

Kindergarten

Indiana's academic standards for science contain six standards. Each standard is described below. On the pages that follow, age-appropriate concepts are listed underneath each standard. These ideas build a foundation for understanding the intent of each standard.

<http://www.sciencenetlinks.com/matrix.php>

<http://www.teachervivion.fen.com/science/games/5833.html>

<http://www.sciencekids.co.nz/gamesactivities.html>

<http://www.col-ed.org/cur/science.html>

Standard 1 — The Nature of Science and Technology

It is the union of science and technology that forms the scientific endeavor and that makes it so successful. Although each of these human enterprises has a character and history of its own, each is dependent on and reinforces the other. This first standard draws portraits of science and technology that emphasize their roles in the scientific endeavor and reveal some of the similarities and connections between them. In order for students to truly understand the nature of science and technology, they must model the process of scientific investigation through inquiries, fieldwork, lab work, etc. Through these experiences, students will practice designing investigations and experiments, making observations, and formulating theories based on evidence.

Standard 2 — Scientific Thinking

There are certain thinking skills associated with science, mathematics, and technology that young people need to develop during their school years. These are mostly, but not exclusively, mathematical and logical skills that are essential tools for both formal and informal learning and for a lifetime of participation in society as a whole. Good communication is also essential in order to both receive and disseminate information and to understand others' ideas as well as have one's own ideas understood. Writing, in the form of journals, essays, lab reports, procedural summaries, etc., should be an integral component of students' experiences in science.

Standard 3 — The Physical Setting

One of the grand success stories of science is the unification of the physical universe. It turns out that all natural objects, events, and processes are connected to each other. This standard contains recommendations for basic knowledge about the overall structure of the universe and the physical principles on which it seems to run. This standard focuses on two principle subjects: the structure of the universe and the major processes that have shaped planet Earth, and the concepts with which science describes the physical world in general – organized under the headings of *Matter and Energy* and *Forces of Nature*. In Kindergarten, students learn that objects are made of different materials and that they move in different ways.

Standard 4 — The Living Environment

People have long been curious about living things – how many different species there are, what they are like, how they relate to each other, and how they behave. Living organisms are made of the same components as all other matter, involve the same kinds of transformations of energy, and move using the

same basic kinds of forces. Thus, all of the physical principles discussed in Standard 3 – The Physical Setting, apply to life as well as to stars, raindrops, and television sets.

This standard offers recommendations on basic knowledge about how living things function and how they interact with one another and their environment. In Kindergarten, students learn that different types of plants and animals inhabit Earth.

Standard 5 — The Mathematical World

Mathematics is essentially a process of thinking that involves building and applying abstract, logically connected networks of ideas. These ideas often arise from the need to solve problems in science, technology, and everyday life — problems ranging from how to model certain aspects of a complex scientific problem to how to balance a checkbook.

Standard 6 — Common Themes

Some important themes pervade science, mathematics, and technology and appear over and over again, whether we are looking at ancient civilization, the human body, or a comet. These ideas transcend disciplinary boundaries and prove fruitful in explanation, in theory, in observation, and in design.

A focus on *Constancy and Change* within this standard provides students opportunities to engage in long-term and on-going laboratory and field work, and thus understand the role of change over time in studying The Physical Setting and The Living Environment.

Standard 1

The Nature of Science and Technology

Students are actively engaged in beginning to explore how their world works. They explore, observe, ask questions, discuss observations, and seek answers.*

Scientific Inquiry

K.1.1 Raise questions about the natural world.

The Scientific Enterprise

K.1.2 Begin to demonstrate that everyone can do science.

* observation: gaining information through the use of one or more of the senses, such as sight, smell, etc.

Standard 2

Scientific Thinking

Students use numbers, pictures, and words when observing and communicating to help them begin to answer their questions about the world.

Computation and Estimation

K.2.1 Use whole numbers*, up to 10, in counting, identifying, sorting, and describing objects and experiences.

Communication

K.2.2 Draw pictures and write words to describe objects and experiences.

* whole number: 0, 1, 2, 3, etc.

Standard 3 The Physical Setting

Students investigate, describe, and discuss their natural surroundings. They begin to question why things move.

<http://classroom.jc-schools.net/sci-units/earth.htm>

<http://sciencespot.net/Pages/classearthlsn.html>

<http://geology.com/teacher>

<http://www.homeeducationresources.com/top500/Rphyssci.htm>

Matter and Energy

K.3.1 Describe objects in terms of the materials they are made of, such as clay, cloth, paper, etc.

Forces of Nature

K.3.2 Investigate that things move in different ways, such as fast, slow, etc.

Standard 4 The Living Environment

Students ask questions about a variety of living things and everyday events that can be answered through shared observations.

<http://www.bbc.co.uk/nature/blueplanet/games.shtml>

<http://www.proteacher.com/110003.shtml>

<http://www.woodlands-junior.kent.sch.uk/revision/Science/living.htm>

<http://sciencespot.net/Pages/classbiolsn.html>

Diversity of Life

K.4.1 Give examples of plants and animals.

K.4.2 Observe plants and animals, describing how they are alike and how they are different in the way they look and in the things they do.

Standard 5

The Mathematical World

Students use shapes to compare objects and they begin to recognize patterns.

Shapes and Symbolic Relationships

K.5.1 Use shapes — such as circles, squares, rectangles, and triangles — to describe different objects.

Standard 6

Common Themes

Students begin to understand how things are similar and how they are different. They look for ways to distinguish between different objects by observation.

Models and Scale

K.6.1 Describe an object by saying how it is similar to or different from another object.

Grade 1

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<http://www.teachervision.fen.com/science/games/5833.html>

<http://www.sciencekids.co.nz/gamesactivities.html>

<http://www.col-ed.org/cur/science.html>

Standard 1 — The Nature of Science and Technology

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Standard 2 — Scientific Thinking

There are certain thinking skills associated with science, mathematics, and technology that young people need to develop during their school years. These are mostly, but not exclusively, mathematical and logical skills that are essential tools for both formal and informal learning and for a lifetime of participation in society as a whole. Good communication is also essential in order to both receive and disseminate information and to understand others' ideas as well as have one's own ideas understood. Writing, in the form of journals, essays, lab reports, procedural summaries, etc., should be an integral component of students' experiences in science.

Standard 3 — The Physical Setting

One of the grand success stories of science is the unification of the physical universe. It turns out that all natural objects, events, and processes are connected to each other. This standard contains recommendations for basic knowledge about the overall structure of the universe and the physical principles on which it seems to run. This standard focuses on two principle subjects: the structure of the universe and the major processes that have shaped planet Earth, and the concepts with which science describes the physical world in general – organized under the headings of *Matter and Energy* and *Forces of Nature*. In Grade 1, students learn that objects continually move and change within the environment.

Standard 4 — The Living Environment

People have long been curious about living things – how many different species there are, what they are like, how they relate to each other, and how they behave. Living organisms are made of the same components as all other matter, involve the same kinds of transformations of energy, and move using the same basic kinds of forces. Thus, all of the physical principles discussed in Standard 3 – The Physical Setting, apply to life as well as to stars, raindrops, and television sets. This standard offers recommendations on basic knowledge about how living things function and how they interact with one

another and their environment. In Grade 1, students learn that a great diversity exists among plants and animals.

Standard 5 — The Mathematical World

Mathematics is essentially a process of thinking that involves building and applying abstract, logically connected networks of ideas. These ideas often arise from the need to solve problems in science, technology, and everyday life — problems ranging from how to model certain aspects of a complex scientific problem to how to balance a checkbook.

Standard 6 — Common Themes

Some important themes pervade science, mathematics, and technology and appear over and over again, whether we are looking at ancient civilization, the human body, or a comet. These ideas transcend disciplinary boundaries and prove fruitful in explanation, in theory, in observation, and in design. A focus on *Constancy and Change* within this standard provides students opportunities to engage in long-term and on-going laboratory and field work, and thus understand the role of change over time in studying The Physical Setting and The Living Environment.

Standard 1 The Nature of Science and Technology

Students are actively engaged in exploring how the world works. They explore, observe, count, collect, measure, compare, and ask questions. They discuss observations and use tools to seek answers and solve problems. They share their findings.

Scientific Inquiry

- 1.1.1 Observe, describe, draw, and sort objects carefully to learn about them.
- 1.1.2 Investigate and make observations to seek answers to questions about the world, such as “In what ways do animals move?”

The Scientific Enterprise

- 1.1.3 Recognize that and demonstrate how people can learn much about plants and animals by observing them closely over a period of time. Recognize also that care must be taken to know the needs of living things and how to provide for them.

Technology and Science

- 1.1.4 Use tools, such as rulers and magnifiers, to investigate the world and make observations.

* observation: gaining information through the use of one or more of the senses, such as sight, smell, etc.

Standard 2 Scientific Thinking

Students begin to find answers to their questions about the world by using measurements, estimation, and observation as well as working with materials. They communicate with others through numbers, words, and drawings.

Computation and Estimation

- 1.2.1 Use whole numbers*, up to 100, in counting, identifying, measuring, and describing objects and experiences.
- 1.2.2 Use sums and differences of single digit numbers in investigations and judge the reasonableness of the answers.
- 1.2.3 Explain to other students how to go about solving numerical problems.

