



Cleveland Heights-University Heights City School District  
2155 Miramar Boulevard  
University Heights, Ohio 44118

SCIENCE  
COURSE OF STUDY  
GRADES K-12

Volume I

Carlton J. Moody, Superintendent

Adopted by the Cleveland Heights-University Heights  
Board of Education

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## K-12 SCIENCE TASK FORCE

<b>Teachers</b>	<b>School</b>	<b>Teachers</b>	<b>School</b>
Andy Trujillo	Boulevard	Leatrice Douglas	Wiley
Kathy Gill	Boulevard	Robert Gambatese	Wiley
Patrick Dooner	Canterbury	Gary Love	Wiley
Teresa Ware	Canterbury	Judy Spain-Howard	Bellefaire
Terri Gilliam	Coventry	Evelyn Bradshaw	Heights High
Terri McGeary	Coventry	Joyce Calo	Heights High
Darren Campbell	Fairfax	Blair Chirdon	Heights High
Wendy Ward	Fairfax	Virginia Hellstern	Heights High
Nancy Machmer	Gearity	Eugene Rackoff	Heights High
Cynthia Martin	Gearity	Fred Thaxton	Heights High
Julie Conway	Noble	Robin Norwood	Heights High
Ralph Sustar	Noble	Sherri Bellini	Math/Science – Boulevard
Margie Dunlevy	Oxford	Leslie Ferguson	Math/Science – Fairfax
Sherri Malek	Oxford	Karen Gutwein	Math/Science – Gearity
Patty Clary	Roxboro El.	Lorraine Turner	Integrated Science Team
Lynne Maragliano	Roxboro El.	Gene Rust	Coordinator of Gifted
Jason Jeske	Monticello	Mary Kastanis	Administrator – High School
Dorothy McBryde	Monticello	Joseph Micheller	Exec. Dir. Of Curriculum/Inst. and Staff Development
Zakiyyah Bergen	Roxboro Mid.	Ronald Wolfe	Science Content Consultant Cleveland State University
Martin Javorek	Roxboro Mid		

## DISTRICT PHILOSOPHY

6121\*  
(Policy Notebook)

### PHILOSOPHY OF EDUCATION

The educational organization, administration, development, and programs within our school system are to be guided by the following premises:

1. All children are entitled to a public education that will encourage the fullest development of their individual talents.
2. Learning is essential to individual independence and the general welfare of the changing American society.
3. Effective learning develops both intellectual and emotional qualities and is for action; its proper evaluation lies in the quality of resultant activity, not mere response.
4. Organized education, a deployment of human and material resources as means toward learning, implies learning for all (students, teachers, administrators) at different levels of understanding and maturity.
5. Organized education is at its best when graced with experimental attitudes and dedicated to the proposition that all issues between organization and learning shall be resolved in favor of learning.
6. All rewards and penalties, adopted in the organization of education, become legitimate only insofar as they assist learning.
7. For purposes of learning and growth, internal motivations are more valuable than the external, such as grades and competition.

The primary people in our school system are first, the students, and next, the teachers. Accordingly, they will be given primary consideration in any action taken by the Board of Education.

Our school system should provide a framework in which basic problem-solving and personal-adjustment methods can be learned in an orderly, phased, and wholly accessible manner.

Our school system should educate toward both responsibility and responsiveness. It should provide greatly enriched conditions for individual growth in self-awareness, in a larger social awareness, and in controlled and meaningful response, both to inner and to outer influences. It should strive to heighten the developing student's appreciation of the cultural and individual diversity within the human family and improve his/her skill in working harmoniously and creatively with that diversity, since this is a rich resource for innovative and successful growth.

A major effort of the teaching-learning process should be the early development of positive self-assurance and the continuing development of individual potential to deal with a changing society, to think rationally and creatively, to be independent and productive, and to choose rewarding life activities. Thinking, creativity, independence, productivity, and activity are also characterized by individual differences. Yet, they must meet external requirements, and these change with the changing society.

\*Ohio Administrative Code 3301-35-02

Approved by Board of Education February 9, 1970

Revised by Board of Education January 31, 1977

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# Introduction

This science course of study includes six standards which describe the over-arching goals and themes of science literacy. The grade-level indicators are grouped under the standards of:

## Content Areas

**Earth and Space Sciences**  
**Physical Sciences**  
**Life Sciences**

## Processes

**Science and Technology**  
**Scientific Inquiry**  
**Scientific Ways of Knowing**

The grade-level indicators should provide clear and specific links to the standards. The indicators must sufficiently inform teachers, students, and parents of the appropriate rigor and emphasis of instruction and assessment at each grade level. The amount of content at each grade level should be manageable, allowing teachers flexibility and ample time to address local curricular expectations, diverse student abilities, and current issues as they emerge.

**The course of study for science is based on the 2<sup>nd</sup> draft of the Ohio Academic Content Standards** utilizing a scope and sequence which progresses logically from grade level to grade level. The indicators at each grade level are considered to be developmentally appropriate for each age group of students based on *The National Science Education Standards* and *Benchmarks for Science Literacy*. In kindergarten through grade eight students will study a connected science program consisting of all six science standards. Students will study not only the content of the specific domains of science but also the connections that exist between the domains. These include: earth and space sciences, life sciences, physical sciences, science and technology, scientific inquiry, and scientific ways of knowing.

The proposed scope and sequence allows students to study all aspects of science in a connected manner, even at the high school level, while still paying attention to the discrete domains of science.

## **Standards Definitions**

### **Life Sciences Standard**

Students demonstrate an understanding of how living systems function and how they interact with the physical environment, as well as the concepts, processes and principles of the life sciences including: the principle of heredity and related concepts; the characteristics and structure of life; biological evolution; diversity and interdependence of life; and the historical perspectives and scientific revolutions associated with the life sciences.

### **Physical Sciences Standard**

Students understand the properties of matter and energy, and demonstrate knowledge of the interactions between matter and energy. Students can describe the energy transformations in a system, and identify the nature of matter and energy, forces and motion, and the historical perspectives and scientific revolutions associated with the physical sciences.

