Academic Standards* by integrating multiple Standard Indicators into a small number of instructionally-coherent targets that reflect priorities for each school year or course.

It is our sincerest hope that the *Core Standards* help teachers' efforts in defining and developing curriculum, selecting instruction, assessing student outcomes and integrating content areas when appropriate to support the success of Indiana's students.

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CORE STANDARDS

INTRODUCTION

Purpose of the Core Standards

The Core Standards invite new ways of aligning K-12 curriculum and assessment to *Indiana's Academic Standards*.

Core Standards in the Classroom

The teachers can use the Core Standards to:

- help students focus on the key concepts (the most important Standard Indicators necessary for understanding the "big ideas") of each grade level and content area;
- help parents understand the most important concepts to be learned at each grade level;
- inform decision-making when planning and delivering instruction and designing assessment;
- create more focused goals for student performance at the end of each school year; and
- communicate to administrators, school officials and the public that Indiana continues to strive for high standards in education.

Core Standards in the Education Community

The public can use the Core Standards to:

- gain a clearer understanding of what is expected of Indiana students and teachers;
- enhance discussions of ways to integrate curriculum, instruction and assessment;
- engage in conversations regarding professional development within the K-12 environment;
- explore collaborative opportunities between K-12 teachers and higher education faculty; and
- discuss conceptual learning across and outside the education community.

THE CORE STANDARDS:

- Highlight the most important concepts presented in each grade level and content area by integrating multiple Standard Indicators from *Indiana's Academic Standards*;
- outline a manageable number of concepts that all students must understand and be able to do at the end of the year;
- emphasize the concepts that are central to each grade and are connected to subsequent grade levels;
- set challenging and explicit goals that delineate which Standard Indicators should receive the most instructional time;
- support the development of assessment that is focused on concepts that are central to a grade level or content area;
- enable teachers to assess critical skills in greater depth and use student responses to guide further instruction; and
- provide the opportunity to integrate multiple content areas in the classroom by analyzing the connections among the manageable lists of concepts in each grade level and content area.

CORE STANDARDS

The *Core Standards* represent ideas that are broad in scope and encompass multiple Standard Indicators. Students should be proficient in these *Core Standards* in order to successfully move on to the next levels of Science.

Core Standards for Kindergarten Science

CORE STANDARD 1

The Nature of Science

Asking Questions and Making Observations

Ask open-ended questions about events and processes in the natural world and make careful observations in an effort to answer these questions.

[**Standard Indicators: K.1.1, K.1.2, K.2.2**]

CORE STANDARD 2

The Nature of Technology

Construction

Create structures using natural or human-made materials and simple tools. Examine how component parts of the structures can be disassembled and reassembled into new and different strucures. Describe the physical properties of these structures in words and pictures.

[**Standard Indicators: K.2.2, K.5.1**]

CORE STANDARD 3

Physical Science

Properties of Matter

Describe objects in terms of the materials that compose them and of their physical properties. Draw pictures that portray the features of each object described.

[**Standard Indicators: K.2.2, K.3.1, K.5.1, K.6.1, 1.1.1**]

Changes in Matter

Experiment with ways in which objects can be physically changed. Describe, and draw pictures to show, how changing the object makes it the same or different from a similar unchanged object of the same materials.

[**Standard Indicators: K.2.2, K.3.1, K.6.1, 1.1.1**]

Motion

Experiment with ways in which different objects can move and compare their movement.

[**Standard Indicator: K.3.2**]

Energy

Observe that the sun warms the soil, air and water and raise questions about the differences in their warmth.

[**Standard Indicators: K.1.1, 1.3.3**]

Core Standards for Kindergarten Science (cont.)

CORE STANDARD 4

Earth and Space Science

Earth Systems

Observe light and dark in a day-night cycle and identify the changes as a pattern. Observe that weather changes occur from day to day and weather patterns occur from season to season.

[**Standard Indicators:** Forthcoming]

CORE STANDARD 5

Life Science

Structures and Functions of Living Systems

Examine and classify living and nonliving organisms in order to compare and contrast their characteristics. Observe plants and animals and describe their similarities and differences.

[**Standard Indicators: K.2.2, K.4.1, K.4.2, K.6.1**]

Core Standards for Grade 1 Science

CORE STANDARD 1

The Nature of Science

Making and Recording Observations

Make observations about the natural world through the use of tools. Draw pictures and write descriptions of the features of the objects or phenomena being studied.