*whole numbers: 0,1,2,3,etc.

Manipulation and Observation

- 1.2.4 Measure the length of objects having straight edges in inches, centimeters, or non-standard units.
- 1.2.5 Demonstrate that magnifiers help people see things they could not see without them.

Communication Skills

- 1.2.6 Describe and compare objects in terms of number, shape, texture, size, weight, color, and motion.
- 1.2.7 Write brief informational descriptions of a real object, person, place, or event using information from observations.

Standard 3

The Physical Setting

Students investigate, describe, and discuss their natural surroundings. They question why things move and change.

The Earth and the Processes That Shape It

<http://classroom.jc-schools.net/sci-units/earth.htm>

<http://sciencespot.net/Pages/classearthlsn.html>

<http://geology.com/teacher>

- 1.3.1 Recognize and explain that water can be a liquid or a solid and can go back and forth from one form to the other. Investigate by observing that if water is turned into ice and then the ice is allowed to melt, the amount of water is the same as it was before freezing.
- 1.3.2 Investigate by observing and then describing that water left in an open container disappears, but water in a closed container does not disappear.

Matter and Energy

<http://www.homeeducationresources.com/top500/Rphyssci.htm>

- 1.3.3 Investigate by observing and also measuring that the sun warms the land, air, and water.

Forces of Nature

- 1.3.4 Investigate by observing and then describe how things move in many different ways, such as straight, zigzag, round-and-round, and back-and-forth.
- 1.3.5 Recognize that and demonstrate how things near Earth fall to the ground unless something holds them up.

Standard 4 The Living Environment

Students ask questions about a variety of living things and everyday events that can be answered through observations. They become aware of plant and animal interaction. They consider things and processes that plants and animals need to stay alive.

<http://www.bbc.co.uk/nature/blueplanet/games.shtml>

<http://www.proteacher.com/110003.shtml>

<http://www.woodlands-junior.kent.sch.uk/revision/Science/living.htm>

<http://sciencepsot.net/Pages/classbiolan.html>

Diversity of Life

- 1.4.1 Identify when stories give attributes to plants and animals, such as the ability to speak, that they really do not have.
- 1.4.2 Observe and describe that there can be differences, such as size or markings, among the individuals within one kind of plant or animal group.

Interdependence of Life

- 1.4.3 Observe and explain that animals eat plants or other animals for food.

1.4.4 Explain that most living things need water, food, and air.

Standard 5

The Mathematical World

Students apply mathematics in scientific contexts. They begin to use numbers for computing, estimating, naming, measuring, and communicating specific information. They make picture graphs and recognize patterns.

Numbers

1.5.1 Use numbers, up to 10, to place objects in order, such as first, second, and third, and to name them, such as bus numbers or phone numbers.

1.5.2 Make and use simple picture graphs to tell about observations.

Shapes and Symbolic Relationships

1.5.3 Observe and describe similar patterns, such as shapes, designs, and events that may show up in nature, such as honeycombs, sunflowers, or shells. See similar patterns in the things people make, such as quilts, baskets, or pottery.

Standard 6

Common Themes

Students begin to understand how things are similar and how they are different. They look for what changes and what does not change and make comparisons.

Models and Scale

1.6.1 Observe and describe that models, such as toys, are like the real things in some ways but different in others.

Constancy and Change

1.6.2 Observe that and describe how certain things change in some ways and stay the same in others, such as in their color, size, and weight.

Grade 2

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<http://www.sciencenetlinks.com/matrix.php>

<http://www.teachervision.fen.com/science/games/5833.html>

<http://www.sciencekids.co.nz/gamesactivities.html>

<http://www.col-ed.org/cur/science.html>

Standard 1 — The Nature of Science and Technology

It is the union of science and technology that forms the scientific endeavor and that makes it so successful. Although each of these human enterprises has a character and history of its own, each is dependent on and reinforces the other. This first standard draws portraits of science and technology that emphasize their roles in the scientific endeavor and reveal some of the similarities and connections between them. In order for students to truly understand the nature of science and technology, they must model the process of scientific investigation through inquiries, fieldwork, lab work, etc. Through these experiences, students will practice designing investigations and experiments, making observations, and formulating theories based on evidence.

Standard 2 — Scientific Thinking

There are certain thinking skills associated with science, mathematics, and technology that young people need to develop during their school years. These are mostly, but not exclusively, mathematical and logical skills that are essential tools for both formal and informal learning and for a lifetime of participation in society as a whole. Good communication is also essential in order to both receive and disseminate information and to understand other's ideas as well as have one's own ideas understood. Writing, in the form of journals, essays, lab reports, procedural summaries, etc., should be an integral component of students' experience in science.

Standard 3 — The Physical Setting

One of the grand success stories of science is the unification of the physical universe. It turns out that all natural objects, events, and processes are connected to each other. This standard contains recommendations for basic knowledge about the overall structure of the universe and the physical principles on which it seems to run. This standard focuses on two principle subjects: the structure of the universe and the major processes that have shaped planet Earth, and the concepts with which science describes the physical world in general – organized under the headings of Matter and Energy and Forces of Nature. In Grade 2, students learn that change is a continual process.

Standard 4 — The Living Environment

People have long been curious about living things – how many different species there are, what they are like, how they relate to each other, and how they behave. Living organisms are made of the same components as all other matter, involve the same kinds of transformations of energy, and move using the same basic kinds of forces. Thus, all of the physical principles discussed in Standard 3 – The Physical Setting, apply to life as well as to stars, raindrops, and television sets. This standard offers

recommendations on basic knowledge about how living things function and how they interact with one another and their environment. In Grade 2, students learn that although diverse, living things are dependent on one another and the environment.

Standard 5 — The Mathematical World

Mathematics is essentially a process of thinking that involves building and applying abstract, logically connected networks of ideas. These ideas often arise from the need to solve problems in science, technology, and everyday life — problems ranging from how to model certain aspects of a complex scientific problem to how to balance a checkbook.

Standard 6 — Common Themes

Some important themes pervade science, mathematics, and technology and appear over and over again, whether we are looking at ancient civilization, the human body, or a comet. These ideas transcend disciplinary boundaries and prove fruitful in explanation, in theory, in observation, and in design. A focus on Constancy and Change within this standard provides students opportunities to engage in long-term and on-going laboratory and field work, and thus understand the role of change over time in studying The Physical Setting and The Living Environment.

Standard 1

Number Sense

Students understand the relationships among numbers, quantities, and place value in whole numbers up to 100. They understand that fractions may refer to parts of a set* and parts of a whole.*

- 2.1.1 Count by ones, twos, fives, and tens to 100.
Example: Count 74 pencils by groups of tens and twos.
* set: collection of objects, numbers, etc.

Standard 1

The Nature of Science and Technology

Students are actively engaged in exploring how the world works. They explore, observe, count, collect, measure, compare, and ask questions. They discuss observations and use tools to seek answers and solve problems. They share their findings.*

Scientific Inquiry

- 2.1.1 Manipulate an object to gain additional information about it.
2.1.2 Use tools — such as thermometers, magnifiers, rulers, or balances — to gain more information about objects.
2.1.3 Describe, both in writing and verbally, objects as accurately as possible and compare observations with those of other people.
2.1.4 Make new observations when there is disagreement among initial observations.

The Scientific Enterprise

- 2.1.5 Demonstrate the ability to work with a team but still reach and communicate one's own conclusions about findings.

Technology and Science

- 2.1.6 Use tools to investigate, observe, measure, design, and build things.
2.1.7 Recognize and describe ways that some materials — such as recycled paper, cans, and plastic jugs — can be used over again.

* observation: gaining information through the use of one or more of the senses, such as sight, smell, etc.

Standard 2

Scientific Thinking

Students begin to find answers to their questions about the world by using measurement, estimation, and observation as well as working with materials. They communicate with others through numbers, words, and drawings.

Computation and Estimation

- 2.2.1 Give estimates of numerical answers to problems before doing them formally.
- 2.2.2 Make quantitative estimates of familiar lengths, weights, and time intervals and check them by measurements.
- 2.2.3 Estimate and measure capacity using cups and pints.

Manipulation and Observation

- 2.2.4 Assemble, describe, take apart, and/or reassemble constructions using such things as interlocking blocks and erector sets. Sometimes pictures or words may be used as a reference.

Communication Skills

- 2.2.5 Draw pictures and write brief descriptions that correctly portray key features of an object.

Standard 3

The Physical Setting

Students investigate, describe, and discuss their natural surroundings. They wonder why things move and change.

Earth and the Processes That Shape It

<http://classroom.jc-schools.net/sci-units/earth.htm>

<http://sciencespot.net/Pages/classearthlsn.html>

<http://geology.com/teacher>

- 2.3.1 Investigate by observing and then describe that some events in nature have a repeating pattern, such as seasons, day and night, and migrations.
- 2.3.2 Investigate, compare, and describe weather changes from day to day but recognize, describe, and chart that the temperature and amounts of rain or snow tend to be high, medium, or low in the same months every year.
- 2.3.3 Investigate by observing and then describe chunks of rocks and their many sizes and shapes, from boulders to grains of sand and even smaller.
- 2.3.4 Investigate by observing and then describe how animals and plants sometimes cause changes in their surroundings.