### **Earth & Space Sciences Standard**

Students will connect the concepts of energy, matter, motion and forces to Earth, the solar system and the universe. Students will recognize the interconnected cycles and systems that make up our environment and understand the concepts, processes and principles of the earth and space sciences including: the universe; the Earth system; processes that shape the Earth; and the historical perspectives and scientific revolutions associated with the earth and space sciences.

### **Science & Technology Standard**

Students should build the scientific and technological knowledge and skills required to design and implement problem-solving procedures and understand that a problem can be solved in several ways. Students should recognize that science and technology are interconnected, and that using technology can involve analyzing both risks and benefits and may require making tradeoffs.

### **Scientific Ways of Knowing Standard**

Students should understand that scientific discovery can be tentative, probabilistic, historic, and replicable. Students realize that science reflects the social and historical perspective of the many people that have contributed to the development of the current body of scientific knowledge, providing us with a more reliable and comprehensive understanding of the natural world.

### **Scientific Inquiry Standard**

Students use the processes of scientific inquiry to ask questions, gather and analyze information, make inferences and predictions, and create, modify, and possibly discard some explanations. Students should understand how to ask valid questions and develop an action plan to discover the answers.

## **Science Scope and Sequence**

### **Kindergarten**

Kindergarten offers children the opportunity to develop the science skills of wondering, questioning, investigating and communicating so that they can begin to make sense of the world. Kindergartners learn through discovery using hands-on exploration in the areas of earth and sky; the way things move; and plants and animals in their local community. They will learn about tools and materials and how people know about science. Students will demonstrate their knowledge of these scientific concepts through verbal and non-verbal representations (journals, drawings, etc.).

### **Grade 1**

Science instruction in the first grade builds on the science skills developed in kindergarten and the child's life experiences by increasing opportunities to explore how living things interact with their environment. Students will also explore science concepts in the areas of physical interactions and changes and observe plants and animals in Ohio. First graders will explore how things are built and used by people. Students will demonstrate their knowledge of scientific concepts through verbal and nonverbal representations (journals, drawings, etc.).

### **Grade 2**

Students continue to relate science concepts and skills to their life experiences. Cycles serve as an organizing theme for science in the second grade. Second graders will discover how cycles are present in their everyday lives through investigations in the areas of sky and earth cycles; sound and light; and plants and animals in the United States of America. They will investigate the purpose, process and effects of using technology.

### **Grade 3**

The scientific skills of observation and classification serve as a focal point for the third grade year. Students will explore the properties and composition of rocks and soils; classification of animals and adaptations to their environment; and the interaction of forces and motion. Students conduct safe investigations in which they collect and analyze data and communicate their findings. They also investigate results of technology and explore scientific careers and contributions from diverse cultures.

**Grade 4**

During grade four students will draw inferences from simple experiments while studying the physical and chemical changes of matter. They will expand their study of cycles through in-depth investigations of plants and weather, and will learn how weather reshapes the earth's surface. They will explore how to use results and data from investigations, and how technology affects our lives.

**Grade 5**

Earth and space sciences are investigated in more detail in the fifth grade. Students will explore the earth and the earth's place in our solar system. Students will learn about cells, ecosystems, energy, and the transfer of energy. They will evaluate design processes, technology resources, and environmental impacts and distinguish between facts and theories.

**Grade 6**

Students in the sixth grade will observe rocks and minerals, biotic ecosystems, and cells. They will also explore the chemical and physical changes of matter. They will begin to apply math skills to evaluate and analyze variables and data from investigations as they continue to learn to draw conclusions from scientific evidence. Six graders will explore how technology influences the quality of life and ways that science is helpful.

**Grade 7**

Students in the seventh grade will continue to explore ecosystems and their abiotic factors, including weather and climate. They will investigate the nature of energy as they continue to develop their skills of scientific inquiry. They will apply math skills to evaluate and analyze variables and data from investigations as they draw conclusions from scientific evidence.

**Grade 8**

Students in the eighth grade will explore space and plate tectonics as they continue to draw conclusions from scientific evidence that supports theories related to the study of space and plate tectonics. They will investigate diversity through genetics, similarities and differences among species and the survival of species. Students will design technological solutions and study the interactions between science and society, and the relationship between technology, society and cultures.

### **Grade 9**

The ninth grade year will emphasize physical science and related principles in earth and space sciences. Physical science concepts include the nature of matter and energy, forces and motion. Earth and space science topics will include processes that shape the earth, earth's interaction within the solar system, and the formation of the universe. Students will continue to develop a deeper understanding of the processes of scientific inquiry and improve their skills for doing scientific investigation as they study these topics. Students will investigate the ways in which science and technologies are interdependent, explore scientific theories and develop their scientific literacy and be aware of its importance.

### **Grade 10**

The tenth grade year will emphasize the concepts, principles and theories that enable people to understand the living environment. Students study life science concepts such as the characteristics and structure of life; heredity, evolution, diversity and interdependence of life. Intertwined throughout the tenth grade are related principles in the earth and space and physical science such as the earth system, processes that shape the earth, and the nature of matter. Embedded throughout this study will be the basic science processes of inquiry, scientific investigation, and the nature of science. These will be filtered through the study of ethical practices and the use of appropriate technology.

### **Grade 11**

In grade eleven students will draw on their previous experience and connect the earth/space, life and physical sciences into a coherent study of the environment. Emphasis will be placed on man's role in the biosphere. How man has modified the current ecosystems and the natural systems (e.g., earthquakes, storms, floods etc.) which in turn modify what man tries to accomplish. Students will have the opportunity to use the basic science processes of inquiry, scientific investigation and the nature of science to examine past events, current situations and predict future possibilities.

### **Grade 12**

Grade twelve will focus on advanced topics in biological and physical sciences. Biological topic clusters include heredity, evolution, diversity and interdependence of life. In the physical sciences topics students will study equilibrium of systems, electromagnetic radiation, and concepts of forces and motion as applied to large and small objects. Integrated with these topics will be the process of inquiry, nature of science, ethical practices, and use of appropriate technology. The indicators in grade twelve may be arranged into several advanced single discipline science courses or several advanced integrated science courses.