[**Standard Indicators: 1.1.1, 1.1.4, 1.2.6, 1.2.7, 1.6.1**]

CORE STANDARD 2

The Nature of Technology

Machines

Use tools to make a simple machine (e.g., a ramp) out of common objects such as paper, cardboard, wood or plastic. Put together parts and demonstrate that these can be used to do things that could not be done with the individual parts alone. Explain how tools are used to complete specific tasks every day.

[**Standard Indicators: 1.1.4** and Forthcoming]

CORE STANDARD 3

Physical Science

Properties of Matter

Identify materials as solids or liquids and describe the observable properties of each. Observe a variety of objects and identify their components. Use magnifiers to show that not all objects can be seen with the naked eye and that variations can exist within objects.

[**Standard Indicators: 1.1.1, 1.1.4, 1.2.4, 1.2.5, 1.2.6, 1.6.2, 2.6.1**]

Changes in Matter

Observe and describe that water and other materials can change from liquid to solid and back again. Observe that liquids left in an open container decrease in amount over time, but the amount of liquid in a closed container does not change.

[**Standard Indicator: 1.3.1**]

Motion

Change how an object is moving by giving it a push or a pull. Investigate and explain how objects move at different rates and in different ways. Observe and show that objects near earth fall to the ground unless something holds them up.

[**Standard Indicators: 1.1.1, 1.2.6, 1.2.7, 1.3.4, 1.3.5**]

Core Standards for Grade 1 Science (cont.)

CORE STANDARD 4

Earth and Space Science

Earth and Space Systems

Observe that the sun and moon are objects in the sky that have patterns of movement. Recognize that the sun and moon appear to rise and set in a regular pattern.

[**Standard Indicators:** Forthcoming]

Earth Structures

Observe that the sun provides warmth and light to the earth and is necessary for life.

[**Standard Indicators: 1.3.3, 1.4.4**]

CORE STANDARD 5

Life Science

Structures and Functions of Living Systems

Describe the different resources that living organisms need for survival. Identify natural earth materials, such as rocks, and give examples of how these help to sustain plant and animal life. Explain that animals and plants obtain food in different ways.

[**Standard Indicators: 1.1.3, 1.4.3, 1.4.4**]

Core Standards for Grade 2 Science

CORE STANDARD 1

The Nature of Science

Comparing Observations

Observe and measure properties of objects and substances using appropriate tools. Compare observations in terms of shape, size, weight, color and number.

[**Standard Indicators: 2.1.1, 2.1.2, 2.1.3, 2.1.4, 2.2.2, 2.2.3**]

CORE STANDARD 2

The Nature of Technology

Design Process

Understand that tools, such as paper, pencils or computer programs, are used to gain more information about objects and/or to design and build things.

[**Standard Indicators: 2.1.2, 2.1.6**]

CORE STANDARD 3

Physical Science

Properties of Matter

Describe ways in which materials can change form without being lost. Describe different types of earth materials that are useful, in either natural or modified form, in meeting human needs. Identify some resources that can be used over and over again, and others that have a limited life span.

[**Standard Indicators: 2.1.7, 2.2.5, 2.4.5**]

Changes in Matter

Observe and describe the ways in which the properties of a sample of water (including amount) change or stay the same as it is heated and cooled and enters different states (i.e., liquid, solid, gas). Observe the properties of liquids other than water and describe how the liquids behave in response to changes.

[**Standard Indicators: 1.3.1, 2.1.1, 2.3.5, 2.5.3, 2.6.3**]

Motion

Change the motion of objects by applying contact forces and forces that act at a distance. Determine how different types of materials respond to magnetic and electrical forces.

[**Standard Indicators: 2.3.7, 2.3.8**]

Core Standards for Grade 2 Science (cont.)

CORE STANDARD 3 cont.

Physical Science

Energy

Describe ways in which people use different energy sources in daily life and work.

[**Standard Indicator: 2.3.6**]

CORE STANDARD 4

Earth and Space Science

Earth and Space Systems

Observe and describe events in nature that have repeating patterns. Chart their occurrences and predict their recurrence.

[**Standard Indicators: 2.3.1, 2.3.2, 2.5.5**]

Earth Structures

Identify ways in which humans depend on their natural and constructed environments. Describe how humans have found ways to make some limited resources last longer or have replaced them with other resources. Classify human-caused changes to environments as either harmful or helpful, depending on the circumstances.