Matter and Energy

<http://woodlands-junior.kent.sch.uk/revision/Science/physical.htm>

<http://www.homeeducationresources.com/top500/Rphyssci.htm>

- 2.3.5 Investigate that things can be done to materials — such as freezing, mixing, cutting, heating, or wetting — to change some of their properties. Observe that not all materials respond in the same way.
- 2.3.6 Discuss how people use electricity or burn fuels, such as wood, oil, coal, or natural gas, to cook their food and warm their houses.

Forces of Nature

- 2.3.7 Investigate and observe that the way to change how something is moving is to give it a push or a pull.
- 2.3.8 Demonstrate and observe that magnets can be used to make some things move without being touched.

Standard 4 The Living Environment

Students ask questions about a variety of living things and everyday events that can be answered through observations. They consider things and processes that plants and animals need to stay alive. Students begin to understand plant and animal interaction.

<http://www.bbc.co.uk/nature/blueplanet/games.shtml>

<http://www.proteacher.com/110003.shtml>

<http://www.woodlands-junior.kent.sch.uk/revision/Science/living.htm>

<http://sciencespot.net/Pages/classbiolsn.html>

Diversity of Life

- 2.4.1 Observe and identify different external features of plants and animals and describe how these features help them live in different environments.

Interdependence of Life

- 2.4.2 Observe that and describe how animals may use plants, or even other animals, for shelter and nesting.
- 2.4.3 Observe and explain that plants and animals both need to take in water, animals need to take in food, and plants need light.
- 2.4.4 Recognize and explain that living things are found almost everywhere in the world and that there are somewhat different kinds in different places.
- 2.4.5 Recognize and explain that materials in nature, such as grass, twigs, sticks, and leaves, can be recycled and used again, sometimes in different forms, such as in birds' nests.

Human Identity

- 2.4.6 Observe and describe the different external features of people, such as their size, shape, and color of hair, skin, and eyes.
- 2.4.7 Recognize and discuss that people are more like one another than they are like other animals.
- 2.4.8 Give examples of different roles people have in families and communities.

Standard 5 **The Mathematical World**

Students apply mathematics in scientific contexts. They use numbers for computing, estimating, naming, measuring, and communicating specific information. They make picture and bar graphs. They recognize and describe shapes and patterns. They use evidence to explain how or why something happens.

Numbers

- 2.5.1 Recognize and explain that, in measuring, there is a need to use numbers between whole numbers*, such as $2\frac{1}{2}$ centimeters.
- 2.5.2 Recognize and explain that it is often useful to estimate quantities.
* whole number: 0, 1, 2, 3, etc.

Shapes and Symbolic Relationships

- 2.5.3 Observe that and describe how changing one thing can cause changes in something else, such as exercise and its effect on heart rate.

Reasoning and Uncertainty

- 2.5.4 Begin to recognize and explain that people are more likely to believe ideas if good reasons are given for them.
- 2.5.5 Explain that some events can be predicted with certainty, such as sunrise and sunset, and some cannot, such as storms. Understand that people aren't always sure what will happen since they do not know everything that might have an effect.
- 2.5.6 Explain that sometimes a person can find out a lot (but not everything) about a group of things, such as insects, plants, or rocks, by studying just a few of them.

Standard 6 **Common Themes**

Students begin to observe how objects are similar and how they are different. They begin to identify parts of an object and recognize how these parts interact with the whole. They look for what changes and what does not change and make comparisons.

Systems

2.6.1 Investigate that most objects are made of parts.

Models and Scale

2.6.2 Observe and explain that models may not be the same size, may be missing some details, or may not be able to do all of the same things as the real things.

Constancy and Change

2.6.3 Describe that things can change in different ways, such as in size, weight, color, age, and movement. Investigate that some small changes can be detected by taking measurements.

Grade 3

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Standard 2 — Scientific Thinking

There are certain thinking skills associated with science, mathematics, and technology that young people need to develop during their school years. These are mostly, but not exclusively, mathematical and logical skills that are essential tools for both formal and informal learning and for a lifetime of participation in society as a whole. Good communication is also essential in order to both receive and disseminate information and to understand others' ideas as well as have one's own ideas understood. Writing, in the form of journals, essays, lab reports, procedural summaries, etc., should be an integral component of students' experiences in science.

Standard 3 — The Physical Setting

One of the grand success stories of science is the unification of the physical universe. It turns out that all natural objects, events, and processes are connected to each other. This standard contains recommendations for basic knowledge about the overall structure of the universe and the physical principles on which it seems to run, with emphasis on Earth and the solar system. This standard focuses on two principle subjects: the structure of the universe and the major processes that have shaped planet Earth, and the concepts with which science describes the physical world in general – organized under the headings of *Matter and Energy* and *Forces of Nature*. In Grade 3, students learn that most changes that occur on Earth and in the sky are observable.

Standard 4 — The Living Environment

People have long been curious about living things – how many different species there are, what they are like, how they relate to each other, and how they behave. Living organisms are made of the same components as all other matter, involve the same kinds of transformations of energy, and move using the same basic kinds of forces. Thus, all of the physical principles discussed in Standard 3 – The Physical

Setting, apply to life as well as to stars, raindrops, and television sets. This standard offers recommendations on basic knowledge about how living things function and how they interact with one another and their environment. In Grade 3, students learn that adaptations in physical structure or behavior may improve an organism's chance for survival.

Standard 5 — The Mathematical World

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Some important themes pervade science, mathematics, and technology and appear over and over again, whether we are looking at ancient civilization, the human body, or a comet. These ideas transcend disciplinary boundaries and prove fruitful in explanation, in theory, in observation, and in design. A focus on *Constancy and Change* within this standard provides students opportunities to engage in long-term and on-going laboratory and field work, and thus understand the role of change over time in studying The Physical Setting and The Living Environment.

Standard 1

The Nature of Science and Technology

Students, working collaboratively, carry out investigations. They question, observe, and make accurate measurements. Students increase their use of tools, record data in journals, and communicate results through chart, graph, written, and verbal forms.

<http://www.lessonplanet.com/search?keywords=scientific+inquiry&rating=3>

The Scientific View of the World

- 3.1.1 Recognize and explain that when a scientific investigation is repeated, a similar result is expected.

Scientific Inquiry

- 3.1.2 Participate in different types of guided scientific investigations, such as observing objects and events and collecting specimens for analysis.
- 3.1.3 Keep and report records of investigations and observations* using tools, such as journals, charts, graphs, and computers.
- 3.1.4 Discuss the results of investigations and consider the explanations of others.

* observation: gaining information through the use of one or more of the senses, such as sight, smell, etc.

The Scientific Enterprise

- 3.1.5 Demonstrate the ability to work cooperatively while respecting the ideas of others and communicating one's own conclusions about findings.

Technology and Science

- 3.1.6 Give examples of how tools, such as automobiles, computers, and electric motors, have affected the way we live.
- 3.1.7 Recognize that and explain how an invention can be used in different ways, such as a radio being used to get information and for entertainment.
- 3.1.8 Describe how discarded products contribute to the problem of waste disposal and that recycling can help solve this problem.

Standard 2 Scientific Thinking

Students use a variety of skills and techniques when attempting to answer questions and solve problems. They describe their observations accurately and clearly, using numbers, words, and sketches, and are able to communicate their thinking to others.

Computation and Estimation

- 3.2.1 Add and subtract whole numbers* mentally, on paper, and with a calculator.

* whole number: 0, 1, 2, 3, etc.

Manipulation and Observation

- 3.2.2 Measure and mix dry and liquid materials in prescribed amounts, following reasonable safety precautions.
- 3.2.3 Keep a notebook that describes observations and is understandable weeks or months later.
- 3.2.4 Appropriately use simple tools, such as clamps, rulers, scissors, hand lenses, and other technology, such as calculators and computers, to help solve problems.
- 3.2.5 Construct something used for performing a task out of paper, cardboard, wood, plastic, metal, or existing objects.

Communication Skills

- 3.2.6 Make sketches and write descriptions to aid in explaining procedures or ideas.

Critical Response Skills

- 3.2.7 Ask “How do you know?” in appropriate situations and attempt reasonable answers when others ask the same question.

Standard 3 The Physical Setting

Students observe changes of Earth and the sky. They continue to explore the concepts of energy and motion*.*

<http://www.classroom.jc-schools.net/sci-units/earth.htm>

<http://sciencespot.net/Pages/classearthlsn.html>

<http://geology.com/teacher>

http://lessonplancentral.com/lessons/Science/Earth_Science/index.htm

The Universe

- 3.3.1 Observe and describe the apparent motion of the sun and moon over a time span of one day.
- 3.3.2 Observe and describe that there are more stars in the sky than anyone can easily count, but they are not scattered evenly.
- 3.3.3 Observe and describe that the sun can be seen only in the daytime.
- 3.3.4 Observe and describe that the moon looks a little different every day, but looks the same again about every four weeks.

- * energy: what is needed to make things move
- * motion: the change in position of an object in a certain amount of time

Earth and the Processes That Shape It

- 3.3.5 Give examples of how change, such as weather patterns, is a continual process occurring on Earth.
- 3.3.6 Describe ways human beings protect themselves from adverse weather conditions.
- 3.3.7 Identify and explain some effects human activities have on weather.

