4

A Supplement to *Planning Curriculum in Science*

This section is designed to assist the teacher of science to make decisions about science instruction before working with students. This section is intended to be informative. **Ultimately, final instructional decisions should be made using the local district's science curriculum and program.**

The grade-level foundations in this section are intended to be a helpful tool for district science committees in the process of making decisions about science concepts that should be included in a K–9 science curriculum. These foundations might also be useful to district committees developing grade-specific concepts that will make up the district's curriculum or scope and sequence. **While extensive, the document is not intended to be exhaustive. Curricular details reside at the local level.**

When using this section, it is important to note that the content reflects the work of the committee only, and may or may not be in agreement with a particular district's textbook scope and sequence or the district's existing science scope and sequence. As the committee developed the science foundations, the committee drew information from *Wisconsin's Model Academic Standards in Science*, which are linked throughout thi section, and the *Assessment Framework for Science*. On the pages that follow, science concepts are organized by grade, beginning with kindergarten. The tables under each grade include the following:

Part 1:

a) Tables list the concepts for the nature of science, grade specific science concepts, habits of mind in science, and examples of the science classroom in action.
b) Science concepts for each grade are presented in the traditional sequence of life, earth, and physical science. The big ideas for those concepts are also included.
c) Wisconsin's state science standards are linked to the foundations in this section.

Part 2:

a) This part is a repeat of Section 1, Part A.
b) This part shows the relationship of the science concepts to the big ideas for life, earth, and physical science and illustrates that relationship.
c) Uniquely found in this section are the page number references to the Curriculum Topic Study for Section 2, Parts A & B.

Part 3:

a) Repeated in the section are the science concepts for each grade.

Ancillary Materials Include:

a) Examples of traditional science vocabulary.
b) Bibliographic information for this publication.

Kindergarten Science

Science Skills and Applications in Kindergarten:

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Science explains the natural world.	*Opportunities for:* • Asking questions. • Making observations. • Conducting simple science investigations. • Reporting the results of science investigations to different audiences (friends, teachers, and younger students) by using (simple) graphs, tables, and illustrations.	*Activities to develop science skills:* • Selecting and safely using equipment relevant to a simple science investigation—for examples, rulers, simple balance, hand lenses, computers, etc. • Making simple graphs.
21st Century Skills: Critical thinking and problem solving, productivity and accountability, communication and collaboration		

*Please note***:**

All skills listed in the nature of science, science practices and inquiry, and skills for doing science (*Wisconsin's Model Academic Standards for Science* B and C) are expected to continue in subsequent grades, rather than stand alone at a grade level. They appear at the grade level at which they are ***introduced with teacher guidance*** and should continue with increasing student independence.

Science Concepts in Kindergarten:

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
Living things have basic needs, such as the need for water and food, etc. (F.4.1)	Earth is made up of many different things, such as, rocks, soil, water, etc. (E.4.1)	Objects have properties, such as color, smell, texture, etc. (D.4.1)
There are many different kinds of living things; some are alike and some are different. (F.4.1)		Objects can be organized by sorting, patterns, etc. (D.4.2)
		Many objects are made of parts. (D.4.2)
		Many objects can be taken apart and put together. (D.4.2)

Please note:

Each science concept presented above is linked to its respective science performance standard from *Wisconsin's Model Academic Standards for Science* and to the assessment framework from the *WKCE-CRT Science Assessment Framework*. Standards are shown in parentheses. Refer to DPI's Web site for a copy of the *WKCE-CRT Science Assessment Framework*. The publication lists both the assessment framework statements and the performance standards.

While the science concepts are presented in a science traditional format, the concepts can be integrated or presented to students in this traditional format. These concepts, in conjunction with the nature of science concepts, will form a coherent unit of science instruction. Further information about coherence in science can be found in *Planning Curriculum in Science*.

The big ideas listed above are found at every grade level and represent focused science as defined in the guide to *Planning Curriculum in Science* for this grade. To understand the relationship of each science concept to its big idea, please see the K–12 presentation of the concepts.

Finally, please note that science content standard A is infused throughout these foundations and is seemingly invisible at first glance. Standard A, *Science Connections*, is one of the unifying standards for science instruction and science curriculum. The themes are as follows: systems, order, organization, interactions, evidence, models, explanations, constancy, change, measurement, evolution, equilibrium, energy, and form and function among scientific disciplines. The rationale from standard A states, "these unifying themes are ways of thinking rather than theories or discoveries" (DPI, 1998). Students should know these themes and realize that the more they learn about science the better they will understand how the themes organize and enlarge their knowledge. Students will also understand science better when they connect and integrate these unifying themes into what they know about themselves and the world around them.

Classroom science in action—suggestions that can lead to a unit of science instruction:

- Sorting and observing objects and/or materials (patterns).
- Identifying basic needs of living things.
- Collecting simple evidence that shows change, constancy, patterns, or lack of change.
- Using senses to sort things by color, etc.

Science application—ideas for the classroom (*Wisconsin's Model Academic Standards for Science* G and H):

- Technology found at a dentist's office or a doctor's office
- Basic needs of people related to staying healthy—for examples, washing hands, brushing teeth, eating healthy foods, or wearing appropriate clothing
- Career awareness and career connections to science

First Grade Science

Science Skills and Applications in First Grade

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Science relies on evidence.	*Opportunities for:* • Identifying data relevant to questions and investigations. • Collecting data relevant to questions and investigations.	*Activities to develop science skills:* • Selecting and safely using equipment relevant to a science investigation.—for examples: rulers, balances, graduated cylinders, hand lenses, thermometers, and computers. • Making graphs.
21st Century Skills: Critical thinking and problem solving, productivity and accountability, communication and collaboration		

Please note:

All skills listed in the nature of science, science practices and inquiry, and skills for doing science (*Wisconsin's Model Academic Standards for Science* B and C) are expected to continue in subsequent grades, rather than stand alone at a grade level. They appear at the grade level at which they are ***introduced with teacher guidance*** and should continue with increasing student independence.

Science Concepts in First Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
There are many different kinds of plants. (F.4.1)	Earth materials have different properties, such as, shape, texture, color, etc. (E.4.2)	Some objects are stationary. (D.4.6)
Plants have life cycles. (F.4.3)		Some objects move due to a push or pull. (D.4.6; D.4.7)
Plants respond to their environment. (F.4.2)		

Please note:

Each science concept presented above is linked to its respective science performance standard from *Wisconsin's Model Academic Standards for Science* and to the assessment framework from the *WKCE-CRT Science Assessment Framework*. Standards are shown in parentheses. Refer to DPI's Web site for a copy of the *WKCE-CRT Science Assessment Framework*. The publication lists both the assessment framework statements and the performance standards.

While the science concepts are presented in a science traditional format, the concepts can be integrated or presented to students in this traditional format. These concepts in conjunction with the nature of science concepts will form a coherent unit of science instruction. Further information about coherence in science can be found in *Planning Curriculum in Science*.

The big ideas listed above are found at every grade level and represent focused science as defined in the guide to *Planning Curriculum in Science* for this grade. To understand the relationship of each science concept to its big idea, please see the K–12 presentation of the concepts.

Finally, please note that science content standard A is infused throughout these foundations and is seemingly invisible at first glance. Standard A, *Science Connections*, is one of the unifying standards for science instruction and science curriculum. The themes are as follows: systems, order, organization, interactions, evidence, models, explanations, constancy, change, measurement, evolution, equilibrium, energy, and form and function among scientific disciplines. The rationale from standard A states, "these unifying themes are ways of thinking rather than theories or discoveries" (DPI, 1998). Students should know these themes and realize that the more they learn about science the better they will understand how the themes organize and enlarge their knowledge. Students will also understand science better when they connect and integrate these unifying themes into what they know about themselves and the world around them.

Classroom science in action—suggestions that can lead to a unit of science instruction:

- Sorting, observing, and describing
  - sorting plants and plant parts by color, shape, and size
  - sorting rocks and soils using properties of color, texture, and size
- Simple motion of objects
  - objects are made of parts
  - moving objects in various ways—straight, zigzag, round and round, back and forth, fast or slow, up and down
- Change
  - plant survival needs

Science application—ideas for the classroom (*Wisconsin's Model Academic Standards for Science* G and H):

- Changes in technology related to growing plants, such as student arrival at school
- Changes in technology related to types of transportation.
- Technological advances in agriculture—helping and hindering quality of life
- Technological advances in transportation— helping and hindering quality of life

Second Grade Science

Science Skills and Applications in Second Grade

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Much has been learned about objects, events, and phenomena in nature through scientific inquiry, but much more remains to be learned and understood. • Scientific knowledge has changed over time.	*Opportunities for:* • Planning a simple investigation. • Predicting results of investigations. • Deciding observations that are needed to explain results. • Safely conducting simple investigations. • Using evidence collected to explain results. • Interpreting data (using the results of data) to answer questions developed during investigations. • After completing an investigation, developing additional questions that support new investigations about the original topic of study.	*Activities to develop science skills:* • Communicating understandings about science using time lines or simple diagrams as possible tools.
21st Century Skills: Critical thinking and problem solving, productivity and accountability, communication and collaboration, initiative and self-direction, creativity and innovation		

Please note:

All skills listed in the nature of science, science practices and inquiry and skills for doing science (*Wisconsin's Model Academic Standards for Science* B and C) are expected to continue in subsequent grades, rather than stand alone at a grade level. They appear at the grade level at which they are ***introduced with teacher guidance*** and should continue with increasing student independence.