[**Standard Indicators: 2.1.7, 2.3.4**]

CORE STANDARD 5

Life Science

Structures and Functions of Living Systems

Give examples of adaptations that plants and animals have that allow them to thrive in specific environments. Describe ways in which animals are dependent on plants for shelter, nesting and food.

[**Standard Indicators: 2.4.1, 2.4.2, 2.4.3, 2.4.4**]

Core Standards for Grade 3 Science

CORE STANDARD 1

The Nature of Science

Reproducibility

Work cooperatively to identify and investigate questions that can be examined using a fair test. Confirm that if an investigation is repeated, similar results are expected.

[**Standard Indicators: 3.1.1, 3.1.2, 3.1.3, 3.1.5, 3.2.3, 3.2.6, 3.2.7**]

CORE STANDARD 2

The Nature of Technology

Significance of Inventions

Identify ways in which people use technology and tools in their daily life and work. Describe how recent inventions have significantly changed the way people live.

[**Standard Indicators: 3.1.6, 3.1.7**]

CORE STANDARD 3

Physical Science

Properties of Matter

Give examples of solids, liquids and gases and identify the characteristics of each. Describe ways in which the properties of solids, liquids and gases can be measured.

[**Standard Indicators: 3.2.4, 3.4.2, 3.5.2, 3.6.1, 4.3.10**]

Changes in Matter

Demonstrate that the properties of materials can change, but not all materials respond in the same way to the same action. Observe and explain that when objects gain heat, evaporation and melting can occur; and that when objects lose heat, condensation and freezing can occur.

[**Standard Indicators: 2.3.5** and Forthcoming]

Motion

Explain that an object is in motion when its position is changing. Demonstrate that objects move in different ways. Demonstrate that the earth pulls any object toward it without touching it by means of its gravitational attraction. Observe that wind is air in motion.

[**Standard Indicators: 4.3.2** and Forthcoming]

Core Standards for Grade 3 Science (cont.)

CORE STANDARD 3 cont.

Physical Science

Energy

Identify magnetism, light and sound as forms of energy. Measure the force of attraction between magnets as the distance between them changes. Demonstrate that light travels in a straight line until it strikes an object, thus making a shadow. Show how a vibrating object makes the surrounding air vibrate and thus produces sound.

[**Standard Indicators: 3.3.9, 3.6.5, 4.3.15**]

CORE STANDARD 4

Earth and Space Science

Earth and Space Systems

Explain that the earth is part of a larger system that includes the sun, planets, various moons and other smaller objects. Observe that the sun appears in different locations in the sky during the day. Observe that the shape of the moon appears a little different each day, but looks the same again about every four weeks.

[**Standard Indicators: 3.3.1, 3.3.3, 3.3.4, 3.6.3, 3.6.4, 3.6.5**]

CORE STANDARD 5

Life Science

Structures and Functions of Living Systems

Investigate and diagram the life cycles of a plant and of an animal. Identify stages that are similar within the life cycles of organisms from the same group. Identify differences in the life cycles of organisms from different subgroups.

[**Standard Indicators: 3.4.1, 3.4.2, 3.4.3**]

Changes in Living Systems

Give examples of characteristics in plants and animals that could be advantageous for survival and reproduction. Describe the fossil evidence that shows some kinds of plants and animals that once lived on the earth have disappeared but resemble plants and animals alive today.

[**Standard Indicators: 3.4.3, 3.4.5**]

Core Standards for Grade 4 Science

CORE STANDARD 1

The Nature of Science

Supporting Evidence

Recognize that the results of repeated experiments may be different and be able to identify possible reasons for the differences. Support findings and conclusions with data from investigations and print resources.

[**Standard Indicators: 4.1.1, 4.1.2, 4.2.1, 4.2.4, 4.2.5, 4.2.6**]

CORE STANDARD 2

The Nature of Technology

Engineering and Society

Identify differences between the disciplines of science and engineering, and give reasons why clear communication is essential between scientists and engineers who work together. Describe situations in which engineering designs have failed despite steps having been taken to minimize the chances of failure.

[**Standard Indicators: 4.1.3, 4.1.5, 4.1.6, 4.1.7**]

CORE STANDARD 3

Physical Science

Properties of Matter

Identify matter as anything that takes up space and has mass. Identify that all matter is made up of parts too small to be seen without magnification. Demonstrate that regardless of how parts of an object are assembled, the weight of the whole object is identical to the sum of the masses of the parts.