Matter and Energy*

<http://www.woodlands-junior.kent.sch.uk/revision/Science/physical.htm>

<http://www.homeeducationresources.com/top500/Rphyssci.htm>

- 3.3.8 Investigate and describe how moving air and water can be used to run machines like windmills and waterwheels.

- * matter: anything that has mass* and takes up space
- * mass: a measure of how much matter is in an object

Forces of Nature

- 3.3.9 Demonstrate that things that make sound do so by vibrating, such as vocal cords and musical instruments.

Standard 4

The Living Environment

Students learn about an increasing variety of organisms. They use appropriate tools and identify similarities and differences among them. Students explore how organisms satisfy their needs in typical environments.

<http://www.bbc.co.uk/nature/blueplanet/games.shtml>

<http://www.proteacher.com/110003.shtml>

<http://www.woodlands-junior.kent.sch.uk/revision/Science/living.htm>

<http://sciencespot.net/Pages/classbiolsn.html>

Diversity of Life

- 3.4.1 Demonstrate that a great variety of living things can be sorted into groups in many ways using various features, such as how they look, where they live, and how they act, to decide which things belong to which group.
- 3.4.2 Explain that features used for grouping depend on the purpose of the grouping.
- 3.4.3 Observe that and describe how offspring are very much, but not exactly, like their parents and like one another.

Interdependence of Life and Evolution

- 3.4.4 Describe that almost all kinds of animals' food can be traced back to plants.
- 3.4.5 Give examples of some kinds of organisms that have completely disappeared and explain how these organisms were similar to some organisms living today.

Human Identity

- 3.4.6 Explain that people need water, food, air, waste removal, and a particular range of temperatures, just as other animals do.
- 3.4.7 Explain that eating a variety of healthful foods and getting enough exercise and rest help people stay healthy.
- 3.4.8 Explain that some things people take into their bodies from the environment can hurt them and give examples of such things.
- 3.4.9 Explain that some diseases are caused by germs and some are not. Note that diseases caused by germs may be spread to other people. Also understand that washing hands with soap and water reduces the number of germs that can get into the body or that can be passed on to other people.

Standard 5

The Mathematical World

Students apply mathematics in scientific contexts. Students make more precise and varied measurements when gathering data. Based upon collected data, they pose questions and solve problems. Students use numbers to record data and construct graphs and tables to communicate their findings.

Numbers

- 3.5.1 Select and use appropriate measuring units, such as centimeters (cm) and meters (m), grams (g) and kilograms (kg), and degrees Celsius (°C).
- 3.5.2 Observe that and describe how some measurements are likely to be slightly different, even if what is being measured stays the same.

Shapes and Symbolic Relationships

- 3.5.3 Construct tables and graphs to show how values of one quantity are related to values of another.
- 3.5.4 Illustrate that if 0 and 1 are located on a line, any other number can be depicted as a position on the line.

Reasoning and Uncertainty

- 3.5.5 Explain that one way to make sense of something is to think of how it relates to something more familiar.

Standard 6

Common Themes

Students work with an increasing variety of systems and begin to modify parts in systems and models and notice the changes that result. They question why change occurs.

Systems

- 3.6.1 Investigate how and describe that when parts are put together, they can do things that they could not do by themselves.
- 3.6.2 Investigate how and describe that something may not work if some of its parts are missing.

Models and Scale

- 3.6.3 Explain how a model of something is different from the real thing but can be used to learn something about the real thing.

Constancy and Change

- 3.6.4 Take, record, and display counts and simple measurements of things over time, such as plant or student growth.

3.6.5 Observe that and describe how some changes are very slow and some are very fast and that some of these changes may be hard to see and/or record.

Grade 4

Indiana's academic standards for science contain six standards. Each standard is described below. On the pages that follow, age-appropriate concepts are listed underneath each standard. These ideas build a foundation for understanding the intent of each standard.

<http://www.sciencenetlinks.com/matrix.php>

<http://www.teachervision.fen.com/science.games.5833.html>

<http://www.sciencekids.co.nz/gamesactivities.html>

<http://www.col-ed.org/cur/science.html>

Standard 1 — The Nature of Science and Technology

It is the union of science and technology that forms the scientific endeavor and that makes it so successful. Although each of these human enterprises has a character and history of its own, each is dependent on and reinforces the other. This first standard draws portraits of science and technology that emphasize their roles in the scientific endeavor and reveal some of the similarities and connections between them. In order for students to truly understand the nature of science and technology, they must model the process of scientific investigation through inquiries, fieldwork, lab work, etc. Through these experiences, students will practice designing investigations and experiments, making observations, and formulating theories based on evidence.

Standard 2 — Scientific Thinking

There are certain thinking skills associated with science, mathematics, and technology that young people need to develop during their school years. These are mostly, but not exclusively, mathematical and logical skills that are essential tools for both formal and informal learning and for a lifetime of participation in society as a whole. Good communication is also essential in order to both receive and disseminate information and to understand others' ideas as well as have one's own ideas understood. Writing, in the form of journals, essays, lab reports, procedural summaries, etc., should be an integral component of students' experiences in science.

Standard 3 — The Physical Setting

One of the grand success stories of science is the unification of the physical universe. It turns out that all natural objects, events, and processes are connected to each other. This standard contains recommendations for basic knowledge about the overall structure of the universe and the physical principles on which it seems to run, with emphasis on Earth and the solar system. This standard focuses on two principle subjects: the structure of the universe and the major processes that have shaped planet Earth, and the concepts with which science describes the physical world in general – organized under the headings of Matter and Energy and Forces of Nature. In Grade 4, students learn that the properties of rocks reflect the processes that formed them. They investigate force and energy.

Standard 4 — The Living Environment

People have long been curious about living things – how many different species there are, what they are like, how they relate to each other, and how they behave. Living organisms are made of the same components as all other matter, involve the same kinds of transformations of energy, and move using the same basic kinds of forces. Thus, all of the physical principles discussed in Standard 3 – The Physical

Setting, apply to life as well as to stars, raindrops, and television sets. This standard offers recommendations on basic knowledge about how living things function and how they interact with one another and their environment. In Grade 4, students learn that all organisms need energy and matter to live and grow.

Standard 5 — The Mathematical World

Mathematics is essentially a process of thinking that involves building and applying abstract, logically connected networks of ideas. These ideas often arise from the need to solve problems in science, technology, and everyday life — problems ranging from how to model certain aspects of a complex scientific problem to how to balance a checkbook.

Standard 6 — Common Themes

Some important themes pervade science, mathematics, and technology and appear over and over again, whether we are looking at ancient civilization, the human body, or a comet. These ideas transcend disciplinary boundaries and prove fruitful in explanation, in theory, in observation, and in design. A focus on *Constancy and Change* within this standard provides students opportunities to engage in long-term and on-going laboratory and fieldwork, and thus understand the role of change over time in studying The Physical Setting and The Living Environment.

Standard 1

The Nature of Science and Technology

Students, working collaboratively, carry out investigations. They observe and make accurate measurements, increase their use of tools and instruments, record data in journals, and communicate results through chart, graph, written, and verbal forms.

<http://www.lessonplanet.com/search?keywords=scientific+inquiry&rating=3>

The Scientific View of the World

- 4.1.1 Observe and describe that scientific investigations generally work the same way in different places.

Scientific Inquiry

- 4.1.2 Recognize and describe that results of scientific investigations are seldom exactly the same. If differences occur, such as a large variation in the measurement of plant growth, propose reasons for why these differences exist, using recorded information about investigations.

The Scientific Enterprise

- 4.1.3 Explain that clear communication is an essential part of doing science since it enables scientists to inform others about their work, to expose their ideas to evaluation by other

scientists, and to allow scientists to stay informed about scientific discoveries around the world.

- 4.1.4 Describe how people all over the world have taken part in scientific investigation for many centuries.

Technology and Science

- 4.1.5 Demonstrate how measuring instruments, such as microscopes, telescopes, and cameras, can be used to gather accurate information for making scientific comparisons of objects and events. Note that measuring instruments, such as rulers, can also be used for designing and constructing things that will work properly.
- 4.1.6 Explain that even a good design may fail even though steps are taken ahead of time to reduce the likelihood of failure.
- 4.1.7 Discuss and give examples of how technology, such as computers and medicines, has improved the lives of many people, although the benefits are not equally available to all.
- 4.1.8 Recognize and explain that any invention may lead to other inventions.
- 4.1.9 Explain how some products and materials are easier to recycle than others.

Standard 2 Scientific Thinking

Students use a variety of skills and techniques when attempting to answer questions and solve problems. They describe their observations accurately and clearly, using numbers, words, and sketches, and are able to communicate their thinking to others. They compare, explain, and justify both information and numerical functions.*

Computation and Estimation

- 4.2.1 Judge whether measurements and computations of quantities, such as length, area*, volume*, weight, or time, are reasonable.
- 4.2.2 State the purpose, orally or in writing, of each step in a computation.

* observation: gaining information through the use of one or more of the senses, such as sight, smell, etc.

* area: a measure of the size of a two-dimensional region

* volume: a measure of the size of a three-dimensional object

Manipulation and Observation

- 4.2.3 Make simple and safe electrical connections with various plugs, sockets, and terminals.