Science Concepts in Second Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
There are many different kinds of animals. (F.4.1)	The sun, moon, and stars appear to change position. (E.4.4)	Objects are composed of matter. (D.4.1; D.4.8)
Animals (including humans) have life cycles. (F.4.3)	There are observable daily/seasonal weather changes in Wisconsin. (E.4.6)	Matter has physical properties that can be measured—for example, by weight, volume, size, etc. (D.4.1)
Animals (including humans) have different structures that enable them to grow, reproduce, and survive. (F.4.1, F.4.2)	There are changes in the sky that are observable during the day, during the night, and during seasonal events on earth. (E.4.5)	
Animals respond to their environment. (F.4.4)	The shape of the moon changes in regular patterns. (E.4.4; E.4.5)	

Please note:

Each science concept presented above is linked to its respective science performance standard from *Wisconsin's Model Academic Standards for Science* and to the assessment framework from the *WKCE-CRT Science Assessment Framework*. Standards are shown in parentheses. Refer to DPI's Web site for a copy of the *WKCE-CRT Science Assessment Framework*. The publication lists both the assessment framework statements and the performance standards.

While the science concepts are presented in a science traditional format, the concepts can be integrated or presented to students in this traditional format. These concepts, in conjunction with the nature of science concepts, will form a coherent unit of science instruction. Further information about coherence in science can be found in *Planning Curriculum in Science*.

The big ideas listed above are found at every grade level and represent focused science as defined in the guide to *Planning Curriculum in Science* for this grade. To understand the relationship of each science concept to its big idea, please see the K–12 presentation of the concepts.

Finally, please note that science content standard A is infused throughout these foundations and is seemingly invisible at first glance. Standard A, *Science Connections*, is one of the unifying standards for science instruction and science curriculum. The themes are as follows: systems, order, organization, interactions, evidence, models, explanations, constancy, change, measurement, evolution, equilibrium, energy, and form and function among scientific disciplines. The rationale from standard A states, "these unifying themes are ways of thinking rather than theories or discoveries." (DPI, 1998). Students should know these themes and realize that the more they learn about science, the better they will understand how the themes organize and enlarge their knowledge.

Students will also understand science better when they connect and integrate these unifying themes into what they know about themselves and the world around them.

Classroom science in action—suggestions that can lead to a unit of science instruction:

- Change, motion
    - objects can change position, patterns in the sky, simple weather patterns
- Matter
    - simple properties
- Diversity
    - animal varieties
    - animal growth, development, and behavior

Science application—ideas for the classroom *(Wisconsin's Model Academic Standards for Science G and H):*

- Advances in measuring weather changes
- Weather instruments found in the typical science classroom compared to instruments used by a meteorologist
- How a meteorologist predicts the weather as compared to weather predictions made by students in the classroom
- Weather safety activities, such as tornado drills in school and sounding tornado sirens

Third Grade Science

Science Skills and Applications in Third Grade

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Men and women from many cultures have contributed to science throughout history. • Science must be communicated to others for verification. • Science is a human endeavor .	*Opportunities for:* • Asking testable questions about the natural world. • Stating evidence from data collected to justify/explain conclusions from investigations.	*Activities to develop science skills:* • Determining which resources are the most appropriate to use when asking testable questions and planning investigations. • Developing a list of issues that citizens must make decisions about, and describing a strategy for becoming informed about the science behind these issues.
21st Century Skills: Social and cross-cultural skills, critical thinking and problem solving, information literacy, communication and collaboration		

Please note:

All skills listed in the nature of science, science practices and inquiry, and skills for doing science (*Wisconsin's Model Academic Standards for Science* B and C) are expected to continue in subsequent grades, rather than stand alone at a grade level. They appear at the grade level at which they are ***introduced with teacher guidance*** and should continue with increasing student independence.

Science Concepts in Third Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of Earth systems, and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
Plants have different structures that enable them to grow, reproduce, and survive. (F.4.1)	There are different types of soils (sand, clay, etc.), which can be identified by their properties. (E.4.1; E.4.2)	Each state of matter has unique properties. (D.4.3)
An interdependence exists among living and nonliving things in the environment. (F.4.4)	Rocks and minerals are identified by their properties. (E.4.2)	Matter exists in several different states, the most commonly encountered are solid, liquid, and gas. (D.4.4)
	Some of earth's natural resources are used by humans. (E.4.8)	An object is in motion when its position is changing. (D.4.6)
		The speed of an object can be determined by simple measurement. (D.4.7)

Please note:

Each science concept presented above is linked to its respective science performance standard from *Wisconsin's Model Academic Standards for Science* and to the assessment framework from the *WKCE-CRT Science Assessment Framework*. Standards are shown in parentheses. Refer to DPI's Web site for a copy of the *WKCE-CRT Science Assessment Framework.* The publication lists both the assessment framework statements and the performance standards.

While the science concepts are presented in a science traditional format, the concepts can be integrated or presented to students in this traditional format. These concepts, in conjunction with the nature of science concepts, will form a coherent unit of science instruction. Further information about coherence in science can be found in *Planning Curriculum in Science*.

The big ideas listed above are found at every grade level and represent focused science as defined in the guide to *Planning Curriculum in Science* for this grade. To understand the relationship of each science concept to its big idea, please see the K–12 presentation of the concepts.

Finally, please note that science content standard A is infused throughout these foundations and is seemingly invisible at first glance. Standard A, *Science Connections,* is one of the unifying standards for science instruction and science curriculum. The themes are as follows: systems, order, organization, interactions, evidence, models, explanations, constancy, change, measurement, evolution, equilibrium, energy, and form and function among scientific disciplines. The rationale from standard A states, "these unifying themes are ways of thinking rather than theories or discoveries" (DPI, 1998). Students should know these themes and realize that the more they learn about science the better they will understand how the themes organize and enlarge their knowledge. Students will also understand science better when they connect and integrate these unifying themes into what they know about themselves and the world around them.

Classroom science in action—suggestions that can lead to a unit of science instruction:

- Earth's resources
    - properties of rocks and minerals
    - properties of soils
    - human use of natural resources
- Changes in matter and energy
    - food chains and transfer of energy within the chain
    - ecosystems such as environmental ecosystems
    - interactions among living and nonliving components
    - plant growth processes
    - states of matter

Science application—ideas for the classroom (*Wisconsin's Model Academic Standards for Science* G and H):

- Issues associated with natural resource use and consumption

Fourth Grade Science

Science Skills and Applications for Fourth Grade

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • The results of scientific investigations have changed throughout history because additional knowledge has been developed or learned about the topic being investigated. • Many people choose science as a career and devote their entire life to doing science. • While men and women using scientific inquiry have learned much about the objects, events, and phenomena in nature, much remains to be understood. • Science will never be finished.	*Opportunities for:* • Identifying questions that can be answered with available equipment, resources, scientific tools, and logical reasoning. • Determining if the questions asked are testable. • Identifing sources of data. • Explaining the results of an investigation to others using multiple forms of communication such as oral presentations or written reports. • Explaining which data is the most logical data needed to answer a scientific question.	*Activities to develop science skills:* • Determining which is the most logical equipment to use when answering a question in science • Using appropriate safety measures in all scientific investigations • Routinely incorporating and discussing the use of appropriate graphical representations of data • Using equipment and/or computer software, such as probe ware, for data to present logical and reasoned results to others.
21st Century Skills: Critical thinking and problem solving, communication and collaboration, information, communications and technology literacy, productivity and accountability, flexibility and adaptability		

Please note:

All skills listed in the nature of science, science practices and inquiry, and skills for doing science (*Wisconsin's Model Academic Standards for Science* B and C) are expected to continue in subsequent grades, rather than stand alone at a grade level. They appear at the grade level at which they are ***introduced with teacher guidance*** and should continue with increasing student independence.

Science Concepts in Fourth Grade:

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
There are many different kinds of microscopic organisms. (F.8.3)	Humans have used renewable and nonrenewable throughout history. (E.8.6)	Objects vary in the extent to which they absorb and reflect light and conduct heat (thermal energy) and electricity. (D.8.8)
All organisms are composed of cells. (F. 8.1)	Earth is composed of land, water masses, and atmosphere. (E.8.1)	Shadows result when light cannot pass through a substance and when light changes direction (through air, water, etc.). (D.8.9)
Some organisms are composed of one cell. Some organisms are composed of many cells. (F.8.3)		There is a relationship between the pitch of a sound and the physical properties of the sound source. (D.8.8)
		Magnets can repel and attract. (D.8.8)
		Some substances can carry an electric current. (D.8.9)
		Simple circuits can be constructed, such as, open, closed, series, and parallel. (D.8.8)
		Electricity flowing through an electrical circuit produces magnetic effects. (D.8.8)

Please note:

Each science concept presented above is linked to its respective science performance standard from *Wisconsin's Model Academic Standards for Science* and to the assessment framework from the *WKCE-CRT Science Assessment Framework*. Standards are shown in parentheses. Refer to DPI's Web site for a copy of the *WKCE-CRT Science Assessment Framework.* The publication lists both the assessment framework statements and the performance standards.

While the science concepts are presented in a science traditional format, the concepts can be integrated or presented to students in this traditional format. These concepts, in conjunction with the nature of science concepts, will form a coherent unit of science instruction. Further information about coherence in science can be found in *Planning Curriculum in Science*.

The big ideas listed above are found at every grade level and represent focused science as defined in the guide to *Planning Curriculum in Science* for this grade. To understand the relationship of each science concept to its big idea, please see the K–12 presentation of the concepts.