Grade level indicators correlated to the Fourth and Sixth Grade Ohio Proficiency Tests

Grade Level	Grade 4 Proficiency Outcomes																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
<b>K</b>	✓ ✓ ✓ ✓ ✓ ✓		✓				✓ ✓ ✓	✓ ✓	✓		✓ ✓	✓ ✓	✓ ✓	✓ ✓		✓ ✓ ✓		✓	
<b>1</b>	✓ ✓		✓			✓	✓ ✓	✓ ✓	✓		✓ ✓ ✓	✓ ✓ ✓		✓		✓	✓	✓	
<b>2</b>	✓ ✓		✓	✓ ✓	✓ ✓ ✓		✓ ✓	✓ ✓	✓				✓ ✓	✓ ✓	✓ ✓	✓ ✓	✓ ✓ ✓		✓
<b>3</b>	✓ ✓	✓	✓	✓	✓	✓	✓ ✓	✓ ✓	✓			✓ ✓ ✓		✓ ✓			✓ ✓	✓	✓
<b>4</b>	✓ ✓ ✓	✓ ✓	✓	✓	✓ ✓ ✓ ✓	✓ ✓ ✓	✓ ✓	✓ ✓	✓	✓ ✓	✓ ✓	✓ ✓ ✓	✓ ✓ ✓	✓ ✓	✓ ✓ ✓	✓	✓ ✓	✓	✓
	Grade 6 Proficiency Outcomes																		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17		
<b>5</b>		✓	✓	✓	✓ ✓ ✓ ✓ ✓				✓ ✓ ✓ ✓	✓ ✓ ✓	✓ ✓ ✓			✓ ✓	✓ ✓ ✓ ✓		✓ ✓ ✓		
<b>6</b>	✓	✓	✓ ✓ ✓ ✓ ✓ ✓ ✓	✓ ✓	✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓ ✓	✓		✓ ✓ ✓	✓ ✓	✓	✓ ✓ ✓	✓ ✓ ✓ ✓	✓	✓ ✓ ✓ ✓	✓ ✓ ✓	✓	✓ ✓		

## CH-UH Content Matrix Based on ODE Content Standards

❖ CH-UH Content in Support of the 4<sup>th</sup> Grade Ohio Proficiency Test

<b>Scientific Inquiry:</b> Wondering, Questioning, Investigating, Communicating								
Grade Level	<b>Earth and Space Sciences</b>		<b>Life Sciences</b>		<b>Physical Sciences</b>		<b>Science and Technology</b>	<b>Scientific Ways of Knowing</b>
<b>K</b>	Changes in the Earth and Sky	❖ Gravity ❖ Rocks	Characteristics and Diversity of Local Plants and Animals	❖ Living Things ❖ Physical Attributes ❖ Human Impact	Characteristics of Objects and How They Move		Tools and Materials	People and their ways of knowing
<b>1</b>	Interactions between Living Things and Their Environment		Diversity and Interdependence of Plants and Animals in Ohio	❖ Adaptations ❖ Physical Changes of Living Things	Physical Interactions and Changes	❖ Magnets	Building and Using Things	People and their ways of knowing
<b>2</b>	Sky and Earth Cycles	❖ Shapes and Classifications	Interdependence and Survival of Plants and Animals in the US	❖ Needs of Living Things ❖ Extinction	Light and Sound	❖ Physical Attributes	Purpose, Process and Effect	People and their ways of knowing.

## CH-UH Content Matrix Based on ODE Content Standards

- ❖ CH-UH Content in Support of the 4<sup>th</sup> Grade Ohio Proficiency Test
- CH-UH Content in Support of the 6<sup>TH</sup> Ohio Proficiency Test

<b>Scientific Inquiry:</b> Safely Conducting Investigations, Measuring and Collecting, Formulating Conclusions, Communicating Findings								
Grade Level	Earth and Space Sciences		Life Sciences		Physical Sciences		Science Technology	Scientific Ways of Knowing
<b>3</b>	Rocks and Soil	❖ Human Impact	Animal Classifications and Adaptations	❖ Food Pyramid ❖ Nutrition ❖ Living/Non-living	Forces and Motions		Helpful and Harmful Results	Careers; Cultural Impact
<b>4</b>	Weather Erosion	❖ Weather Predictions ❖ Human Impact	Plant Classifications and Adaptations	❖ Characteristics of Living Things ❖ Adaptations to Changing Environments ❖ Nutrition	Physical Changes in Matter Chemical Changes in Matter	❖ Newton's 3 Laws ❖ Simple Machines	Technology and Human Lives	Using Results and Data
<b>5</b>	Earth and It's Place in the Solar System	➤ Planets ➤ Stars	Ecosystems Cells		Energy and Energy Transfer		Design Processes; Technology Resources and Environment	Facts and Theories; Experiments; Environmental Impacts

## CH-UH Content Matrix Based on ODE Content Standards

➤ CH-UH Content in Support of the 6<sup>th</sup> Grade Ohio Proficiency Test

**Scientific Inquiry:** Conducting Investigations, Applying Mathematics Skills, Evaluating and Analyzing Variables of Data, Drawing Valid Conclusions Based on Evidence.