Communication Skills

- 4.2.4 Use numerical data to describe and compare objects and events.
- 4.2.5 Write descriptions of investigations, using observations and other evidence as support for explanations.

Critical Response Skills

- 4.2.6 Support statements with facts found in print and electronic media, identify the sources used, and expect others to do the same.
- 4.2.7 Identify better reasons for believing something than “Everybody knows that ...” or “I just know,” and discount such reasons when given by others.

Standard 3

The Physical Setting

Students continue to investigate changes of Earth and the sky and begin to understand the composition and size of the universe. They explore, describe, and classify materials, motion, and energy*.*

<http://classroom.jc-schools.net/sci-units/earth.htm>

<http://sciencespot.net/Pages/classearthlsn.html>

<http://geology.com/teacher>

http://lessonplancentral.com/lessons/Science/Earth_Science/index.htm

The Universe

- 4.3.1 Observe and report that the moon can be seen sometimes at night and sometimes during the day.

- * motion: the change in position of an object in a certain amount of time
- * energy: what is needed to make things move

Earth and the Processes That Shape It

- 4.3.2 Begin to investigate and explain that air is a substance that surrounds us and takes up space, and whose movements we feel as wind.
- 4.3.3 Identify salt as the major difference between fresh and ocean waters.
- 4.3.4 Describe some of the effects of oceans on climate.
- 4.3.5 Describe how waves, wind, water, and glacial ice shape and reshape Earth’s land surface by the erosion* of rock and soil in some areas and depositing them in other areas.
- 4.3.6 Recognize and describe that rock is composed of different combinations of minerals.
- 4.3.7 Explain that smaller rocks come from the breakage and weathering of bedrock and larger rocks and that soil is made partly from weathered rock, partly from plant remains, and also contains many living organisms.
- 4.3.8 Explain that the rotation of Earth on its axis every 24 hours produces the night-and-day cycle.
- 4.3.9 Draw or correctly select drawings of shadows and their direction and length at different times of day.

- * erosion: the process by which the products of weathering* are moved from one place to another
- * weathering: breaking down of rocks and other materials on Earth’s surface by such processes as rain or wind

Matter and Energy*

<http://www.homeeducationresources.com/top500/Rphyssci.htm>

- 4.3.10 Demonstrate that the mass* of a whole object is always the same as the sum of the masses of its parts.
- 4.3.11 Investigate, observe, and explain that things that give off light often also give off heat*.
- 4.3.12 Investigate, observe, and explain that heat is produced when one object rubs against another, such as one's hands rubbing together.
- 4.3.13 Observe and describe the things that give off heat, such as people, animals, and the sun.
- 4.3.14 Explain that energy in fossil fuels* comes from plants that grew long ago.

* matter: anything that has mass* and takes up space

* mass: a measure of how much matter is in an object

* heat: a form of energy characterized by random motion at the molecular level

* fossil fuels: a fuel, such as natural gas or coal, that was formed a long time ago from decayed plants and animals

Forces of Nature

<http://www.woodlands-junior.kent.sch.uk/revision/Science/physical.htm>

- 4.3.15 Demonstrate that without touching them, a magnet pulls all things made of iron and either pushes or pulls other magnets.
- 4.3.16 Investigate and describe that without touching them, material that has been electrically charged pulls all other materials and may either push or pull other charged material.

Standard 4 The Living Environment

Students learn about an increasing variety of organisms – familiar, exotic, fossil, and microscopic. They use appropriate tools in identifying similarities and differences among them. They explore how organisms satisfy their needs in their environments.

<http://www.bbc.co.uk/nature/blueplanet/games.shtml>

<http://www.proteacher.com/110003.shtml>

<http://www.woodlands-junior.kent.sch.uk/revision/Science/living.htm>

<http://sciencespot.net/Pages/classbiolsn.html>

Diversity of Life

- 4.4.1 Investigate, such as by using microscopes, to see that living things are made mostly of cells.

Interdependence of Life and Evolution

- 4.4.2 Investigate, observe, and describe that insects and various other organisms depend on dead plant and animal material for food.
- 4.4.3 Observe and describe that organisms interact with one another in various ways, such as providing food, pollination, and seed dispersal.
- 4.4.4 Observe and describe that some source of energy is needed for all organisms to stay alive and grow.
- 4.4.5 Observe and explain that most plants produce far more seeds than those that actually grow into new plants.
- 4.4.6 Explain how in all environments, organisms are growing, dying, and decaying, and new organisms are being produced by the old ones.

Human Identity

- 4.4.7 Describe that human beings have made tools and machines, such as x-rays, microscopes, and computers, to sense and do things that they could not otherwise sense or do at all, or as quickly, or as well.
- 4.4.8 Know and explain that artifacts and preserved remains provide some evidence of the physical characteristics and possible behavior of human beings who lived a very long time ago.
- 4.4.9 Explain that food provides energy and materials for growth and repair of body parts. Recognize that vitamins and minerals, present in small amounts in foods, are essential to keep everything working well. Further understand that as people grow up, the amounts and kinds of food and exercise needed by the body may change.
- 4.4.10 Explain that if germs are able to get inside the body, they may keep it from working properly. Understand that for defense against germs, the human body has tears, saliva, skin, some blood cells, and stomach secretions. Also note that a healthy body can fight most germs that invade it. Recognize, however, that there are some germs that interfere with the body's defenses.
- 4.4.11 Explain that there are some diseases that human beings can only catch once. Explain that there are many diseases that can be prevented by vaccinations, so that people do not catch them even once.

Standard 5

The Mathematical World

Students apply mathematics in scientific contexts. Their geometric descriptions of objects are comprehensive. They realize that graphing demonstrates specific connections between data. They identify questions that can be answered by data distribution.

Numbers

- 4.5.1 Explain that the meaning of numerals in many-digit numbers depends on their positions.
- 4.5.2 Explain that in some situations, "0" means none of something, but in others it may be just the label of some point on a scale.

Shapes and Symbolic Relationships

- 4.5.3 Illustrate how length can be thought of as unit lengths joined together, area as a collection of unit squares, and volume as a set of unit cubes.
- 4.5.4 Demonstrate how graphical displays of numbers may make it possible to spot patterns that are not otherwise obvious, such as comparative size and trends.

Reasoning and Uncertainty

- 4.5.5 Explain how reasoning can be distorted by strong feelings.

Standard 6
Common Themes

Students work with an increasing variety of systems and begin to modify parts in systems and models and notice the changes that result. They question why change occurs.

Systems

- 4.6.1 Demonstrate that in an object consisting of many parts, the parts usually influence or interact with one another.
- 4.6.2 Show that something may not work as well, or at all, if a part of it is missing, broken, worn out, mismatched, or incorrectly connected.

Models and Scale

- 4.6.3 Recognize that and describe how changes made to a model can help predict how the real thing can be altered.

Constancy and Change

- 4.6.4 Observe and describe that some features of things may stay the same even when other features change.

Grade 5

Indiana's academic standards for science contain six standards. Each standard is described below. On the pages that follow, age-appropriate concepts are listed underneath each standard. These ideas build a foundation for understanding the intent of each standard.

<http://www.sciencenetlinks.com/matrix.php>

<http://www.teachervision.fen.com/science/games/5833.html>

<http://www.sciencekids.co.nz/gamesactivities.html>

<http://www.col-ed.org/cur/science.html>

Standard 1 — The Nature of Science and Technology

It is the union of science and technology that forms the scientific endeavor and that makes it so successful. Although each of these human enterprises has a character and history of its own, each is dependent on and reinforces the other. This first standard draws portraits of science and technology that emphasize their roles in the scientific endeavor and reveal some of the similarities and connections between them. In order for students to truly understand the nature of science and technology, they must model the process of scientific investigation through inquiries, fieldwork, lab work, etc. Through these experiences, students will practice designing investigations and experiments, making observations, and formulating theories based on evidence.

Standard 2 — Scientific Thinking

There are certain thinking skills associated with science, mathematics, and technology that young people need to develop during their school years. These are mostly, but not exclusively, mathematical and logical skills that are essential tools for both formal and informal learning and for a lifetime of participation in society as a whole. Good communication is also essential in order to both receive and disseminate information and to understand others' ideas as well as have one's own ideas understood. Writing, in the form of journals, essays, lab reports, procedural summaries, etc., should be an integral component of students' experiences in science.

Standard 3 — The Physical Setting

One of the grand success stories of science is the unification of the physical universe. It turns out that all natural objects, events, and processes are connected to each other. This standard contains recommendations for basic knowledge about the overall structure of the universe and the physical principles on which it seems to run, with emphasis on Earth and the solar system. This standard focuses on two principle subjects: the structure of the universe and the major processes that have shaped planet Earth, and the concepts with which science describes the physical world in general – organized under the headings of *Matter and Energy* and *Forces of Nature*. In Grade 5, students continue to learn about changes to Earth and the sky. They learn about the properties of materials and how those properties can change.

Standard 4 — The Living Environment

People have long been curious about living things – how many different species there are, what they are like, how they relate to each other, and how they behave. Living organisms are made of the same components as all other matter, involve the same kinds of transformations of energy, and move using the same basic kinds of forces. Thus, all of the physical principles discussed in Standard 3 – The Physical Setting, apply to life as well as to stars, raindrops, and television sets. This standard offers recommendations on basic knowledge about how living things function and how they interact with one another and their environment. In Grade 5, students learn that organisms are composed of collections of similar cells and that these cells benefit from cooperating. They learn that characteristics of organisms, as well as their environment, affect survival.