Finally, please note that science content standard A is infused throughout these foundations and is seemingly invisible at first glance. Standard A, *Science Connections,* is one of the unifying standards for science instruction and science curriculum. The themes are as follows: systems, order, organization, interactions, evidence, models, explanations, constancy, change, measurement, evolution, equilibrium, energy, and form and function among scientific disciplines. The rationale from standard A states, "these unifying themes are ways of thinking rather than theories or discoveries" (DPI, 1998). Students should know these themes and realize that the more they learn about science the better they will understand how the themes organize and enlarge their knowledge. Students will also understand science better when they connect and integrate these unifying themes into what they know about themselves and the world around them.

Classroom science in action—suggestions that can lead to a unit of science instruction:

- Energy
    - sound, electricity, magnetism
- Diversity
    - microscopic organisms
- Connections
    - use of land and water resources in Wisconsin

Science application—ideas for the classroom (*Wisconsin's Model Academic Standards for Science* G and H):

- History of sound, such as, telephone history and Alexander Graham Bell
- Different sound devices that produce, transmit, or, reproduce sound; influence of consumer needs on changes made to those sound devices
- Strengths and weaknesses of increased use of the cell phone
- Recommendations about the increased use of the cell phone
- Types of technology and/or careers related to water resources in Wisconsin
- Issues related to the quality of drinking water in Wisconsin

Fifth Grade Science

Science Skills and Applications in Fifth Grade

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Science and scientific reasoning can assist humans while making decisions. • Not all real-world problems can be solved through science because of human limitations. • A hypothesis is a prediction based on previous information. • Science often uses models to illustrate sceintific concepts, phenomena, or events.	*Opportunities for:* • Designing an investigation that will answer a scientifically testable question. • Conducting experiments that will generate both qualitative and quantitative data. • Verifying (either accept or reject) the decided results through experimentation. • Explaining their results by using the science concepts being investigated.	*Activities to develop science skills:* • Using equipment and computer software for their data that allows students to present logical and reasoned results to others. Equipment may include computers, probe ware, microscopes, or telescopes. • Appropriately using science vocabulary when explaining the data and results.
21st Century Skills: Critical thinking and problem solving, communication and collaboration, creativity and innovation, information, communications and technology literacy, initiative and self-direction		

Please note:

All skills listed in the nature of science, science practices and inquiry, and skills for doing science (*Wisconsin's Model Academic Standards for Science* B and C) are expected to continue in subsequent grades, rather than stand alone at a grade level. They appear at the grade level at which they are ***introduced with teacher guidance*** and should continue with increasing student independence.

Science Concepts in Fifth Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
There are (genetic) variations within a species. (F.8.4; F.8.5)	Earth consists of several layers (mantle, core, atmosphere, etc.) each with unique characteristics and properties. (E.8.2)	Heat (thermal energy), electricity, light, and sound are forms of energy. (D.8.8)
All organisms need a supply of energy for growth and reproduction, and to continue living. (F.8.6)	Many types of forces shape Earth. (E.8.4)	Some types of matter are pure substances—elements. (D.8.1)
Ecosystems are communities of living organisms and the nonliving materials of their surroundings. (F.8.8)	Uneven distribution of solar energy causes convection, which influences climate, weather, and ocean currents. (E.8.3)	Matter can be identified by physical properties such as, mass, weight, volume, etc. (D.8.1)
There are many different types of ecosystems allowing organisms to interact. (F.8.8)	Living organisms have had an impact on Earth's atmosphere. (E.8.6)	Chemical properties of a substance describe its "potential" to undergo some chemical change or reaction by virtue of its composition. (D.8.3)
Organisms interact with one another in an ecosystem in several ways: producer/consumer, predator/prey, etc. (F.8.9)	Seasons are caused by the tilt of Earth on its axis as it revolves around the sun. (E.8.8)	Chemical reactions cause new substances to be formed. (D.8.4)
	Rotation of Earth on its axis causes day and night. (E.8.8)	Energy is an important property of substances, and most change involves energy transfer. (D.8.2; D.8.7)
	Landforms are formed by erosion and deposition. (E.8.1)	

Please note:

Each science concept presented above is linked to its respective science performance standard from *Wisconsin's Model Academic Standards for Science* and to the assessment framework from the *WKCE-CRT Science Assessment Framework*. Standards are shown in parentheses. Refer to DPI's Web site for a copy of the *WKCE-CRT Science Assessment Framework*. The publication lists both the assessment framework statements and the performance standards.

While the science concepts are presented in a science traditional format, the concepts can be integrated or presented to students in this traditional format. These concepts, in conjunction with the nature of science concepts, will form a coherent unit of science instruction. Further information about coherence in science can be found in *Planning Curriculum in Science*.

The big ideas listed above are found at every grade level and represent focused science as defined in the guide to *Planning Curriculum in Science* for this grade. To understand the relationship of each science concept to its big idea, please see the K–12 presentation of the concepts.

Finally, please note that science content standard A is infused throughout these foundations and is seemingly invisible at first glance. Standard A, *Science Connections,* is one of the unifying standards for science instruction and science curriculum. The themes are as follows: systems, order, organization, interactions, evidence, models, explanations, constancy, change, measurement, evolution, equilibrium, energy, and form and function among scientific disciplines. The rationale from standard A states, "these unifying themes are ways of thinking rather than theories or discoveries" (DPI, 1998). Students should know these themes and realize that the more they learn about science the better they will understand how the themes organize and enlarge their knowledge. Students will also understand science better when they connect and integrate these unifying themes into what they know about themselves and the world around them.

Classroom science in action—suggestions that can lead to a unit of science instruction:

- Variation, changes and interactions
    - erosion and changes on earth
    - properties of matter
    - chemical and physical changes/interactions
    - variations changes and interactions in ecosystems
    - energy

Science applications—ideas for the classroom (*Wisconsin's Model Academic Standards for Science* G and H):

- Issues related to the erosion of natural and/or human-made resources in Wisconsin, such as lakeshores, streambeds, soil, and/or pavement.
- Reach consensus (using scientific evidence) about issues involving natural and/or human-made resources in Wisconsin, such as: lakeshores, streambeds, soil, and pavement.
- A study of the flow of energy in the school's natural area.

Sixth Grade Science

Science Skills and Applications in Sixth Grade

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Multicultural historical events have contributed to the development of science over time. • Nonscientific evidence can lead to non-scientific conclusions about the natural world.	*Opportunities for:* • Regularly discussing the results and implications of an investigation within the classroom with peers, teachers, and other adults. • Recognizing that a hypothesis is a prediction based on previous information. • Verifying the accuracy of the science concepts being presented.	*Activities to develop science skills:* • Understanding the impact on society when making a decision. • Demonstrating and communicating how science and scientific evidence can assist with making an informed decision.
21st Century Skills: Critical thinking and problem solving, communication and collaboration, information literacy, social and cross-cultural skills, leadership and responsibility		

Please note:

All skills listed in the nature of science, science practices and inquiry, and skills for doing science (*Wisconsin's Model Academic Standards for Science* B and C) are expected to continue in subsequent grades, rather than stand alone at a grade level. They appear at the grade level at which they are ***introduced with teacher guidance*** and should continue with increasing student independence.

Science Concepts in Sixth Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
Organisms inherit genetic information from their parents through either sexual or asexual reproduction. (F.8.5)	The sun is the star in our solar system. (E.8.7)	Forces have magnitude, and direction and can be added. (D.8.5)
Organisms have structural, functional, and behavioral adaptations that increase their chance of surviving in their environment. (F.8.7)	Stars differ in properties and composition. (E.8.7)	An object's motion can be described by its speed and the direction it is moving. (D.8.6)
Organisms maintain internal stability in response to internal and external stimuli, such as, temperature. (F.8.6)	Gravity interacts with the planets in our solar system and holds most objects in the solar system in their orbits. (E.8.7)	Forces can cause an object to change its position. (D.8.5)
	Objects in the solar system have regular and predictable orbits and motion. (E.8.7)	Gravity causes objects to fall toward Earth. (D.8.5)
		Kinetic energy is stored energy; potential energy is energy in motion. (D.8.7)
		Kinetic energy goes through transformations, such as, kinetic to potential, heat to light, etc. (D.8.8)
		Energy is transferred from place to place, through, radiation, conduction, etc. (D.8.9)

Please note:

Each science concept presented above is linked to its respective science performance standard from *Wisconsin's Model Academic Standards for Science* and to the assessment framework from the *WKCE-CRT Science Assessment Framework*. Standards are shown in parentheses. Refer to DPI's Web site for a copy of the *WKCE-CRT Science Assessment Framework*. The publication lists both the assessment framework statements and the performance standards.

While the science concepts are presented in a science traditional format, the concepts can be integrated or presented to students in this traditional format. These concepts, in conjunction with the nature of science concepts, will form a coherent unit of science instruction. Further information about coherence in science can be found in *Planning Curriculum in Science*.

The big ideas listed above are found at every grade level and represent focused science as defined in the guide to *Planning Curriculum in Science* for this grade. To understand the relationship of each science concept to its big idea, please see the K–12 presentation of the concepts.

Finally, please note that science content standard A is infused throughout these foundations and is seemingly invisible at first glance. Standard A, *Science Connections,* is one of the unifying standards for science instruction and science curriculum. The themes are as follows: systems, order, organization, interactions, evidence, models, explanations, constancy, change, measurement, evolution, equilibrium, energy, and form and function among scientific disciplines. The rationale from standard A states, "these unifying themes are ways of thinking rather than theories or discoveries" (DPI, 1998). Students should know these themes and realize that the more they learn about science the better they will understand how the themes organize and enlarge their knowledge. Students will also understand science better when they connect and integrate these unifying themes into what they know about themselves and the world around them.