[**Standard Indicator: 4.3.10**]

Changes in Matter

Identify ways in which the properties of naturally occurring materials may be changed irreversibly. Observe and explain what causes liquid water to enter different states. Compare the freezing and melting properties of other materials to those of water. Use tables and graphs to show changes.

[**Standard Indicators: 2.6.3, 3.1.3, 3.5.3, 4.5.4, 5.3.4, 5.3.8, 5.6.4**]

Energy

Identify heat as a form of energy. Describe that heat (thermal) energy can come from different sources and is produced in different ways.

[**Standard Indicators: 4.3.11, 4.3.12, 4.3.13**]

Core Standards for Grade 4 Science (cont.)

CORE STANDARD 4

Earth and Space Science

Earth Systems

Use models and draw diagrams to show the relationship between the earth's day-night cycle and the rotation of the earth on its axis in a 24-hour period.

[**Standard Indicators:** 4.3.1, 4.3.8, 4.3.9]

Earth Structures

Compare and contrast the different ways in which wind, heat, water and ice constantly reshape the earth's surface. Provide examples of reshaping processes, including events that occur slowly and those that occur quickly. Differentiate among sedimentary, metamorphic and igneous rocks by their properties and methods of formation.

[**Standard Indicators:** 4.3.2, 4.3.5, 4.3.6, 4.3.7, 4.6.4]

CORE STANDARD 5

Life Science

Structures and Functions of Living Systems

Compare and contrast how plants and animals meet their energy needs. Describe how all animals are directly or indirectly dependent upon plants for their food.

[**Standard Indicators:** 3.4.4, 4.4.2, 4.4.3, 4.4.4, 4.4.9]

Core Standards for Grade 5 Science

CORE STANDARD 1

The Nature of Science

Collecting Data and Making Conclusions

Make inferences and draw conclusions based on data collected. Examine conclusions from past scientific investigations and determine how and why scientists were able to draw those conclusions. Give examples of how scientists make predictions about the future based on what is known about the past.

[**Standard Indicators: 5.1.1, 5.1.2, 5.2.8, 5.5.1, 5.5.7, 5.5.8, 5.5.9, 5.5.10**]

CORE STANDARD 2

The Nature of Technology

Effects of New Technology

Describe how the interaction between science and technology makes available scientific instruments and materials that are integral to modern science and/or daily life. Give examples of situations in which new technology had unexpected positive and negative effects on the world. Explain how the solution to one problem may create other problems.

[**Standard Indicators: 5.1.3, 5.1.4, 5.1.5, 5.1.6, 5.1.7**]

CORE STANDARD 3

Physical Science

Properties of Matter

Give examples of chemical changes such that when a new material is made by combining two or more materials, it has properties that are different from the original materials. Describe how physical properties are not dependent on size or volume of a material.

[**Standard Indicators: 6.3.18, 6.3.20**]

Changes in Matter

Identify heat as the energy of moving particles too small to be seen. Describe how the properties and phases of materials change as the materials gain or lose heat energy.

[**Standard Indicators: 5.3.8, 5.6.4**]

Motion

Explain that objects move at different rates, dependent on the distance traveled and the amount of time it took to travel a given distance. Demonstrate that changes in speed are caused by forces: the greater the force exerted on a particular object, the greater the change in speed.

[**Standard Indicator: 5.3.11**]

Core Standards for Grade 5 Science (cont.)

CORE STANDARD 3 cont.

Physical Science

Energy

Demonstrate how a warmer object transfers heat to a cooler one by contact or by radiation at a distance, so that the cooler object gets warmer and the warmer object gets cooler. Demonstrate that when heat is made to flow into an object by putting it in contact with a hotter object, its temperature increases.

[**Standard Indicator: 5.3.9**]

CORE STANDARD 4

Earth and Space Science

Earth Systems

Observe and describe the pattern of weather changes throughout the year and explain how weather can be forecasted by examining air masses that move across the surface of the earth. Describe how different aspects of weather can be measured.

[**Standard Indicators: 4.3.2, 5.3.5,** and Forthcoming]

Earth and Space Systems

Describe how the appearance of the sky is affected by the daily rotation of the earth on its axis. Draw diagrams depicting the motion of the earth around the sun in a year's time. Describe the cycle of the moon, including how the shape of the moon changes. Observe and explain the uses of telescopes.