Standard 5 — The Mathematical World

Mathematics is essentially a process of thinking that involves building and applying abstract, logically connected networks of ideas. These ideas often arise from the need to solve problems in science, technology, and everyday life — problems ranging from how to model certain aspects of a complex scientific problem to how to balance a checkbook.

Standard 6 — Common Themes

Some important themes pervade science, mathematics, and technology and appear over and over again, whether we are looking at ancient civilization, the human body, or a comet. These ideas transcend disciplinary boundaries and prove fruitful in explanation, in theory, in observation, and in design. A focus on *Constancy and Change* within this standard provides students opportunities to engage in long-term and on-going laboratory and fieldwork, and thus understand the role of change over time in studying The Physical Setting and The Living Environment.

Standard 1

The Nature of Science and Technology

Students work collaboratively to carry out investigations. They observe and make accurate measurements, increase their use of tools and instruments, record data in journals, and communicate results through chart, graph, written, and verbal forms. Students repeat investigations, explain inconsistencies, and design projects.

<http://www.lessonplanet.com/search?keywords=scientific+inquiry&rating=3>

The Scientific View of the World

5.1.1 Recognize and describe that results of similar scientific investigations may turn out differently because of inconsistencies in methods, materials, and observations*.

* observation: gaining information through the use of one or more of the senses, such as sight, smell, etc.

Scientific Inquiry

- 5.1.2 Begin to evaluate the validity of claims based on the amount and quality of the evidence cited.

The Scientific Enterprise

- 5.1.3 Explain that doing science involves many different kinds of work and engages men, women, and children of all ages and backgrounds.

Technology and Science

- 5.1.4 Give examples of technology, such as telescopes, microscopes, and cameras, that enable scientists and others to observe things that are too small or too far away to be seen without them and to study the motion of objects that are moving very rapidly or are hardly moving.
- 5.1.5 Explain that technology extends the ability of people to make positive and/or negative changes in the world.
- 5.1.6 Explain how the solution to one problem, such as the use of pesticides in agriculture or the use of dumps for waste disposal, may create other problems.
- 5.1.7 Give examples of materials not present in nature, such as cloth, plastic, and concrete, that have become available because of science and technology.

Standard 2
Scientific Thinking

Students use a variety of skills and techniques when attempting to answer questions and solve problems. Students describe their observations accurately and clearly using numbers, words, and sketches, and are able to communicate their thinking to others. They compare, contrast, explain, and justify both information and numerical functions.

Computation and Estimation

- 5.2.1 Multiply and divide whole numbers* mentally, on paper, and with a calculator.
- 5.2.2 Use appropriate fractions and decimals when solving problems.

* whole number: 0, 1, 2, 3, etc.

Manipulation and Observation

- 5.2.3 Choose appropriate common materials for making simple mechanical constructions and repairing things.
- 5.2.4 Keep a notebook to record observations and be able to distinguish inferences* from actual observations.
- 5.2.5 Use technology, such as calculators or spreadsheets, in determining area and volume from linear dimensions. Find area*, volume*, mass*, time, and cost, and find the difference between two quantities of anything.

* inference: a train of logic based on observations, leading to an explanation

* area: a measure of the size of a two-dimensional region

- * volume: a measure of the size of a three-dimensional object
- * mass: a measure of how much matter* is in an object
- * matter: anything that has mass and takes up space

Communication Skills

- 5.2.6 Write instructions that others can follow in carrying out a procedure.
- 5.2.7 Read and follow step-by-step instructions when learning new procedures.

Critical Response Skills

- 5.2.8 Recognize when and describe that comparisons might not be accurate because some of the conditions are not kept the same.

Standard 3

The Physical Setting

Students continue to investigate changes of Earth and the sky. They explore, describe, and classify materials, motion, and energy*.*

<http://classroom.jc-schools.net/sci-units/earth.htm>

<http://sciencespot.net/Pages/classearthlsn.html>

<http://geology.com/teacher>

http://www.lessonplancentral.com/lessons/Science/Earth_Science/index.htm

<http://kids.earth.nasa.gov/games>

The Universe

- 5.3.1 Explain that telescopes are used to magnify distant objects in the sky, including the moon and the planets.
- 5.3.2 Observe and describe that stars are like the sun, some being smaller and some being larger, but they are so far away that they look like points of light.
- 5.3.3 Observe the stars and identify stars that are unusually bright and those that have unusual colors, such as reddish or bluish.

- * motion: the change in position of an object in a certain amount of time
- * energy: what is needed to make things move

Earth and the Processes That Shape It

- 5.3.4 Investigate that when liquid water disappears it turns into a gas* (vapor) mixed into the air and can reappear as a liquid* when cooled or as a solid* if cooled below the freezing point of water.

- 5.3.5 Observe and explain that clouds and fog are made of tiny droplets of water.
- 5.3.6 Demonstrate that things on or near Earth are pulled toward it by Earth's gravity*.
- 5.3.7 Describe that, like all planets and stars, Earth is approximately spherical in shape.

- * gas: matter with no definite shape or volume
- * liquid: matter with no definite shape but with a definite volume
- * solid: matter with a definite shape and volume
- * gravity: a force that pulls or attracts objects toward one another

Matter and Energy

<http://www.homeeducationresources.com/top500/Rphyssci.htm>

- 5.3.8 Investigate, observe, and describe that heating and cooling cause changes in the properties of materials, such as water turning into steam by boiling and water turning into ice by freezing. Notice that many kinds of changes occur faster at higher temperatures*.
- 5.3.9 Investigate, observe, and describe that when warmer things are put with cooler ones, the warm ones lose heat* and the cool ones gain it until they are all at the same temperature. Demonstrate that a warmer object can warm a cooler one by contact or at a distance.
- 5.3.10 Investigate that some materials conduct* heat much better than others, and poor conductors can reduce heat loss.

- * temperature: a measure of average heat energy that can be measured using a thermometer
- * heat: a form of energy characterized by random motion at the molecular level
- * conduction: the movement of heat through matter

Forces of Nature

<http://www.woodlands-junior.kent.sch.uk/revision/Science/physical.htm>

- 5.3.11 Investigate and describe that changes in speed* or direction of motion of an object are caused by forces*. Understand that the greater the force, the greater the change in motion and the more massive an object, the less effect a given force will have.
- 5.3.12 Explain that objects move at different rates, with some moving very slowly and some moving too quickly for people to see them.
- 5.3.13 Demonstrate that Earth's gravity pulls any object toward it without touching it.

- * speed: the rate per unit time at which an object moves
- * force: a push or a pull that can cause a change in the motion* of an object
- * motion: the change in position of an object in a certain amount of time

Standard 4

The Living Environment

Students learn about an increasing variety of organisms – familiar, exotic, fossil, and microscopic. They use appropriate tools in identifying similarities and differences among these organisms. Students explore how organisms satisfy their needs in their environments.

<http://www.bbc.co.uk/nature/blueplanet/games.shtml>

<http://www.proteacher.com/110003.shtml>

<http://www.woodlands-junior.kent.sch.uk/revision/Science/living.htm>

<http://sciencespot.net/Pages/classbiolsn.html>

Diversity of Life

- 5.4.1 Explain that for offspring to resemble their parents there must be a reliable way to transfer information from one generation to the next.
- 5.4.2 Observe and describe that some living things consist of a single cell that needs food, water, air, a way to dispose of waste, and an environment in which to live.
- 5.4.3 Observe and explain that some organisms are made of a collection of similar cells that benefit from cooperating. Explain that some organisms' cells, such as human nerve and muscle cells, vary greatly in appearance and perform very different roles in the organism.

Interdependence of Life and Evolution

- 5.4.4 Explain that in any particular environment, some kinds of plants and animals survive well, some do not survive as well, and some cannot survive at all.
- 5.4.5 Explain how changes in an organism's habitat are sometimes beneficial and sometimes harmful.
- 5.4.6 Recognize and explain that most microorganisms do not cause disease and many are beneficial.
- 5.4.7 Explain that living things, such as plants and animals, differ in their characteristics, and that sometimes these differences can give members of these groups (plants and animals) an advantage in surviving and reproducing.
- 5.4.8 Observe that and describe how fossils can be compared to one another and to living organisms according to their similarities and differences.

Human Identity

- 5.4.9 Explain that like other animals, human beings have body systems.

Standard 5

The Mathematical World

Students apply mathematics in scientific contexts. They make more precise and varied measurements in gathering data. Their geometric descriptions of objects are comprehensive, and their graphing demonstrates specific connections. They identify questions that can be answered by data distribution,

e.g., “Where is the middle?” and their support of claims or answers with reasons and analogies becomes important.