	<b>Earth and Space Sciences</b>		<b>Life Sciences</b>		<b>Physical Sciences</b>		<b>Science Technology</b>	<b>Scientific Ways of Knowing</b>
<b>6</b>	Rocks and Minerals	<ul style="list-style-type: none"> <li>➤ Soil</li> <li>➤ Cycles                             <ul style="list-style-type: none"> <li>○ Sun</li> <li>○ Earth</li> <li>○ Moon</li> </ul> </li> <li>➤ Cycles                             <ul style="list-style-type: none"> <li>○ Carbon</li> <li>○ Nitrogen</li> <li>○ Water</li> </ul> </li> </ul>	Biotic Ecosystem; Cells	<ul style="list-style-type: none"> <li>➤ Human Impact                             <ul style="list-style-type: none"> <li>○ Health</li> <li>○ Behaviors</li> <li>○ Activities</li> </ul> </li> </ul>	Chemical and Physical Changes	<ul style="list-style-type: none"> <li>➤ Simple Machines                             <ul style="list-style-type: none"> <li>○ Advantages</li> <li>○ Disadvantages</li> </ul> </li> <li>➤ Motion</li> <li>➤ Matter and Energy                             <ul style="list-style-type: none"> <li>○ Transformation</li> <li>○ Conservation</li> </ul> </li> <li>➤ Patterns</li> </ul>	Technology Influences the Quality of Life	Skills of Scientific Inquiry; Science is helpful; Scientific understanding may change
<b>7</b>	Weather and Climate		Diversity and Abiotic Factors of Ecosystems		Nature of Energy		Technology Influences the Quality of Life	Skills of Scientific Inquiry; Science is helpful; Scientific understanding may change
<b>8</b>	Space: Plate Tectonics		Heredity/Similarities and Differences Among Species Survival of Species		Forces and Motion Waves		Design Solutions; Relationships between Culture, Society and Technology	Interaction of Science and Society

## Grades 9-10

### 9-10 Scientific Inquiry: Modeling Investigations

Grade Level	Earth and Space Sciences	Life Sciences	Physical Sciences	Science Technology	Scientific Ways of Knowing
9	Processes Within and On the Earth; Earth's History through Geologic Evidence; Resources	Not a focus at Grade 9	Atoms; Chemical Reactions; Physical Properties; Mixtures and Solutions; Laws of Motion; Forces; Energy; Waves	Relationship between Technology and Science; Relationship between Technology and Society	Scientific Inquiry; Scientific Theories; Scientific Literacy; Scientific Conclusions
10	Processes Within and On the Earth; Earth's History through Geologic Evidence; Resources	Cells; Genetics and DNA; Ecology; Diversity of Life; Evolution	Not a focus at Grade 10	Importance and Value of Technology	Nature of Inquiry; Ethics in Science

## Grades 11-12

### 11-12 Scientific Inquiry: Application of science processes, techniques and research

Grade Level	Earth and Space Sciences	Life Sciences	Physical Sciences	Science Technology	Scientific Ways of Knowing
11	Interactions between humans and the earth	Characteristics of organisms, evolution, populations, diversity	Matter and energy relationships	Human interactions with science and technology	Research, reviewing scientific literature, science and society
12	Not a focus at Grade 12	Cell specialization, biotechnology, DNA, evolutionary change	Electromagnetic radiation, force and motion, equilibrium	Differences between science and technology	Research, reviewing scientific literature, science and society

# Science Grade Level Indicators

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**K - 8**

## Earth and Space Sciences

**Demonstrate an understanding of how Earth systems and processes interact to sustain the habitability of Earth. This includes students demonstrating an understanding of the composition and formation of the universe, the solar system and Earth; properties and the interconnected nature of Earth's systems; energy transfer in Earth systems; processes that shape Earth and Earth's history; and how the concepts and principles of energy, matter, motion and forces explain Earth systems, the solar system and the universe.**

- 1. Understand that there are more stars in the sky than anyone can easily count.**
- 2. Observe that the sun can be seen only in the daytime, but the moon can be seen sometimes at night and sometimes during the day.**
- 3. Explore that animals and plants sometimes cause changes in their surroundings.**
- 4. Know that sometimes change is fast and sometimes change is very slow.**
- 5. Explore that short-term weather conditions can change daily.**

*4.S.13 Make predictions about the weather from observed conditions and weather maps.*

*CH-UH indicators in support of the OPT*

- 6. Demonstrate Things near the Earth fall to the ground unless something holds them up.**
- 7. Know that chunks of rocks come in many sizes and shapes from boulders to grains of sand and even smaller.**

*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*

## Life Sciences

**Students demonstrate an understanding of how living systems function and how they interact with the physical environment. This includes students demonstrating an understanding of the flow of matter and energy in living systems; the characteristics, structure, and function of cells and organisms; principles of heredity; and biological evolution and the diversity and interdependence of life.**

- 1. Distinguish between living things and things that were once living as well as between living things and non-living (never alive) things (e.g., plant-wood, plant-rock).**

*4.S.18 Distinguish between living and nonliving things and provide justification for these distinctions.*

- 2. Understand that stories sometimes give plants and animals characteristics they really do not have (e.g., talking flowers).**

- 3. Know that organisms, including people, have basic needs, which include air, water, food and space.**

*4.S.16 Demonstrate an understanding of the basic needs of living things.*

- 4. Know that plants and animals have observable features that help them live in different kinds of places**

- 5. Investigate the habitats of many different kinds of local plants and animals and some of the ways in which animals depend on plants and each other in our community.**

*4.S.17 Identify ways in which organisms react to changing environments.*

- 6. Know that plants and animals usually resemble their parents.**

- 7. Know that variations exist among individuals of the same kind of plant or animal**

*CH-UH indicators in support of the OPT*

- 8. Design developmentally appropriate relationships to man's impact on the environment.**

*4.S.14 Identify and/or describe the relationship between human activity and the environment.*

**9. Understand that most living things need water, food and air.**

*4.S.16 Demonstrate an understanding of the basic needs of living things.*

**10. Understand things in nature and things people make have very different sizes, weights, ages, and speeds.**

*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*

**11. Understand that people have different external features such as size, shape and color of hair, skin and eyes, but they are more like one another than like other animals.**

*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*

**12. Understand that some animals and plants are alike in the way they look and the things they do and others are very different from one another.**

*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*

## Physical Sciences

Students demonstrate an understanding of how physical systems are put together and the concepts and principles that describe and predict physical interactions and events in the natural world. This includes students demonstrating an understanding of the structure and properties of matter and the properties of materials and objects; chemical reactions and the conservation of matter; nature, transfer and conservation of energy; motions and the forces causing motions; nature of waves and interactions of matter and energy.