Classroom science in action—suggestions that can lead to a unit of science instruction:

- Systems
    - atmospheric systems on Earth
    - astronomy
    - forces in systems
    - energy transfers
- Adaptations
- Structure and function
    - cells
- Light and the solar system
- Electromagnetic spectrum
- Gravity in the solar system

Science application—ideas for the classroom (*Wisconsin's Model Academic Standards for Science* G and H)***:***

- Advances in medical technology and changes in medical testing/imaging
- Advances in cellular science, from a hand lens to an electron microscope
- Survival rates associated with seat belt use
- Survival rates associated with bike helmet use

Seventh Grade Science

Science Skills and Applications in Seventh Grade

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Evidence and peer review are hallmarks of scientific thought. • A scientific theory is an explanation that has been robustly tested and supported through several lines of evidence. • Evidence and peer review can be used while establishing scientific thought. • Science knowledge is shared, replicated, and extended by scientists through peer review, journals, databases, and student presentations.	*Opportunities for:* • Deciding the most logical results for an investigation. • Raising further questions after making comparisons of experimental results to known science understandings. • Using collected data to support and explain scientific inferences. • Using collected data to defend the validity of the experimental design and results. • Generating new questions about existing experiments that reflect upon new science understandings. • Comparing individual results to known science concepts, models, or theories, to determine the accuracy of their results.	*Activities to develop science skills:* • Explaining ways to make a scientific investigation valid.
21st Century Skills: Critical thinking and problem solving, communication and collaboration, creativity and innovations, information, communications and technology literacy, flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, leadership and responsibility		

Please note:

All skills listed in the nature of science, science practices and inquiry, and skills for doing science (*Wisconsin's Model Academic Standards for Science* B and C) are expected to continue in subsequent grades, rather than stand alone at a grade level. They appear at the grade level at which they are ***introduced with teacher guidance*** and should continue with increasing student independence.

Science Concepts in Seventh Grade

Life Science: **Big ideas include continuity and change in living things, characteristics of organisms, organisms and their environment.**	Earth Science: **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science: **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
Genetic variation is essential for natural selection to occur. (F.8.2)	Geologic evidence, including evidence from rocks, fossils, and satellite imagery, provide information about the history and formation of Earth. (E.8.5)	Atoms are the basic building blocks of matter that make up everyday objects. (D.8.10)
Evidence supports the idea of common descent through mechanisms of evolution and natural selection. (F.8.2; F.8.7)	Geologic events and changes to Earth's surface can result from plate movement. (E.8.2)	As more is learned about the atom, models of the atom changed. (D.8.10)
Cells need energy for all basic functions: photosynthesis, cellular respiration, etc. (F.8.1)		
Cells function in a similar way in all living organisms. (F.8.1)		
Specialized cells in multicellular organisms are structured to accomplish specific functions. (F.8.3)		
Environmental changes impact ecosystems, such as, natural disasters, human use of resources, etc. (F.8.10)		

Please note:

Each science concept presented above is linked to its respective science performance standard from *Wisconsin's Model Academic Standards for Science* and to the assessment framework from the *WKCE-CRT Science Assessment Framework*. Standards are shown in parentheses. Refer to DPI's Web site for a copy of the *WKCE-CRT Science Assessment Framework*. The publication lists both the assessment framework statements and the performance standards.

While the science concepts are presented in a science traditional format, the concepts can be integrated or presented to students in this traditional format. These concepts, in conjunction with the nature of science concepts, will form a coherent unit of science instruction. Further information about coherence in science can be found in *Planning Curriculum in Science*.

The big ideas listed above are found at every grade level and represent focused science as defined in the guide to *Planning Curriculum in Science* for this grade. To understand the relationship of each science concept to its big idea, please see the K–12 presentation of the concepts.

Finally, please note that science content standard A is infused throughout these foundations and is seemingly invisible at first glance. Standard A, *Science Connections,* is one of the unifying standards for science instruction and science curriculum. The themes are as follows: systems, order, organization, interactions, evidence, models, explanations, constancy, change, measurement, evolution, equilibrium, energy, and form and function among scientific disciplines. The rationale from standard A states, "these unifying themes are ways of thinking rather than theories or discoveries" (DPI, 1998). Students should know these themes and realize that the more they learn about science the better they will understand how the themes organize and enlarge their knowledge. Students will also understand science better when they connect and integrate these unifying themes into what they know about themselves and the world around them.

Classroom science in action—suggestions that can lead to a unit of science instruction:

- History of Earth
    - plate tectonics
    - catastrophic geological events
        - *tsunami*
        - *volcanic eruptions*
        - *earthquakes*
        - *glaciers*
- History of the atom
- Constancy and change
- Evolution and genetics

Science application—ideas for the classroom (*Wisconsin's Model Academic Standards for Science* G and H)***:***

- Comparing information found in the popular press and/or media about a specific issue to the scientific information found about the issue, such as, resource use, discovery of fossils, and local environmental issues
- Researching, testing, and revising a model that represents Earth's processes, such as, stream models, mountain formation models, and erosion
- Using the model developed about Earth's processes to predict a future event that may impact the local community, such as, changes in water tables/levels
- Discussing stem cell research, genetic counseling/engineering, and cloning

Eighth Grade Science

Science Skills and Applications in Eighth Grade

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Cultures and individuals have contributed to the development of major ideas in the earth and space, life and environmental, and physical sciences. • Cultural conditions are usually present during great periods of discovery, scientific development, and invention, such as, war, prosperity, competition between countries, government support, and political philosophies—for example, the space race of the 1960s, the Manhattan Project. • There are specific differences in scientific facts, scientific hypotheses, scientific theories, and scientific laws. • Results of scientific investigations are replicable. • Science distinguishes itself from other ways of knowing and from other bodies of knowledge through the use of empirical standards, logical arguments, skepticism, creativity, intuition, imagination, and perseverance.	*Opportunities for:* • Asking testable questions suggested by current social issues, scientific literature, or observations of phenomena. • Developing alternative hypotheses for questions. • Evaluating data collected during an investigation. • Critiquing data collection procedures and results. • Using the results of an experiment to develop a valid explanation. • Explaining concepts in science using appropriate models, such as, plate tectonics, erosion patterns, cell models, magnetic fields, light, heat, and forces of nature. • Evaluating models, physical or conceptual, for accuracy and completeness. • Developing and defending ideas or conclusions based on data. • Generalizing results to the natural world. *When presenting conclusions to others:* • Present clear and logical arguments for the results. • Be able to answer questions about the results. • Defend the results. • Communicate the results and their implications in ways that others will understand.	*Activities to develop science skills:* • Choosing appropriate resources that could be used to research questions. • Reviewing previous research available for the questions. • Demonstrating knowledge of basic safe laboratory procedures. • Distinguishing qualitative and quantitative data and representing the data appropriately, such as, graphing techniques, mean, median, and mode. • Using the metric system (SI: System International units). • During investigations, choosing the best data collection procedures. • Selecting appropriate materials and tools for an investigation. • Using procedures and materials competently.
21st Century Skills: Critical thinking and problem solving, communication and collaboration, creativity and innovations, information literacy, information, communications and technology literacy, flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, leadership and responsibility		

Please note:

All skills listed in the nature of science, science practices and inquiry, and skills for doing science (*Wisconsin's Model Academic Standards for Science* B and C) are expected to continue in subsequent grades, rather than stand alone at a grade level. They appear at the grade level at which they are ***introduced with teacher guidance*** and should continue with increasing student independence.

Science Concepts in the Eighth Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
Organ systems are composed of cells and function to serve the needs of the cells for air, food, and waste removal. (F.12.1; F.12.2)	The origin and evolution of the universe can be explained by examining cosmic events that took place billions of years ago. (E.12.3; E.12.5)	Atoms have a specific atomic structure. (D.12.1)
Behavior can be genetically determined in some organisms and can be learned in others. (F.12.6; F.12.5)		Chemical changes can occur when two substances, elements, or compounds react. (D.12.4)
The sensory and nervous systems of organisms react to the external and internal environment. (F.12.12)		New substances are formed due to chemical interactions. (D.12.4; D.12.12)
		Molecules are held together by attractive forces. (D.12.1; D.12.4)
		There are several types of chemical interactions/reactions, such as, endothermic, exothermic, etc. (D.12.6)
		Energy exchanges occur in chemical reactions. (D.12.3)

Please note:

Each science concept presented above is linked to its respective science performance standard from *Wisconsin's Model Academic Standards for Science* and to the assessment framework from the *WKCE-CRT Science Assessment Framework*. Standards are shown in parentheses. Refer to DPI's Web site for a copy of the *WKCE-CRT Science Assessment Framework*. The publication lists both the assessment framework statements and the performance standards.

While the science concepts are presented in a science traditional format, the concepts can be integrated or presented to students in this traditional format. These concepts, in conjunction with the nature of science concepts, will form a coherent unit of science instruction. Further information about coherence in science can be found in *Planning Curriculum in Science*.

The big ideas listed above are found at every grade level and represent focused science as defined in the guide to *Planning Curriculum in Science* for this grade. To understand the relationship of each science concept to its big idea, please see the K–12 presentation of the concepts.