Numbers

5.5.1 Make precise and varied measurements and specify the appropriate units.

Shapes and Symbolic Relationships

5.5.2 Show that mathematical statements using symbols may be true only when the symbols are replaced by certain numbers.

5.5.3 Classify objects in terms of simple figures and solids.

5.5.4 Compare shapes in terms of concepts, such as parallel and perpendicular, congruence*, and symmetry.

5.5.5 Demonstrate that areas of irregular shapes can be found by dividing them into squares and triangles.

5.5.6 Describe and use drawings to show shapes and compare locations of things very different in size.

* congruent: the term to describe two figures that are the same size and shape

Reasoning and Uncertainty

5.5.7 Explain that predictions can be based on what is known about the past, assuming that conditions are similar.

5.5.8 Realize and explain that predictions may be more accurate if they are based on large collections of objects or events.

5.5.9 Show how spreading data out on a number line helps to see what the extremes are, where they pile up, and where the gaps are.

5.5.10 Explain the danger in using only a portion of the data collected to describe the whole.

Standard 6

Common Themes

Students work with an increasing variety of systems and begin to modify parts in systems and models and notice the changes that result.

Systems

5.6.1 Recognize and describe that systems contain objects as well as processes that interact with each other.

Models and Scale

5.6.2 Demonstrate how geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories can be used to represent objects, events, and processes in the real world, although such representation can never be exact in every detail.

5.6.3 Recognize and describe that almost anything has limits on how big or small it can be.

Constancy and Change

5.6.4 Investigate, observe, and describe that things change in steady, repetitive, or irregular ways, such as toy cars continuing in the same direction and air temperature reaching a high or low value. Note that the best way to tell which kinds of changes are happening is to make a table or a graph of measurements.

Grade 6

Beginning with Grade 6, Indiana's academic standards for science contain seven standards, with the addition of Historical Perspectives. Each standard is described below. On the pages that follow, age-appropriate concepts are listed underneath each standard. These ideas build a foundation for understanding the intent of each standard.

<http://www.sciencenetlinks.com/matrix.php>

<http://www.teachervision.fen.com/science/games/5833.html>

<http://www.sciencekids.co.nz/gamesactivities.html>

<http://www.col-ed.org/cur/science.html>

Standard 1 — The Nature of Science and Technology

It is the union of science and technology that forms the scientific endeavor and that makes it so successful. Although each of these human enterprises has a character and history of its own, each is dependent on and reinforces the other. This first standard draws portraits of science and technology that emphasize their roles in the scientific endeavor and reveal some of the similarities and connections between them. In order for students to truly understand the nature of science and technology, they must model the process of scientific investigation through inquiries, fieldwork, lab work, etc. Through these experiences, students will practice designing investigations and experiments, making observations, and formulating theories based on evidence.

Standard 2 — Scientific Thinking

There are certain thinking skills associated with science, mathematics, and technology that young people need to develop during their school years. These are mostly, but not exclusively, mathematical and logical skills that are essential tools for both formal and informal learning and for a lifetime of participation in society as a whole. Good communication is also essential in order to both receive and disseminate information and to understand others' ideas as well as have one's own ideas understood. Writing, in the form of journals, essays, lab reports, procedural summaries, etc., should be an integral component of students' experiences in science.

Standard 3 — The Physical Setting

One of the grand success stories of science is the unification of the physical universe. It turns out that all natural objects, events, and processes are connected to each other. This standard contains recommendations for basic knowledge about the overall structure of the universe and the physical principles on which it seems to run, with emphasis on Earth and the solar system. This standard focuses on two principle subjects: the structure of the universe and the major processes that have shaped planet Earth, and the concepts with which science describes the physical world in general – organized under the headings of *Matter and Energy* and *Forces of Nature*. In Grade 6, students learn some of the relationships between physical objects, events, and processes in the universe.

Standard 4 — The Living Environment

People have long been curious about living things – how many different species there are, what they are like, how they relate to each other, and how they behave. Living organisms are made of the same components as all other matter, involve the same kinds of transformations of energy, and move using the same basic kinds of forces. Thus, all of the physical principles discussed in Standard 3 – The Physical Setting, apply to life as well as to stars, raindrops, and television sets. This standard offers recommendations on basic knowledge about how living things function and how they interact with one another and their environment. In Grade 6, students learn that plants and animals obtain energy in different ways and contain different structures for obtaining energy.

Standard 5 — The Mathematical World

Mathematics is essentially a process of thinking that involves building and applying abstract, logically connected networks of ideas. These ideas often arise from the need to solve problems in science, technology, and everyday life – problems ranging from how to model certain aspects of a complex scientific problem to how to balance a checkbook.

Standard 6 — Historical Perspectives

Examples of historical events provide a context for understanding how the scientific enterprise operates. By studying these events, one understands that new ideas are limited by the context in which they are conceived, are often rejected by the scientific establishment, sometimes spring from unexpected findings, and grow or transform slowly through the contributions of many different investigators. The historical events listed in Grade 6 are certainly not the only events that could be used to illustrate this standard, but they provide an array of examples. Through these examples, students will gain insight into the historical background of the development of the modern science of chemistry.

Standard 7 — Common Themes

Some important themes pervade science, mathematics, and technology, and appear over and over again, whether we are looking at ancient civilization, the human body, or a comet. These ideas transcend disciplinary boundaries and prove fruitful in explanation, in theory, in observation, and in design. A focus on *Constancy and Change* within this standard provides students opportunities to engage in long-term and on-going laboratory and fieldwork, and thus understand the role of change over time in studying The Physical Setting and The Living Environment.

Standard 1

The Nature of Science and Technology

Students design investigations. They use computers and other technology to collect and analyze data; they explain findings and can relate how they conduct investigations to how the scientific enterprise functions as a whole. Students understand that technology has allowed humans to do many things, yet it cannot always provide solutions to our needs.

<http://www.lessonplanet.com/search?keywords=scientific+inquiry&rating=3>

The Scientific View of the World

- 6.1.1 Explain that some scientific knowledge, such as the length of the year, is very old and yet is still applicable today. Understand, however, that scientific knowledge is never exempt from review and criticism.

Scientific Inquiry

- 6.1.2 Give examples of different ways scientists investigate natural phenomena and identify processes all scientists use, such as collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses* and explanations, in order to make sense of the evidence.
- 6.1.3 Recognize and explain that hypotheses are valuable, even if they turn out not to be true, if they lead to fruitful investigations.

* hypothesis: an informed guess or tentative explanation for which there is not yet much evidence

The Scientific Enterprise

- 6.1.4 Give examples of employers who hire scientists, such as colleges and universities, businesses and industries, hospitals, and many government agencies.
- 6.1.5 Identify places where scientists work, including offices, classrooms, laboratories, farms, factories, and natural field settings ranging from space to the ocean floor.
- 6.1.6 Explain that computers have become invaluable in science because they speed up and extend people's ability to collect, store, compile, and analyze data; prepare research reports; and share data and ideas with investigators all over the world.

Technology and Science

- 6.1.7 Explain that technology is essential to science for such purposes as access to outer space and other remote locations, sample collection and treatment, measurement, data collection and storage, computation, and communication of information.
- 6.1.8 Describe instances showing that technology cannot always provide successful solutions for problems or fulfill every human need.
- 6.1.9 Explain how technologies can influence all living things.

Standard 2 **Scientific Thinking**

Students use computers and other tools to collect information, calculate, and analyze data. They prepare tables and graphs, using these to summarize data and identify relationships.

Computation and Estimation

- 6.2.1 Find the mean* and median* of a set of data.
- 6.2.2 Use technology, such as calculators or computer spreadsheets, in analysis of data.

* mean: the average obtained by adding the values and dividing by the number of values

* median: the value that divides a set of data, written in order of size, into two equal parts

Manipulation and Observation

- 6.2.3 Select tools, such as cameras and tape recorders, for capturing information.
- 6.2.4 Inspect, disassemble, and reassemble simple mechanical devices and describe what the various parts are for. Estimate what the effect of making a change in one part of a system is likely to have on the system as a whole.

Communication Skills

- 6.2.5 Organize information in simple tables and graphs and identify relationships they reveal. Use tables and graphs as examples of evidence for explanations when writing essays or writing about lab work, fieldwork, etc.
- 6.2.6 Read simple tables and graphs produced by others and describe in words what they show.
- 6.2.7 Locate information in reference books, back issues of newspapers and magazines, CD-ROMs, and computer databases.
- 6.2.8 Analyze and interpret a given set of findings, demonstrating that there may be more than one good way to do so.

Critical Response Skills

- 6.2.9 Compare consumer products, such as generic and brand-name products, and consider reasonable personal trade-offs among them on the basis of features, performance, durability, and costs.

Standard 3

The Physical Setting

Students collect and organize data to identify relationships between physical objects, events, and processes. They use logical reasoning to question their own ideas as new information challenges their conceptions of the natural world.

<http://classroom.jc-schools.net/sci-units/earth.htm>

<http://sciencespot.net/Pages/classearthlsn.html>

<http://geology.com/teacher>

http://lessonplancentral.com/lessons/Science/Earth_Science/index.htm

The Universe

- 6.3.1 Compare and contrast the size, composition, and surface features of the planets that comprise the solar system, as well as the objects orbiting them. Explain that the planets, except Pluto, move around the sun in nearly circular orbits.
- 6.3.2 Observe and describe that planets change their position relative to the background of stars.
- 6.3.3 Explain that Earth is one of several planets that orbit the sun, and that the moon, as well as many artificial satellites and debris, orbit around Earth.