1. Demonstrate understanding that most things are made of parts.
2. Explore ways to change some properties of materials (e.g., heating, freezing, melting, mixing, cutting, breaking, dissolving, bending) but not all materials respond the same way to the same external change.  
*4.S.11 Identify characteristics of a simple physical change.*
3. Examine and describe objects according to the materials they are made of and their physical properties.  
*4.S.11 Identify characteristics of a simple physical change.*
4. Observe that change is something that happens to many things.
5. Explore that things can be made to move in many different ways such as straight, zigzag, up and down, round and round, back and forth, or fast and slow.
6. Know that the way to change how something is moving (direction and/or speed) is to give it a push or pull

## Scientific Inquiry

Students demonstrate an understanding of the use of the processes of scientific inquiry to ask questions, gather and analyze information, make inferences and predictions, and create, modify, and possibly discard some explanations. This includes students demonstrating an understanding of how to ask valid questions that can be investigated scientifically about the natural world and develop an action plan to discover the answers.

1. Ask "what if" questions.
2. Raise questions and seek answers by trying things out.
3. Explore and pursue student directed "what if" questions.
4. Create individual conclusions about group findings.  
*4.S.8 Evaluate observations and measurements made by other persons.*
5. Use appropriate safety procedures when completing scientific investigations.  
*4.S.9 Demonstrate an understanding of safe use of materials and/or devices in science activities.*
6. Measure the lengths of objects using non-standard measurement.  
*4.S.3 Identify and/or compare the mass, dimensions, and volume of familiar objects in standard and/or nonstandard units.*
7. Sort concrete objects by one or more properties.  
*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*
8. Make observations using their five senses to learn about the natural world.
9. Draw pictures that correctly portray at least some features of the item being described.
10. Recognize that numbers can be used to count any collection of things.

- 11. Explore use of appropriate tools and simple equipment/instruments to safely gather scientific data (e.g., magnifiers and other appropriate tools).**

*4.S.7 Identify and/or discuss the selection of resources and tools used for exploring scientific phenomena.*

- 12. Explore the use of simple graphs to help tell about observations.**

*4.S.8 Evaluate observations and measurements made by other persons.*

- 13. Use numbers and shapes to tell about things.**

- 14. Make new observations instead of arguing, when people give different descriptions for the same thing.**

*CH-UH indicators in support of the OPT*

- 15. Compare and contrast things through a simple system of classification i.e. trait / non-trait.**

*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*

- 16. Explore how a lot can be learned about plants and animals by observing them closely but care must be taken to know the needs of living things and how to provide for them in the classroom.**

*4.S.16 Demonstrate an understanding of the basic needs of living things.*

## Science and Technology

Students demonstrate an understanding of how scientific knowledge is used to create needed technologies to solve everyday problems and how technologies are used to expand scientific knowledge. This includes students demonstrating an understanding of the differences between natural and human-made objects; how scientific knowledge is used to create and improve design; technology design and implementing technological problem-solving procedures using appropriate tools and methods; analyzing risks and benefits; and of tradeoffs of using technology.

**1. Know objects can be sorted as "natural" or "man-made".**

*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*

**2. Know some materials can be used over and over again (e.g., plastic or glass containers, cardboard boxes and tubes).**

**3. Develop an understanding that the use of tools and machines can be helpful or harmful (e.g., scissors can be used to cut paper but they can also hurt you).**

**4. Know that each kind of tool has a special purpose.**

*4.S.7 Identify and/or discuss the selection of resources and tools used for exploring scientific phenomena.*

*CH-UH indicators in support of the OPT*

**5. Describe how magnifiers can help people see things they could not see without them.**

*4.S.7 Identify and/or discuss the selection of resources and tools used for exploring scientific phenomena.*

## Scientific Ways of Knowing

Students demonstrate an understanding of how social and historical perspectives relate to the contributions that many people make to the development of more reliable and comprehensive understandings of the natural world. This includes demonstrating an understanding that there are different ways to carry out scientific investigation; valid investigations can be repeated by many people with similar results; and scientific discovery is an ongoing process that will change ideas with new discoveries.

1. Demonstrate the understanding that scientific investigations involve asking questions (e.g., how, what if).
2. Demonstrate the understanding that people are more likely to accept your ideas if you can give good reason for them.
3. Interact with living things and the environment in ways that promote respect.  
*4.S.14 Identify and/or describe the relationship between human activity and the environment.*
4. Recognize ways science is practiced by people everyday.

## **Earth and Space Sciences**

**Demonstrate an understanding of how Earth systems and processes interact to sustain the habitability of Earth. This includes students demonstrating an understanding of the composition and formation of the universe, the solar system and Earth; properties and the interconnected nature of Earth's systems; energy transfer in Earth systems; processes that shape Earth and Earth's history; and how the concepts and principles of energy, matter, motion and forces explain Earth systems, the solar system and the universe.**

- 1. Understand that all organisms cause changes in the environment where they live; the changes can be helpful or harmful (e.g., tree roots breaking sidewalks).**
- 2. Understand that resources are things that we get from the living (e.g., forests) and nonliving ( e.g., fossil fuels) environment. Resources may meet the needs and wants of a population (e.g., families of organisms).**

## Life Sciences

**Students demonstrate an understanding of how living systems function and how they interact with the physical environment. This includes students demonstrating an understanding of the flow of matter and energy in living systems; the characteristics, structure, and function of cells and organisms; principles of heredity; and biological evolution and the diversity and interdependence of life.**