[**Standard Indicators: 5.1.4, 5.3.1, 6.3.6,** and Forthcoming]

Core Standards for Grade 5 Science (cont.)

CORE STANDARD	5

Life Science

Structures and Functions of Living Systems

Identify that living organisms are composed of cells and that a single cell is the smallest unit of life. Describe similarities and differences between cells in plants and animals. Observe and explain that cells can come together to form tissues and that tissues can form organs.

[**Standard Indicators: 4.4.1, 5.4.2, 5.4.3, 6.4.5, 6.4.6, 6.4.7, 6.4.11**]

Changes in Living Systems

Describe that the features of each organism are inherited from its parents. Explain why small differences in features between parents and offspring can result in descendents generations later who are quite different from their ancestors. Explain why individual organisms may have an advantage in surviving and reproducing in a particular environment due to certain features.

[**Standard Indicators: 5.4.1, 5.4.4, 5.4.5, 5.4.7, 5.4.8**]

Core Standards for Grade 6 Science

CORE STANDARD 1

The Nature of Science

Formulating Hypotheses

Formulate a hypothesis that can lead to a fair investigation. Examine different ways in which scientists investigate their hypotheses and draw conclusions from their data.

[**Standard Indicators: 6.1.2, 6.1.3, 6.2.1, 6.2.5, 6.2.6, 6.2.7, 6.2.8, 6.5.2, 6.5.4, 6.5.5**]

CORE STANDARD 2

The Nature of Technology

Limits

Describe how technology is used for transportation, data collection and analysis, and communication. Give examples of problems that cannot be solved with technology.

[**Standard Indicators: 6.1.6, 6.1.7, 6.1.8, 6.1.9**]

CORE STANDARD 3

Physical Science

Properties of Matter

Explain that all matter is composed of atoms and describe the basic composition and characteristics of an atom. Explain that all forms of matter are composed of one or more of approximately 100 elements and give examples of specific elements.

[**Standard Indicators: 8.3.11 and Forthcoming**]

Energy

Compare and contrast the two different types of mechanical energy: potential and kinetic. Identify the three common forms of potential energy: gravitational, chemical and elastic.

[**Standard Indicators: 6.3.17, 8.3.15**]

CORE STANDARD 4

Earth and Space Science

Earth and Space Systems

Explain how the sun's gravitational pull keeps objects in our solar system in regular and predictable motion. Use models to demonstrate how earth's gravity pulls all objects near earth toward the center of the earth. Create models of the major bodies in our solar system, showing their relative sizes and their relative distances from the sun.

[**Standard Indicators: 5.3.6, 5.3.13, 6.3.1, 6.3.2, 6.3.3, 8.3.5, 8.3.17**]

Core Standards for Grade 6 Science (cont.)

CORE STANDARD 4 cont.

Earth and Space Science

Earth Systems

Describe with models or drawings how the earth's tilt on its axis relative to the plane of the earth's yearly orbit around the sun is responsible for seasonal weather changes. Explain how global patterns of air movement are caused by differential heating of air, land and oceans, and how these patterns affect weather and climate patterns.

[**Standard Indicators: 6.3.5, 6.3.9, 6.3.11**]

Earth Structures

Explain and give examples of the way in which soil is formed. Compare and contrast the compositions and textures of the layers of different soils. Explain how the metabolic processes of bacteria and fungi affect soil and how the behaviors of larger organisms, including humans, affect soil composition and fertility.

[**Standard Indicators: 4.3.7, 4.3.14, 6.3.7, 6.3.15, 6.4.8**]

CORE STANDARD 5

Life Science

Structures and Functions of Living Systems: Interdependence

Describe specific interactions between organisms and categorize the effects on the organisms as beneficial, harmful, neither or both. Explain how dead plants and animals are broken down by scavengers and decomposers and how this process contributes to the system as a whole.

[**Standard Indicators: 6.4.8, 6.4.9**]

Structures and Functions of Living Systems: Matter and Energy Transformations

Describe how energy from the sun is transformed by plants into sugar and transferred within a food chain from producers to consumers and decomposers. Trace the one-way path energy takes through producers, consumers and decomposers. Compare and contrast organisms at each level of a food chain with regard to how they obtain and use energy. Describe the criteria by which organisms are classified and how their identifying characteristics are related to their role in the food chain.

[**Standard Indicators: 6.4.1, 6.4.10, 7.4.5, 7.4.6**]