Earth and the Processes That Shape It

- 6.3.4 Explain that we live on a planet which appears at present to be the only body in the solar system capable of supporting life.
- 6.3.5 Use models or drawings to explain that Earth has different seasons and weather patterns because it turns daily on an axis that is tilted relative to the plane of Earth's yearly orbit around the sun. Know that because of this, sunlight falls more intensely on different parts of Earth during the year (the accompanying greater length of days also has an effect) and the difference in heating produces seasons and weather patterns.
- 6.3.6 Use models or drawings to explain that the phases of the moon are caused by the moon's orbit around Earth, once in about 28 days, changing what part of the moon is lighted by the sun and how much of that part can be seen from Earth, both during the day and night.
- 6.3.7 Understand and describe the scales involved in characterizing Earth and its atmosphere. Describe that Earth is mostly rock, that three-fourths of its surface is covered by a relatively thin layer of water, and that the entire planet is surrounded by a relatively thin blanket of air.
- 6.3.8 Explain that fresh water, limited in supply and uneven in distribution, is essential for life and also for most industrial processes. Understand that this resource can be depleted or polluted, making it unavailable or unsuitable for life.
- 6.3.9 Illustrate that the cycling of water in and out of the atmosphere plays an important role in determining climatic patterns.
- 6.3.10 Describe the motions of ocean waters, such as tides, and identify their causes.
- 6.3.11 Identify and explain the effects of oceans on climate.
- 6.3.12 Describe ways human beings protect themselves from adverse weather conditions.
- 6.3.13 Identify, explain, and discuss some effects human activities, such as the creation of pollution, have on weather and the atmosphere.
- 6.3.14 Give examples of some minerals that are very rare and some that exist in great quantities. Explain how recycling and the development of substitutes can reduce the rate of depletion of minerals.
- 6.3.15 Explain that although weathered* rock is the basic component of soil, the composition and texture of soil and its fertility and resistance to erosion* are greatly influenced by plant roots and debris, bacteria, fungi, worms, insects, and other organisms.
- 6.3.16 Explain that human activities, such as reducing the amount of forest cover, increasing the amount and variety of chemicals released into the atmosphere, and farming intensively, have changed the capacity of the environment to support some life forms.

- * weathering: the breaking down of rocks and other materials on Earth's surface by such processes as rain or wind
- * erosion: the process by which the products of weathering are moved from one place to another

Matter and Energy**

<http://www.homeeducationresources.com/top500/Rphyssci.htm>

- 6.3.17 Recognize and describe that energy is a property of many objects and is associated with heat, light, electricity, mechanical motion, and sound.
- 6.3.18 Investigate and describe that when a new material, such as concrete, is made by combining two or more materials, it has properties that are different from the original materials.
- 6.3.19 Investigate that materials may be composed of parts that are too small to be seen without magnification.
- 6.3.20 Investigate that equal volumes* of different substances usually have different masses as well as different densities*.

- * matter: anything that has mass* and takes up space
- * mass: a measure of how much matter is in an object
- * energy: what is needed to make things move
- * volume: a measure of the size of a three-dimensional object
- * density: the density of a sample is the sample's mass divided by its volume

Forces of Nature

<http://www.woodlands-junior.kent.sch.uk/revision/Science/physical.htm>

- 6.3.21 Investigate, using a prism for example, that light is made up of a mixture of many different colors of light, even though the light is perceived as almost white.
- 6.3.22 Demonstrate that vibrations in materials set up wavelike disturbances, such as sound and earthquake waves*, that spread away from the source.
- 6.3.23 Explain that electrical circuits* provide a means of transferring electrical energy from sources such as generators to devices in which heat, light, sound, and chemical changes are produced.

- * wave: a traveling disturbance that carries energy from one place to another
- * circuit: the complete path of an electric current

Standard 4

The Living Environment

Students recognize that plants and animals obtain energy in different ways, and they can describe some of the internal structures of organisms related to this function. They examine the similarities and differences between humans and other species. They use microscopes to observe cells and recognize cells as the building blocks of all life.*

<http://www.bbc.co.uk/nature/blueplanet/games.shtml>

<http://www.proteacher.com/110003.shtml>

<http://www.woodlands-junior.kent.sch.uk/revision/Science/living.htm>

<http://sciencespot.net/Pages/classbiolsn.html>

Diversity of Life

- 6.4.1 Explain that one of the most general distinctions among organisms is between green plants, which use sunlight to make their own food, and animals, which consume energy-rich foods.
- 6.4.2 Give examples of organisms that cannot be neatly classified as either plants or animals, such as fungi and bacteria.
- 6.4.3 Describe some of the great variety of body plans and internal structures animals and plants have that contribute to their being able to make or find food and reproduce.
- 6.4.4 Recognize and describe that a species comprises all organisms that can mate with one another to produce fertile offspring.
- 6.4.5 Investigate and explain that all living things are composed of cells whose details are usually visible only through a microscope.
- 6.4.6 Distinguish the main differences between plant and animal cells, such as the presence of chlorophyll* and cell walls in plant cells and their absence in animal cells.
- 6.4.7 Explain that about two-thirds of the mass of a cell is accounted for by water. Understand that water gives cells many of their properties.

* species: a category of biological classification that is comprised of organisms sufficiently and closely related as to be potentially able to mate with one another

* chlorophyll: a substance found in green plants that is needed for photosynthesis*

* photosynthesis: a process by which green plants use energy from sunlight to make their own food

Interdependence of Life and Evolution

- 6.4.8 Explain that in all environments, such as freshwater, marine, forest, desert, grassland, mountain, and others, organisms with similar needs may compete with one another for resources, including food, space, water, air, and shelter. Note that in any environment, the growth and survival of organisms depend on the physical conditions.
- 6.4.9 Recognize and explain that two types of organisms may interact in a competitive or cooperative relationship, such as producer*/consumer*, predator*/prey*, or parasite*/host*.
- 6.4.10 Describe how life on Earth depends on energy from the sun.

- * producer: an organism that can make its own food
- * consumer: an organism that feeds directly or indirectly on producers
- * predator: an organism that kills and eats other organisms
- * prey: an organism that is killed and eaten by a predator
- * parasite: an organism that feeds on other living organisms
- * host: an organism in which or on which another organism lives

Human Identity

- 6.4.11 Describe that human beings have body systems for obtaining and providing energy, defense, reproduction, and the coordination of body functions.
- 6.4.12 Explain that human beings have many similarities and differences and that the similarities make it possible for human beings to reproduce and to donate blood and organs to one another.
- 6.4.13 Give examples of how human beings use technology to match or exceed many of the abilities of other species.

Standard 5 The Mathematical World

Students apply mathematics in scientific contexts. They use mathematical ideas, such as relations between operations, symbols, shapes in three dimensions, statistical relationships, and the use of logical reasoning in the representation and synthesis of data.

Numbers

- 6.5.1 Demonstrate that the operations addition and subtraction are inverses and that multiplication and division are inverses of each other.
- 6.5.2 Evaluate the precision and usefulness of data based on measurements taken.

Shapes and Symbolic Relationships

- 6.5.3 Explain why shapes on a sphere* like Earth cannot be depicted on a flat surface without some distortion.
- 6.5.4 Demonstrate how graphs may help to show patterns — such as trends, varying rates of change, gaps, or clusters — which can be used to make predictions.

- * sphere: a shape best described as that of a round ball, such as a baseball, that looks the same when seen from all directions

Reasoning and Uncertainty

- 6.5.5 Explain the strengths and weaknesses of using an analogy to help describe an event, object, etc.

- 6.5.6 Predict the frequency of the occurrence of future events based on data.
- 6.5.7 Demonstrate how probabilities and ratios can be expressed as fractions, percentages, or odds.

Standard 6

Historical Perspectives

Students gain understanding of how the scientific enterprise operates through examples of historical events. Through the study of these events, they understand that new ideas are limited by the context in which they are conceived, are often rejected by the scientific establishment, sometimes spring from unexpected findings, and grow or transform slowly through the contributions of many different investigators.

- 6.6.1 Understand and explain that from the earliest times until now, people have believed that even though countless different kinds of materials seem to exist in the world, most things can be made up of combinations of just a few basic kinds of things. Note that there has not always been agreement, however, on what those basic kinds of things are, such as the theory of long ago that the basic substances were earth, water, air, and fire. Understand that this theory seemed to explain many observations about the world, but as we know now, it fails to explain many others.
- 6.6.2 Understand and describe that scientists are still working out the details of what the basic kinds of matter are on the smallest scale, and of how they combine, or can be made to combine, to make other substances.
- 6.6.3 Understand and explain that the experimental and theoretical work done by French scientist Antoine Lavoisier in the decade between the American and French Revolutions contributed crucially to the modern science of chemistry.

Standard 7

Common Themes

Students use mental and physical models to conceptualize processes. They recognize that many systems have feedback mechanisms that limit changes.

Systems

- 6.7.1 Describe that a system, such as the human body, is composed of subsystems.

Models and Scale

- 6.7.2 Use models to illustrate processes that happen too slowly, too quickly, or on too small a scale to observe directly, or are too vast to be changed deliberately, or are potentially dangerous.

Constancy and Change

- 6.7.3 Identify examples of feedback mechanisms within systems that serve to keep changes within specified limits.