- 1. Distinguish between living things and things that were once living as well as between living things and non-living (never alive) things (e.g., plant-wood, plant-rock).**  
*4.S.18 Distinguish between living and nonliving things and provide justification for these distinctions.*
- 2. Understand that stories sometimes give plants and animals characteristics they really do not have (e.g., talking flowers).**
- 3. Know that the humans and other animals have parts that help to seek, find, and take in food when it is hungry.**
- 4. Compare and contrast the different living things that are found almost everywhere in the world**
- 5. Investigate that animals eat plants or other animals for food and may also use plants (or even other animals) for shelter and nesting.**  
*4.S.16 Demonstrate an understanding of the basic needs of living things.*
- 6. Compare and contrast the habitats of many different kinds of Ohio plants and animals and some of the ways in which animals depend on plants and each other.**
- 7. Understand that pollution can influence the health, survival, or activities of organisms.**  
*4.S.14 Identify and/or describe the relationship between human activity and the environment.*
- 8. Understand that the supply of many resources is limited but they can be extended through careful use, decreased use, reusing, and/or recycling.**

*CH-UH indicators in support of the OPT*

**9. Know that plants and animals have features that help them live in different environments.**

*4.S.17 Identify ways in which organisms react to changing environments.*

## Physical Sciences

Students demonstrate an understanding of how physical systems are put together and the concepts and principles that describe and predict physical interactions and events in the natural world. This includes students demonstrating an understanding of the structure and properties of matter and the properties of materials and objects; chemical reactions and the conservation of matter; nature, transfer and conservation of energy; motions and the forces causing motions; nature of waves and interactions of matter and energy.

**1. Classify objects according to the materials that they are made of and their physical properties.**

*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*

**2. Investigate that water can be a liquid or a solid and change from one form (phase) to another. In such changes the mass of water stays the same.**

*4.S.11 Identify characteristics of a simple physical change.*

**3. Explore changes that greatly change the properties of an object (e.g., burning paper) and changes that leave the properties largely unchanged (e.g., tearing paper).**

*4.S.11 Identify characteristics of a simple physical change.*

**4. Know that things can be done (e.g., heating, freezing, mixing, cutting, wetting, dissolving, bending, exposing to light ) to materials to change their properties.**

*4.S.11 Identify characteristics of a simple physical change.*

**5. Explain or predict the motion of an object (e.g., where it will end up).**

*4.S.12 Explain and/or predict the motion of objects and/or describe the effects of some objects on other objects.*

**6. Explore the effects of some objects on other objects, even when the two objects might not touch (e.g., wind, magnets).**

*4.S.12 Explain and/or predict the motion of objects and/or describe the effects of some objects on other objects.*

**7. Investigate a variety of ways of making things move and what causes them to change speed, direction, and/or stop.**

*4.S.12 Explain and/or predict the motion of objects and/or describe the effects of some objects on other objects.*

- 8. Demonstrate understanding that the sun is an energy source that warms the land, air, and water.
- 9. Demonstrate an understanding that energy can be obtained from many sources in many ways (e.g., eating, using gasoline, using electricity, using batteries).
- 10. Explore that energy makes things go (e.g., batteries in a toy).

*CH-UH indicators in support of the OPT*

- 11. Know that magnets can be used to make some things move without being touched.

*4.S.12 Explain and/or predict the motion of objects and/or describe the effects of some objects on other objects.*

## Scientific Inquiry

Students demonstrate an understanding of the use of the processes of scientific inquiry to ask questions, gather and analyze information, make inferences and predictions, and create, modify, and possibly discard some explanations. This includes students demonstrating an understanding of how to ask valid questions that can be investigated scientifically about the natural world and develop an action plan to discover the answers.

1. Ask "what happens when" questions.
2. Explore and pursue student directed "what if" questions.
3. Work in a small group, then share findings with others.
4. Use appropriate safety procedures when completing scientific investigations  
*4.S.9 Demonstrate an understanding of safe use of materials and/or devices in science activities.*
5. Describe and compare objects in terms of their physical properties, such as color, weight, shape, and texture.  
*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*
6. Make estimates to compare familiar lengths, weights, and time intervals.  
*4.S.3 Identify and/or compare the mass, dimensions, and volume of familiar objects in standard and/or nonstandard units.*
7. Explore use of appropriate tools and simple equipment/instruments to safely gather scientific data (e.g., magnifiers, stopwatch, simple balances, and other appropriate tools).  
*4.S.7 Identify and/or discuss the selection of resources and tools used for exploring scientific phenomena.*
8. Communicate scientific findings to others through a variety of methods (pictures, written, oral).
9. Describe things as accurately as possible so that people can compare their observations with those of others.  
*4.S.8 Evaluate observations and measurements made by other persons.*

## **Science and Technology**

**Students demonstrate an understanding of how scientific knowledge is used to create needed technologies to solve everyday problems and how technologies are used to expand scientific knowledge. This includes students demonstrating an understanding of the differences between natural and human-made objects; how scientific knowledge is used to create and improve design; technology design and implementing technological problem-solving procedures using appropriate tools and methods; analyzing risks and benefits; and of tradeoffs of using technology.**

- 1. Know that some kinds of materials are better than others for making something new.**
- 2. Materials that are better in some ways may be worse in other ways (e.g., a material used to make a school supply box may be too hard if it is too "strong" to cut and too thick to bend).**
- 3. Understand that when trying to build something or get something to work better, it usually helps to follow directions and ask someone who has done it before.**
- 4. Identify some materials that can be saved for community recycling projects (e.g., newspapers, glass, and aluminum).**
- 5. Know that people burn fuels such as wood, oil, coal, or natural gas or use electricity to cook their food and warm their homes.**
- 6. Know that people can save energy by turning things off (e.g., lights and motors) when they are not using them.**
- 7. Know that most food comes from farms as crops or as the animals that eat crops**
- 8. Know that several steps are usually needed to make things.**
- 9. Know that when parts are put together they can do things that they could not do by themselves.**
- 10. Investigate that tools are used to help make things and some things cannot be made without tools.**

## Scientific Ways of Knowing

Students demonstrate an understanding of how social and historical perspectives relate to the contributions that many people make to the development of more reliable and comprehensive understandings of the natural world. This includes demonstrating an understanding that there are different ways to carry out scientific investigation; valid investigations can be repeated by many people with similar results; and scientific discovery is an ongoing process that will change ideas with new discoveries.