Finally, please note that science content standard A is infused throughout these foundations and is seemingly invisible at first glance. Standard A, *Science Connections,* is one of the unifying standards for science instruction and science curriculum. The themes are as follows: systems, order, organization, interactions, evidence, models, explanations, constancy, change, measurement, evolution, equilibrium, energy, and form and function among scientific disciplines. The rationale from standard A states, "these unifying themes are ways of thinking rather than theories or discoveries" (DPI, 1998). Students should know these themes and realize that the more they learn about science the better they will understand how the themes organize and enlarge their knowledge. Students will also understand science better when they connect and integrate these unifying themes into what they know about themselves and the world around them.

Classroom science in action—suggestions that can lead to a unit of science instruction:

- Systems
    - solar system—astronomy
    - earth systems
    - interactions among systems
    - chemical interactions
    - physical interactions
    - energy exchanges

Science application—ideas for the classroom (*Wisconsin's Model Academic Standards for Science* G and H)***:***

- Researching, designing, revising, and testing a model of the solar system
- Conducting a cost/risk analysis of space exploration
- Planning and designing an extraterrestrial habitat

Ninth Grade Science

Science Skills and Applications in Ninth Grade

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Science is based on assumptions about the natural world and the science themes that describe the natural world. • Mulitple lines of evidence support one another and give more credibility to a scientific idea, such as, evolution. • Basic research and applied research contribute to new discoveries, inventions, and other applications of science.	*Opportunities for:* • Communicating a scientific argument. • Developing logical explanations. • Demonstrating connections between natural phenomena, investigations, and the historical body of evidence.	*Activities to develop science skills:* • Evaluating the scientific accuracy of articles found in popular press, journals, television, and the internet. • Determining the accuracy of an article by using the criteria of evidential quality, type of evidence, kind of evidence, source of the evidence, potential bias, and degree of accuracy. • Determining if research is sufficient to support the claims made in an article. • Using technology and mathematics to improve investigations and communications. • Understanding causality, comprehensibility, reproducibility, tentativeness, and contingency.
21st Century Skills: Critical thinking and problem solving, communication and collaboration, creativity and innovations, information literacy, media literacy, information, communications and technology literacy, flexibility and adaptability, initiative and self-direction, productivity and accountability		

Please note:

All skills listed in the nature of science, science practices and inquiry, and skills for doing science (*Wisconsin's Model Academic Standards for Science* B and C) are expected to continue in subsequent grades, rather than stand alone at a grade level. They appear at the grade level at which they are ***introduced with teacher guidance*** and should continue with increasing student independence.

Ninth Grade Science

Science Skills and Applications in Ninth Grade

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Science is based on assumptions about the natural world and the science themes that describe the natural world. • Mulitple lines of evidence support one another and give more credibility to a scientific idea, such as, evolution. • Basic research and applied research contribute to new discoveries, inventions, and other applications of science.	*Opportunities for:* • Communicating a scientific argument. • Developing logical explanations. • Demonstrating connections between natural phenomena, investigations, and the historical body of evidence.	*Activities to develop science skills:* • Evaluating the scientific accuracy of articles found in popular press, journals, television, and the internet. • Determining the accuracy of an article by using the criteria of evidential quality, type of evidence, kind of evidence, source of the evidence, potential bias, and degree of accuracy. • Determining if research is sufficient to support the claims made in an article. • Using technology and mathematics to improve investigations and communications. • Understanding causality, comprehensibility, reproducibility, tentativeness, and contingency.
21st Century Skills: Critical thinking and problem solving, communication and collaboration, creativity and innovations, information literacy, media literacy, information, communications and technology literacy, flexibility and adaptability, initiative and self-direction, productivity and accountability		

Please note:

All skills listed in the nature of science, science practices and inquiry, and skills for doing science (*Wisconsin's Model Academic Standards for Science* B and C) are expected to continue in subsequent grades, rather than stand alone at a grade level. They appear at the grade level at which they are ***introduced with teacher guidance*** and should continue with increasing student independence.

Please note:

Each science concept presented above is linked to its respective science performance standard from *Wisconsin's Model Academic Standards for Science* and to the assessment framework from the *WKCE-CRT Science Assessment Framework*. Standards are shown in parentheses. Refer to DPI's Web site for a copy of the *WKCE-CRT Science Assessment Framework*. The publication lists both the assessment framework statements and the performance standards.

While the science concepts are presented in a science traditional format, the concepts can be integrated or presented to students in this traditional format. These concepts, in conjunction with the nature of science concepts, will form a coherent unit of science instruction. Further information about coherence in science can be found in *Planning Curriculum in Science*.

The big ideas listed above are found at every grade level and represent focused science as defined in the guide to *Planning Curriculum in Science* for this grade. To understand the relationship of each science concept to its big idea, please see the K–12 presentation of the concepts.

Finally, please note that science content standard A is infused throughout these foundations and is seemingly invisible at first glance. Standard A, *Science Connections,* is one of the unifying standards for science instruction and science curriculum. The themes are as follows: systems, order, organization, interactions, evidence, models, explanations, constancy, change, measurement, evolution, equilibrium, energy, and form and function among scientific disciplines. The rationale from standard A states, "these unifying themes are ways of thinking rather than theories or discoveries" (DPI, 1998). Students should know these themes and realize that the more they learn about science the better they will understand how the themes organize and enlarge their knowledge. Students will also understand science better when they connect and integrate these unifying themes into what they know about themselves and the world around them.

Classroom science in action—suggestions that can lead to a unit of science instruction:

- Constancy, change, evolution, energy
    - energy transfers, cellular energy
    - evolution—life science, earth science
    - biogeochemical cycle
    - force and motion

Science application—ideas for the classroom (*Wisconsin's Model Academic Standards for Science* G and H)***:***

- Discussing the impact of an invasive species on either the land or water; and identifying alternative solutions
- Making an informed decision about a groundwater contamination situation

5

Introduction to Curriculum Topic Study

Part Two:

Part two presents the grade by grade foundations in two ways. First is the presentation about "doing science" in the classroom; specifically, the nature of science, science skills, and practices. This part of this section is a duplication of section one and is replicated here for your use.

Second is the presentation of the science concepts for life, earth, and physical science. The concepts are a replication of the concepts in section one for each grade. They are arranged by their respective big idea. Viewing this section from the big idea perspective will give you an idea of how each science concept builds from the other, and thus builds final understanding for the big idea and will help you achieve coherence in your science instruction or your district's curriculum.

Chapter Two of *Planning Curriculum in Science* illustrates the relationship of the nature of science, science practices to the science concepts. It further describes coherence and focus in science and provides illustrations of what this might look like in a science curriculum.

This part has one distinct addition. There are page number references to the topics found in the *Science Curriculum Topic Study* (CTS). This has been added so you will have access to all the national standards work and research in one reference location. A detailed explanation of the CTS process follows. *Science Curriculum Topic Study* (CTS), developed by the Maine Mathematics and Science Alliance and published jointly by Corwin Press and NSTA Press, is often thought of as the "missing link" by teachers in Wisconsin who are working with and implementing the state standards and assessment framework. Participants in several of the state Mathematics and Science Partnership Initiatives have used CTS as a vehicle for understanding what students should know after completing a unit of study on a particular science topic. Several districts in the state are using CTS with their science curriculum committees, while making changes to their science curriculum program.

Page Keeley, the CTS author, states the following on the CTS Web Site: "CTS is a National Science Foundation-funded Teacher Professional Continuum project that is developing a coordinated set of science materials to help K–12 educators deepen their understanding of the important science topics they teach. CTS builds a bridge between state and national standards, research on students' ideas in science, and opportunities for students to learn science and mathematics through improved teacher practice" (www.curriculumtopicstudy.org).

The CTS process, tools, and materials engage educators in a *systematic* and *scholarly* method of using national stanards and Wisconsin's state standards and research on student learning to study a curricular topic, analyze findings, and

apply the content (curricular, instructional, and assessment implications discovered through the CTS process) to their own teaching and learning context. Rather than providing the answers, CTS promotes inquiry among educators in discovering new knowledge about teaching and learning related to the topics they teach.

CTS is organized around 147 curriculum topics, ranging from specific topics, such as density, to broader topics, such as properties of matter. The majority of CTS is presented in a K–12 manner. CTS is designed to guide educators through the topic with readings from a core set of professional resources found in science education.

Each CTS topic is organized around the content you should know in order to teach the topic to students, instructional implications, concepts and specific ideas, research on student learning (K–12), and coherency and articulation. Within each organizer, there are relevant references that will help you better understand the topic you are learning about. Each CTS topic is organized into one of eleven categories. Each topic within the category is presented in alphabetical order in the CTS publication.

CTS topics are referenced in the pages that follow with the page number or numbers in blue. The page number reference is to the CTS topic or topics that are related to the concepts from Section 4 that students should know in a particular grade. Each CTS topic provides you with specific references to major publications in science education. These publications include the *National Science Education Standards*, the *Benchmarks for Science Literacy*, the *Atlas for Science Literacy* (all were used to develop the state science standards), and *Science for All Americans*.

Be sure to refer to the CTS publication for details on how CTS topics will help you or your district make better use of the foundations document. (Details for purchase are found on DPI's Web site) and the CTS (Web site www.curriculumtopicstudy.org). You can choose to use this information or simply ignore the CTS page number reference. Use of CTS is not designed to be exhaustive, and you are encouraged to examine other relevant publications such as the ones listed in the references at the end of this publication section.

Note: adapted from the topic study Web site at www.curriculumtopicstudy.org.