1. Demonstrate the understanding that when a science investigation is done the way it was done before, we expect to get a very similar result.
2. Recognize that good explanations are based on evidence from investigations and observations.
3. Demonstrate the understanding that scientists use different kinds investigations depending on the questions they are trying to answer.  
*4.S.6 Evaluate a simple procedure to carry out an exploration.*
4. Explore how everybody can do science, invent things, and have scientific ideas, no matter where they are.

## Earth and Space Sciences

**Demonstrate an understanding of how Earth systems and processes interact to sustain the habitability of Earth. This includes students demonstrating an understanding of the composition and formation of the universe, the solar system and Earth; properties and the interconnected nature of Earth's systems; energy transfer in Earth systems; processes that shape Earth and Earth's history; and how the concepts and principles of energy, matter, motion and forces explain Earth systems, the solar system and the universe.**

**1. Know and understand that the sun, moon, and stars all appear to move slowly across the sky.**

*4.S.5 Analyze a series of events and/or simple daily or seasonal cycles and predict the next likely occurrence in the sequence.*

**2. Observe and understand that the moon appears a little different every day, but looks the same again about every four weeks.**

*4.S.5 Analyze a series of events and/or simple daily or seasonal cycles and predict the next likely occurrence in the sequence.*

**3. Observe and investigate that smaller rocks come from the break down of larger rocks through the actions of plants, animals, and weather**

*4.S.15 Identify evidence and show examples of changes in the earth's surface.*

**4. Compare and contrast different sizes and shapes of rocks (e.g., boulders, pebbles, sand).**

*4.S.3 Identify and/or compare the mass, dimensions, and volume of familiar objects in standard and/or nonstandard units.*

**5. Describe weather changes. Observe that some weather changes occur from day to day and some changes occur in a repeating pattern.**

*4.S.13 Make predictions about the weather from observed conditions and weather maps.*

**6. Describe weather by measurable quantities, such as temperature, wind direction and speed, and precipitation.**

*4.S.13 Make predictions about the weather from observed conditions and weather maps.*

**7. Investigate that soils are often found in layers.**

**8. Observe and describe that soil consists of small pieces of rock and decomposed pieces of plants and animals.**

*4.S.15 Identify evidence and show examples of changes in the earth's surface.*

*CH-UH indicators in support of the OPT*

**9. Demonstrate how shapes such as circles, squares, and triangles can be used to describe many things that can be seen.**

*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*

## Life Sciences

**Students demonstrate an understanding of how living systems function and how they interact with the physical environment. This includes students demonstrating an understanding of the flow of matter and energy in living systems; the characteristics, structure, and function of cells and organisms; principles of heredity; and biological evolution and the diversity and interdependence of life.**

- 1. Know and understand that animals, including people, need air, food, water and space, and that plants need air, water, nutrients, space and light to survive.**

*4.S.16 Demonstrate an understanding of the basic needs of living things.*

- 2. Distinguish between plants and animals (e.g., plants need sunlight to make food and to grow, animals eat plants and/or other animals for food).**

- 3. Recognize that plants and animals have features that help them live in different environments. (e.g., lungs, gills, and microscopic holes in leaves to breathe)**

*4.S.17 Identify ways in which organisms react to changing environments.*

- 4. Compare and contrast the habitats of many different kinds of national plants and animals and some of the ways in which animals depend on plants and each other.**

- 5. Compare and contrast the activities of local common animals (e.g., squirrels, chipmunks, butterflies, bees, ants, bats, and frogs) during summer and winter by describing changes in their behaviors and body covering.**

*4.S.5 Analyze a series of events and/or simple daily or seasonal cycles and predict the next likely occurrence in the sequence.*

- 6. Observe and understand that extinct organisms may resemble organisms that are alive today.**

- 7. Observe and explore that fossils provide evidence about plants and animals that lived long ago and the nature of the environment at that time.**

- 8. Identify the many distinct environments that support different kinds of organisms and understand that organisms can survive only in environments that meet their needs.**

*4.S.17 Identify ways in which organisms react to changing environments.*

- 9. Know that many kinds of organisms that once lived on earth have disappeared and have disappeared for different reasons (e.g., natural forces, human caused effects).**

*4.S.14 Identify and/or describe the relationship between human activity and the environment.*

*4.S.17 Identify ways in which organisms react to changing environments.*

- 10. Compare and contrast how some animals and people and plants are alike (the way they look and in the things they do), and how they are very different from one another.**

*CH-UH indicators in support of the OPT*

- 11. Understand how eating a variety of healthful foods and getting enough exercise and rest help people to stay healthy.**

*4.S.19 Analyze and/or evaluate various nutritional plans for humans.*

- 12. Understand that plants and animals both need to take in water, and animals need to take in food. In addition, plants need light.**

*4.S.16 Demonstrate an understanding of the basic needs of living things.*

## Physical Sciences

Students demonstrate an understanding of how physical systems are put together and the concepts and principles that describe and predict physical interactions and events in the natural world. This includes students demonstrating an understanding of the structure and properties of matter and the properties of materials and objects; chemical reactions and the conservation of matter; nature, transfer and conservation of energy; motions and the forces causing motions; nature of waves and interactions of matter and energy.

1. Know how things make sound.
2. Explore and describe sounds (e.g., high, low, soft, loud, pleasant, noisy) produced by vibrating objects
3. Explore with flashlights and shadows that light travels in a straight line until it strikes an object.

*CH-UH indicators in support of the OPT*

4. Describe and compare things in terms of number, shape, texture, size, weight, color, and motion.

*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*

## Scientific Inquiry

Students demonstrate an understanding of the use of the processes of scientific inquiry to ask questions, gather and analyze information, make inferences and predictions, and create, modify, and possibly discard some explanations. This includes students demonstrating an understanding of how to ask valid questions that can be investigated scientifically about the natural world and develop an action plan to discover the answers.