Nature of Science, Science Practices and Inquiry, and the Skills to Do Science

The following explanation of science is from *Taking Science to School: Learning and Teaching Science in Grades K–8,* a National Research Council publication: The current view of science is that it is both a body of knowledge and an evidence-based, model-building enterprise that continually extends, refines, and revises knowledge. Content and process are thus inextricably linked. This implies that students who are proficient in science:

- Know, use, and interpret scientific explanations of the natural world;
- Generate and evaluate scientific evidence and explanations;
- Understand the nature and development of scientific knowledge; and
- Participate productively in scientific practices and discourse (NRC, 2007).

It is with this in mind, the understandings about the nature of science are presented for each grade first. These understandings are intended to help you, the teacher, help students learn about the natural and designed world. The information presented is based on the idea that that our senses, and the extensions of those senses through the use the tools of science, give students accurate information about phenomena and events in science. Thus, the practices of science (inquiry) and the skills needed to do science are presented in the second and third columns.

The ideas presented next, while specific to science, contribute to the 21st century student outcomes of life and career skills, learning and innovation skills, information, media, and technology skills, and to the 21st century themes. As students learn about the nature of science, develop their scientific habits of mind, do science, and develop science skills, they will learn about the global nature of science and the impact science has on society, and they will develop a respect for the many cultural contributions to the nature of science.

Each idea listed in the science practices and inquiry, and in the skills to do science column is expected to continue in following grades, rather than stand alone at a grade level. They appear at the grade level where they are ***introduced with your (teacher) guidance*** and are expected to continue with increasing student independence. Finally, each idea is presented by grade so you will know what happens in the preceding and succeeding grades in science. Vignettes for further reading about the science classroom in action are presented in Wisconsin's *Planning Curriculum in Science* and in the *National Science Education Standards* publications.

As a reminder, page references to the curriculum study topics accompany this section.

Kindergarten Classrooms Will Include

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Science explains the natural world, p. 244.	*Opportunities for:* • Asking questions, p. 244. • Making observations, p. 244. • Conducting simple science investigations, p. 245. • Reporting the results of science investigations to different audiences (friends, teachers, and younger students) by using (simple) graphs, tables, and illustrations, p. 229, 236.	*Activities to develop science skills:* • Selecting and safely using equipment relevant to a simple science investigation, such as, rulers, simple balance, hand lenses, computers, etc., p. 242. • Making simple graphs, p. 236.

First Grade Classrooms Will Include

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Science relies on evidence, p. 244.	*Opportunities for:* • Identifying data relevant to questions and investigations, p. 233. • Collecting data relevant to questions and investigations, pp. 233, 243.	*Activities to develop science skills:* • Selecting and safely using equipment relevant to a science investigation, such as, rulers, balances, graduated cylinders, hand lenses, thermometers, and computers, p. 242. • Making graphs, p. 236.

Second Grade Classrooms Will Include

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Much has been learned about objects, events, and phenomena in nature through scientific inquiry, but much more remains to be learned and understood, p. 252. • Scientific knowledge has changed over time, p. 244.	*Opportunities for:* • Planning a simple investigation, p. 235. • Predicting results of investigations, p. 238. • Deciding observations that are needed to explain results, p. 238. • Safely conducting simple investigations, pp. 238, 245. • Using evidence collected to explain results, pp. 230, 245. • Interpreting data (using the results of data) to answer questions developed during investigations, pp. 233, 234, 249. • After completing an investigation, developing additional questions that support new investigations about the original topic of study, p. 235.	*Activities to develop science skills:* • Communicating understandings about science using time lines or simple diagrams as possible tools, p. 229.

Third Grade Classrooms Will Include

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Men and women from many cultures have contributed to science throughout history, p. 244. • Science must be communicated to others for verification, p. 241. • Science is a human endeavor, p. 244.	*Opportunities for:* • Asking testable questions about the natural world being studied, p. 238. • Stating evidence from data collected to justify/explain conclusions from investigations, pp. 230, 249 .	*Activities to develop science skills:* • Determining which resources are the most appropriate to use when asking testable questions and planning investigations, p. 230. • Developing a list of issues that citizens must make decisions about and describing a strategy for becoming informed about the science behind these issues, p. 230.

Fourth Grade Classrooms Will Include

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • The results of scientific investigations have changed throughout history because additional knowledge has been developed or learned about the topic being investigated, pp. 241, 246. • Many people choose science as a career and devote their entire life to doing science, p. 246. • Men and women using scientific inquiry have learned much about the objects, events, and phenomena in nature. Much remains to be understood, pp. 241, 246. • Science will never be finished, p. 241.	*Opportunities for:* • Identifying questions that can be answered with available equipment, resources, scientific tools, and logical reasoning, p. 238, 242. • Determining if the questions asked are testable, p. 244, 245, 246. • Identifing sources of data, p. 233. • Explaining the results of an investigation to others using multiple forms of communication such as oral presentation or written report, p. 229, 230. • Explaining which data is the most logical data needed to answer a scientific question, p. 233.	*Activities to develop science skills:* • Determining which is the most logical equipment to use when answering a question in science, p. 242. • Using appropriate safety measures in all scientific investigations, p. 242. • Routinely incorporating and discussing the use of appropriate graphical representations of data, p. 236. • Using equipment and/or computer software, such as probe ware, for data to present logical and reasoned results to others, pp. 242. 249.

Fifth Grade Classrooms Will Include

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Science and scientific reasoning can assist humans while making decisions, p. 246. • Not all real world problems can be solved through science because of human limitations, p. 248. • A hypothesis is a prediction based on previous information, pp. 238, 241. • Science often uses models to illustrate sceintific concepts, phenomena, or events, p. 269.	*Opportunities for:* • Designing an investigation that will answer a scientifically testable question, p. 252. • Conducting experiments that will generate both qualitative and quantitative data, pp. 246, 247, 249. • Verifying (either accept or reject) the decided results through experimentation, pp. 245, 246. • Explaining results by using the science concepts being investigated, pp. 230, 234, 240.	*Activities to develop science skills:* • Using equipment and computer software for data to present logical and reasoned results to others. Equipment may include computers, probe ware, microscopes, or telescopes, p. 234 . • Appropriately using science vocabulary when explaining the data and results, pp. 234, 249.

Sixth Grade Classrooms Will Include

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Multicultural historical events have contributed to the development of science over time, p. 241. • Nonscientific evidence can lead to non-scientific conclusions about the natural world, p. 246.	*Opportunities for:* • Regularly discussing the results and implications of an investigation within the classroom with peers, teachers, and other adults, pp. 230, 244, 248. • Recognizing that a hypothesis is a prediction based on previous information, p. 235. • Verifying the accuracy of the science concepts being presented, p. 234, 246.	*Activities to develop science skills:* • Understanding the impact on society when making a decision, pp. 248, 265. • Demonstrating and communicating how science and scientific evidence can assist with making an informed decision, p. 248, 265.

Seventh Grade Classrooms Will Include

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Evidence and peer review are hallmarks of scientific thought, p. 241. • The development of a scientific theory as an explanation that has been robustly tested and supported through several lines of evidence, pp. 241, 246. • Science knowledge is shared, replicated, and extended by scientists through peer review, journals, databases, and student presentations, pp. 246, 250.	*Opportunities for:* • Deciding what are the most logical results for an investigation, p. 246. • Raising further questions after making comparisons of experimental results to known science understandings, pp. 241, 245. • Using collected data to support and explain scientific inferences, pp. 232, 234. • Using collected data, defending the validity of the experimental design and results, pp. 235, 245. • Generating new questions about existing experiments that reflect upon new science understandings, p. 241. • Comparing individual results to known science concepts, models, or theories, to determine the accuracy of the results, p. 241.	*Activities to develop science skills:* • Explaining ways to make a scientific investigation valid, p. 241.

Eighth Grade Classrooms Will Include

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Cultures and individuals have contributed to the development of major ideas in the earth and space, life and environmental, and physical sciences, p. 244. • Cultural conditions are usually present during great periods of discovery, scientific development, and invention, such as, war, prosperity, competition between countries, government support, political philosophies–space race of the 1960s, Manhattan Project, p. 241. • There are specific differences in scientific facts, scientific hypotheses, scientific theories, and scientific laws, p. 241. • Results of scientific investigations are replicable, p. 241. • Science distinguishes itself from other ways of knowing and from other bodies of knowledge through the use of empirical standards, logical arguments, skepticism, creativity, intuition, imagination, and perseverance, p. 241.	*Opportunities for:* • Asking testable questions suggested by current social issues, scientific literature, or observations of phenomena, p. 241. • Developing alternative hypotheses for questions, p. 335. • Evaluating data collected during an investigation, pp. 233, 234. • Critiquing data collection procedures and results, pp. 233, 234. • Using the results of an experiment to develop a valid explanation, pp. 232, 234, 246. • Explaining concepts in science using appropriate models, such as, plate tectonics, erosion patterns, cell models, magnetic fields, light, heat, and forces of nature, p. 269. • Evaluating models, physical or conceptual, for accuracy and completeness, p. 269. • Developing and defending ideas or conclusions based on data, p. 246. • Generalizing results to the natural world, p. 247. *When presenting conclusions to others:* • Present clear and logical arguments for the results. • Be able to answer questions about the results. • Defend the results. • Communicate the results and their implications in ways that others will understand, p. 230.	*Activities to develop science skills:* • Choosing appropriate resources that could be used to research questions, p. 241. • Reviewing previous research available for questions, p. 238. • Demonstrating knowledge of basic safe laboratory procedures, p. 245. • Distinguishing qualitative and quantitative data and representing the data appropriately, such as, graphing techniques, mean, median, mode, p. 236. • Using the metric system (SI: System International units), p. 239. • During investigations choosing the best data collection procedures, p. 246. • Selecting appropriate materials and tools for investigation, pp. 245, 246. • Using procedures and materials competently, p. 245.

Ninth Grade Classrooms Will Include

From the Nature of Science	Science Practices, Inquiry	Skills to Do Science
The understanding that: • Science is based on assumptions about the natural world and the science themes that describe the natural world, pp. 241, 246. • Mulitple lines of evidence support one another and give more credibility to a scientific idea, such as, evolution, pp. 241, 246. • Basic research and applied research contribute to new discoveries, inventions, and other applications of science, p. 261.	*Opportunities for:* • Communicating a scientific argument, pp. 239, 249. • Developing logical explanations, pp. 234, 249. • Demonstrating connections between natural phenomena, investigations, and the historical body of evidence, pp. 259, 246.	*Activities to develop science skills:* • Evaluating the scientific accuracy of articles found in popular press, journals, television, and the Internet, p. 246. • Determining the accuracy of an article by using the criteria of evidential quality, type of evidence, kind of evidence, source of the evidence, potential bias, and degree of accuracy, p. 246. • Determining if research is sufficient to support the claims made in an article, p. 246. • Using technology and mathematics to improve investigations and communications, pp. 251, 253. • Understanding causality, comprehensibility, reproducibility, tentativeness, and contingency, p. 241.

Big Ideas in Science and the Accompanying Concepts per Grade

6

The table presented next begins by laying out the big ideas for life, earth, and physical science, respectively. The concepts following each big idea are linked to a specific grade. The table below maps out how those ideas spiral though the grades. The committee hopes that this spiraling will help with scaffolding your instruction.

The committee also designed this table to help your science district committee develop coherence among the science concepts within a grade and from grade to grade. Additional information about coherence in the science curriculum is found in the guide to *Planning Curriculum in Science*.

Grade Level Concepts in Life Science

Grade Level	Continuity and Change in Living Things	Characteristics of Organisms	Organisms and Their Environment
K	• There are many different kinds of living things; some are alike, and some are different, p. 115.	• Living things have basic needs, such as, the need for water and food, p. 115.	
1	• There are many different kinds of plants, p. 121.	• Plants have life cycles, p. 121.	• Plants respond to their environment, p. 119.
2	• There are many different kinds of animals, p. 115.	• Animals (including humans) have life cycles, p. 119. • Animals (including humans) have different structures that enable them to grow, reproduce, and survive, p. 116.	• Animals respond to their environment, p. 119.
3		• Plants have different structures that enable them to grow, reproduce, and survive, p. 130.	• An interdependence exists among living and nonliving things in the environment, p. 124.

Grade Level	Continuity and Change in Living Things	Characteristics of Organisms	Organisms and Their Environment
4	• There are many diverse microscopic organisms, p. 120.	• All organisms are composed of cells, p. 135. • Some organisms are composed of one cell; some organisms are composed of many cells, p. 135.	
5	• There are (genetic) variations within a species, p. 156.	• All organisms need a supply of energy for growth and reproduction and to continue living, p. 155	• Ecosystems are communities of living organisms and the nonliving materials of their surroundings, pp. 124, 126. • There are many different types of ecosystems allowing organisms to interact, pp. 127. • Organisms interact with one another in an ecosystem in several ways: producer/consumer, predator/prey, etc., p. 129.
6	• Organisms inherit genetic information from their parents through either sexual or asexual reproduction, p. 151.	• Organisms have structural, functional, and behavioral adaptations that increase their chances of surviving in their environment, p. 147. • Organisms maintain internal stability in response to internal and external stimuli, such as, temperature, etc., p. 119.	
7	• Genetic variation is essential for natural selection to occur, pp. 151, 156. • Evidence supports the idea of common descent through mechanisms for evolution and natural selection, pp. 148, 153.	• Cells need energy for all basic functions: photosynthesis, cellular respiration, etc., pp. 136, 138. • Cells function in a similar way in all living organisms, pp. 142, 144. • Specialized cells in multicellular organisms are structured to accomplish specific functions, pp. 142, 144.	• Environmental changes impact ecosystems, such as, natural disasters, human use of resources, etc., pp. 130, 131.

Grade Level	Continuity and Change in Living Things	Characteristics of Organisms	Organisms and Their Environment
8		• Organ systems are composed of cells and function to serve the needs of cells for food, air, and waste removal, pp. 135, 136. • Behavior can be genetically determined in some organisms and can be learned in others, pp. 135, 142.	• The sensory and nervous systems of organisms react to the external and internal environment, pp. 140, 145.
9	• Parents provide DNA to their offspring, p. 137. • DNA determines characteristics of the offspring, p. 137.	• Organisms are classified based on common characteristics, p. 148.	• Energy is continuously transferred in ecosystems, p. 128.

Grade Level Concepts in Earth Science

Grade Level	Composition and Resources of Earth Materials	History and Evolution of Earth in the Universe	Process of Earth and Universe Systems
K	• Earth is made up of different things, such as, rocks, soil, water, etc., p. 188.		
1	• Earth materials have many different properties, such as, shape, size, odor, texture, etc., p. 188.		
2			• The sun, moon, and stars appear to change position, pp. 194, 197. • There are observable daily/seasonal weather changes in Wisconsin, p. 185. • There are changes in the sky that are observable during the day, during the night, and during seasonal events on Earth, pp. 185, 194. • The shape of the moon changes in regular patterns, p. 194.
3	• There are many different soils (sand, clay, etc.) that can be identified by their properties, p. 186. • Rocks and minerals are identified by their properties, p. 184. • Some of earth's natural resources are used by humans, pp. 179, 260.		
4	• Humans have used renewable and nonrenewable natural resources through out history, p. 179. • Earth is composed of land, water masses, and atmosphere, pp. 176, 188, 190.		

Grade Level	Composition and Resources of Earth Materials	History and Evolution of Earth in the Universe	Process of Earth and Universe Systems
5	• Earth consists of several layers (mantle, core, atmosphere, etc.), each with unique characteristics and properties, p. 188.	• Many types of forces change/shape/Earth, p. 192. • Landforms are formed by erosion and deposition, p. 192. • Living organisms have had an impact on Earth's atmosphere, p. 175.	• Uneven distribution of solar energy causes convection, which influences climate, weather, and ocean currents, p. 187. • Seasons are caused by the tilt of Earth on its axis as it revolves around the sun, p. 185. • Rotation of Earth on its axis causes day and night, pp. 194, 197.
6			• The sun is the star in our solar system, p. 194. • Stars differ in their properties and composition, p. 194. • Gravity interacts with the planets in our solar system and holds most objects in the solar system in their orbits, p. 195. • Objects in our solar system have regular and predictable orbits and motion, pp. 195, 197.
7		• Geologic evidence, including evidence from rocks, fossils, and satellite imagery, provide information about the history and formation of Earth, p. 176. • Geologic events and changes to Earth's surface can result from plate movement, pp. 183, 198.	

Grade Level	Composition and Resources of Earth Materials	History and Evolution of Earth in the Universe	Process of Earth and Universe Systems
8			• The origin and expansion of the universe can be explained by examining cosmic events that took place billions of years ago, p. 196.
9	• Earth elements move within and between the land, water, and atmosphere as part of the biogeochemical cycle, pp. 184, 189, 271.		• Earth systems have internal and external sources of energy, both of which create heat, pp. 177, 187.

Grade Level Concepts in Physical Science

Grade Level	Matter and Energy	Forces, Position, and Motion	Interactions of Matter and Energy
K	• Objects have properties, such as, color, smell, texture, etc., p. 171. • Objects can be organized by sorting, patterns, etc., p. 171.		• Many objects are made of parts, p. 171, 172. • Many objects can be taken apart and put together.
1		• Some objects are stationary, p. 207. • Some objects move due to a push or pull, p. 207.	
2	• Objects are composed of matter, p. 171. • Matter has physical properties that can be measured–for example, weight, volume, size, etc., p. 171. • Matter can be changed from one state to another and back again–for example, from heated to cooled, p. 172.		
3	• Each state of matter has unique properties, p. 172.	• An object is in motion when its position is changing, pp. 207, 220. • The speed of an object can be determined by simple measurements, p. 220.	• Matter exists in several different states; the most commonly encountered are solid, liquid, and gas, p. 172.
4	• Objects vary in the extent to which they absorb and reflect light and conduct heat (thermal energy) and electricity, pp. 208, 211, 213. • Shadows result when light cannot pass through a substance and when light changes direction (through air, water, etc.) p. 225. • There is a relationship between the pitch of a sound and the physical properties of the sound source, p. 224.		• Magnets can repel and attract, p. 219. • Some substances can carry an electric current, p. 208. • Simple circuits can be constructed, such as, open, closed, series, parallel, p. 208. • Electricity flowing through an electrical circuit produces magnetic effects.

Grade Level	Matter and Energy	Forces, Position, and Motion	Interactions of Matter and Energy
5	• Heat (thermal energy), electricity, light, and sound are forms of energy, p. 211. • Some types of matter are pure substances–for example, elements, p. 165. • Matter can be identified by physical properties, such as, mass, weight, volume, etc., p. 171. • Chemical properties of a substance describe its "potential" to undergo some chemical change or reaction by virtue of its composition, p. 161.		• Chemical reactions cause new substances to be formed, p. 161. • Energy is an important property of substances; most change involves energy transfer, pp. 211, 213.
6		• Forces have magnitude and direction, and can be added, p. 214. • An object's motion can be described by its speed and the direction it is moving, p. 220. • Forces can cause an object to change its position, p. 214. • Gravity causes objects to fall toward Earth, p. 215.	• Kinetic energy is stored energy; potential energy is energy in motion, p. 217. • Energy goes through transformations, such as, kinetic to potential, heat to light, etc., p. 213. • Energy is transferred from place to place, such as, radiation, conduction, etc., p. 213.
7	• Atoms are the basic building blocks of matter that make up everyday objects, p. 169. • As more was learned about the atom, models of the atom changed, p. 169.		

Grade Level	Matter and Energy	Forces, Position, and Motion	Interactions of Matter and Energy
8	• Atoms have a specific atomic structure, p. 168. • Chemical changes can occur when two substances, elements, or compounds react, p. 161. • There are a several types of chemical interactions/ reactions, such as, endothermic, exothermic, etc. p. 161. • Energy exchanges occur in chemical reactions, pp. 161, 205.		• New substances are formed due to chemical interactions, pp. 161, 162. • Molecules are held together by attractive forces, pp. 169, 214.
9	• Chemical properties of substances are explained by the arrangement of atoms and molecules, pp. 165, 169. • Chemical bonding occurs when electrons are transferred, shared, gained, or lost, pp. 160, 161. • The number and kinds of atoms in reactants are the same as the number and kinds of atoms in products and can be illustrated by equations, pp. 160, 161, 163.	• A net force of zero acting on an object does not change the position of the object, pp. 214, 218, 220. • The motion of an object changes only when a net force is applied, pp. 214, 218, 220. • Some forces act on objects due to direct contact, such as, push or pull; some forces act on an object from a distance, such as, magnetic, electrical, gravitational, etc., pp. 214, 218, 220.	• Changes in the state of matter require a transfer of energy, pp. 173, 213. • When energy is transferred from one system to another, the quantity of energy before the transfer equals the energy after transfer, p. 213. • Mass is conserved when substances undergo chemical changes or changes in their state of matter, pp. 163, 173.

7 Science Concepts Grade by Grade

This part of the foundations document is designed to give you an overall picture of the science concepts in each grade. From this presentation it is conceived that you can form a unit of science study and the lesson, or lessons, to accompany that unit of study. Several examples of these units are given in the first section of this document.

Science Concepts in Kindergarten

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
Living things have basic needs, such as, the need for water and food, etc.	Earth is made up of many different things, such as, rocks, soil, water, etc.	Objects have properties, such as, color, smell, texture, etc.
There are many different kinds of living things—some are alike and some are different.		Objects can be organized by sorting, patterns, etc.
		Many objects are made of parts.
		Many objects can be taken apart and put together.

Science Concepts in First Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
There are many different kinds of plants.	Earth materials have different properties, such as, shape, texture, color, etc.	Some objects are stationary.
There are many different kinds of living things—some are alike and some are different.		Some objects move due to a push or pull.
Plants have life cycles.		
Plants respond to their environment.		

Science Concepts in Second Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
There are many different kinds of animals.	The sun, moon, and stars appear to change position.	Objects are composed of matter.
Animals (including humans) have life cycles.	There are observable daily/seasonal weather changes in Wisconsin	Matter has physical properties that can be measured, such as, weight, volume, size, etc.
Animals (including humans) have different structures that enable them to grow, reproduce, and survive.	There are changes in the sky that are observable during the day, during the night, and during seasonal events on Earth.	
Animals respond to their environment.	The shape of the moon changes in regular patterns.	

Science Concepts in Third Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
Plants have different structures that enable them to grow, reproduce, and survive.	There are different types of soils (sand, clay, etc.), which can be identified by their properties.	Each state of matter has unique properties.
An interdependence exists among living and nonliving things in the environment.	Rocks and minerals are identified by their properties.	Matter exists in several different states; the most commonly encountered are solid, liquid, and gas.
	Some of earth's natural resources are used by humans.	An object is in motion when its position is changing.
		The speed of an object can be determined by simple measurement.

Science Concepts in Fourth Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
There are many different kinds of microscopic organisms.	Humans have used renewable and nonrenewable through out history.	Objects vary in the extent to which they absorb and reflect light and conduct heat (thermal energy) and electricity.
All organisms are composed of cells.	Earth is composed of land, water masses, and atmosphere.	Shadows result when light cannot pass through a substance and when light changes direction through air, water, etc.
Some organisms are composed of one cell; some organisms are composed of many cells.		There is a relationship between the pitch of a sound and the physical properties of the sound source.
		Magnets can repel and attract.
		Some substances can carry an electric current.
		Simple circuits can be constructed, such as, open, closed, series, parallel, etc.
		Electricity flowing through an electrical circuit produces magnetic effects.

Science Concepts in Fifth Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
There are (genetic) variations within a species.	Earth consists of several layers (mantle, core, atmosphere, etc.), each with unique characteristics and properties.	Heat (thermal energy), electricity, light, and sound are forms of energy.
All organisms need a supply of energy for growth and reproduction and to continue living.	Many types of forces shape earth.	Some types of matter are pure substances—for example, elements.
Ecosystems are communities of living organisms and the nonliving materials of their surroundings.	Uneven distribution of solar energy causes convection, which influences climate, weather, and ocean currents.	Matter can be identified by physical properties, such as, mass, weight, volume, etc.
There are many different types of ecosystems allowing organisms to interact.	Living organisms have had an impact on Earth's atmosphere.	Chemical properties of a substance describe its "potential" to undergo some chemical change or reaction by virtue of its composition.
Organisms interact with one another in an ecosystem in several ways—producer/consumer, predator/prey, etc.	Seasons are caused by the tilt of Earth on its axis as it revolves around the sun.	Chemical reactions cause new substances to be formed.
	Rotation of Earth on its axis causes day and night.	Energy is an important property of substances, and most change involves energy transfer.

Science Concepts in Sixth Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
Organisms inherit genetic information from their parents through either sexual or asexual reproduction.	The sun is the star in our solar system.	Forces have magnitude and direction and can be added.
Organisms have structural, functional, and behavioral adaptations that increase their chance of surviving in their environment.	Stars differ in properties and composition.	An object's motion can be described by its speed and the direction it is moving.
Organisms maintain internal stability in response to internal and external stimuli, such as, temperature, etc.	Gravity interacts with the planets in our solar system and holds most objects in the solar system in their orbits.	Forces can cause an object to change its position.
	Objects in the solar system have regular and predictable orbits and motion.	Gravity causes objects to fall toward Earth.
		Kinetic energy goes through transformations: kinetic to potential, heat to light, etc.
		Energy is transferred from place to place through radiation, conduction, etc.

Science Concepts in Seventh Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
Genetic variation is essential for natural selection to occur.	Geologic evidence, including evidence from rocks, fossils, and satellite imagery, provide information about the history and formation of Earth.	Atoms are the basic building blocks of matter that make up everyday objects.
Evidence supports the idea of common descent through mechanisms of evolution and natural selection.	Geologic events and changes to Earth's surface can result from plate movement.	As more is learned about the atom, models of the atom change.
Cells need energy for all basic functions, such as, photosynthesis, cellular respiration, etc.		
Cells function in a similar way in all living organisms.		
Specialized cells in multicellular organisms are structured to accomplish specific functions.		
Environmental changes impact ecosystems—for example, natural disasters, human use of resources, etc.		

Science Concepts in Eighth Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
Organ systems are composed of cells and function to serve the needs of the cells for air, food, and waste removal.	The origin and evolution of the universe can be explained by examining cosmic events that took place billions of years ago.	Atoms have a specific atomic structure.
Behavior can be genetically determined in some organisms and can be learned in others.		Chemical changes can occur when two substances such as, elements or compounds, react.
The sensory and nervous systems of organisms react to the external and internal environment.		New substances are formed due to chemical interactions.
		Molecules are held together by attractive forces.
		There are several types of chemical interactions/reactions—for example endothermic, exothermic, etc.
		Energy exchanges occur in chemical reactions.

Science Concepts in Ninth Grade

Life Science **Big ideas include continuity and change in living things, characteristics of organisms, and organisms and their environment.**	Earth Science **Big ideas include composition and resources of earth materials, history and evolution in the universe, and properties of earth systems and universe systems.**	Physical Science **Big ideas include matter and energy, forces, position and motion, and interactions of matter and energy.**
Parents provide DNA to their offspring.	Earth elements move within and between the land, water, and atmosphere as a part of the biogeochemical cycle.	Chemical properties of substances are explained by the arrangement of atoms and molecules.
DNA determines characteristics of offspring.	Earth systems have internal and external sources of energy, both of which create heat.	Chemical bonding occurs when electrons are transferred, shared, gained, or lost.
Organisms are classified based on common characteristics.		The number and kinds of atoms in reactants are the same as the number and kinds of atoms in products and can be illustrated by equations.
Energy is continuously transferred in ecosystems.		A net force of zero acting on an object does not change the position of the object.
Specialized cells in multicellular organisms are structured to accomplish specific functions.		The motion of an object changes only when a net force is applied.
Environmental changes impact ecosystems—for example, natural disasters, human use of resources, etc.		Some forces act on objects due to direct contact, such as push or pull; some forces act on an object from a distance, such as magnetic, electrical, gravitational, etc.
		Changes in the state of matter require a transfer of energy.
		When energy is transferred from one system to another, the quantity of energy before the transfer equals the energy after transfer.
		Matter is conserved when substances undergo chemical changes or changes in their state of matter.