1. Ask "how can I/we" questions.
2. Ask "how do you know" questions (not "WHY" questions) in appropriate situations and attempt reasonable answers when others ask questions.
3. Explore and pursue student directed "how" questions.
4. Use evidence to develop, explanations of scientific investigations.  
*4.S.8 Evaluate observations and measurements made by other persons.*
5. Explore how explanations generated in response to observations, events, and phenomena are based on evidence (e.g., What do you think? Why do you think it?).
6. Use appropriate safety procedures when completing scientific investigations.  
*4.S.9 Demonstrate an understanding of safe use of materials and/or devices in science activities.*
7. Measure properties of objects using tools such as rulers, balances, and thermometers.  
*4.S.7 Identify and/or discuss the selection of resources and tools used for exploring scientific phenomena.*
8. Explore the use of whole numbers in ordering, counting, identifying, measuring, and describing things and experiences.

- 9. Explore use of appropriate tools and simple equipment/instruments to safely gather scientific data (e.g., magnifiers, non-breakable thermometers, clock, rulers, balances, calculators and other appropriate tools).**

*4.S.7 Identify and/or discuss the selection of resources and tools used for exploring scientific phenomena.*

- 10. Demonstrate the understanding that sharing explanations provides others the opportunity to ask questions, examine evidence, and suggest alternative explanations.**

*CH-UH indicators in support of the OPT*

- 11. Utilize a simple dichotomous key.**

*4.S.4 Use a simple key to distinguish between objects.*

## Science and Technology

Students demonstrate an understanding of how scientific knowledge is used to create needed technologies to solve everyday problems and how technologies are used to expand scientific knowledge. This includes students demonstrating an understanding of the differences between natural and human-made objects; how scientific knowledge is used to create and improve design; technology design and implementing technological problem-solving procedures using appropriate tools and methods; analyzing risks and benefits; and of tradeoffs of using technology.

1. Understand when a group wants to build something or try something new, they should try to figure out ahead of time how it might affect other people and the environment.

*4.S.14 Identify and/or describe the relationship between human activity and the environment.*

2. Understand that people make new products and invent new ways to meet individual needs and wants.
3. Is aware that technology involves risks and benefits.
4. Understand that the design process should include oral, written, and pictorial communication of the process and

## **Scientific Ways of Knowing**

**Students demonstrate an understanding of how social and historical perspectives relate to the contributions that many people make to the development of more reliable and comprehensive understandings of the natural world. This includes demonstrating an understanding that there are different ways to carry out scientific investigation; valid investigations can be repeated by many people with similar results; and scientific discovery is an ongoing process that will change ideas with new discoveries.**

- 1. Describe that science investigations generally work the same way in different places.**
- 2. Recognize that scientists review and ask questions about the results of other scientists' work.**
- 3. People should try to figure out ahead of time how their solution might affect others.**
- 4. Discuss how men and women everywhere have found doing science rewarding both as a career and in their everyday lives.**

## Earth and Space Sciences

**Demonstrate an understanding of how Earth systems and processes interact to sustain the habitability of Earth. This includes students demonstrating an understanding of the composition and formation of the universe, the solar system and Earth; properties and the interconnected nature of Earth's systems; energy transfer in Earth systems; processes that shape Earth and Earth's history; and how the concepts and principles of energy, matter, motion and forces explain Earth systems, the solar system and the universe.**

- 1. Describe the distinct properties of rocks (e.g., color, layering, texture).**
- 2. Describe the composition and properties of soil (e.g., soil contains weathered rock, living organisms, products of plants and animals; properties of soil such as color, texture, capacity to retain water, ability to support plant growth).**

*CH-UH indicators in support of the OPT*

- 3. Determine ways that humans impact the environment, (eg. pollution;erosion, argricultural activities).**

*4.S.14 Identify and/or describe the relationship between human activity and the environment.*

- 4. Know the advantages/disadvantages of the human impact on the environment.**

*4.S.14 Identify and/or describe the relationship between human activity and the environment.*

## Life Sciences

**Students demonstrate an understanding of how living systems function and how they interact with the physical environment. This includes students demonstrating an understanding of the flow of matter and energy in living systems; the characteristics, structure, and function of cells and organisms; principles of heredity; and biological evolution and the diversity and interdependence of life.**

**1. Classify common animals according to their observable characteristics (e.g., body coverings and structure).**

*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*

**2. Describe the life cycles of different animals from birth, developing into adults, reproducing, and dying (e.g., egg-tadpole-frog, egg-caterpillar-chrysalis-butterfly).**

*4.S.5 Analyze a series of events and/or simple daily or seasonal cycles and predict the next likely occurrence in the sequence.*

**3. Identify that characteristics received from parents make offspring similar to their parents.**

**4. Trace how green plants depend on sunlight, and all animals depend on plants. Some animals eat plants for food. Other animals eat animals that eat the plants (e.g., food chain).**

**5. Describe how changes in an organism's habitat are sometimes beneficial to it and sometimes harmful.**

*4.S.17 Identify ways in which organisms react to changing environments.*

**6. Analyze animal adaptations that serve specific survival functions (e.g., obtaining food, escaping, or hiding from**

*4.S.17 Identify ways in which organisms react to changing environments.*

*CH-UH indicators in support of the OPT*

**7. Distinguish Living and Non-living things according to the six characteristics of living things.**

*4.S.18 Distinguish between living and nonliving things and provide justification for these distinctions.*

**8. Read and analyze nutritional fact labels**

*4.S.19 Analyze and/or evaluate various nutritional plans for humans.*

**9. Understand the food pyramid.**

*4.S.19 Analyze and/or evaluate various nutritional plans for humans.*

## Physical Sciences

**Students demonstrate an understanding of how physical systems are put together and the concepts and principles that describe and predict physical interactions and events in the natural world. This includes students demonstrating an understanding of the structure and properties of matter and the properties of materials and objects; chemical reactions and the conservation of matter; nature, transfer and conservation of energy; motions and the forces causing motions; nature of waves and interactions of matter and energy.**

- 1. Explain how objects are put into motion by pushes or pulls and the change in motion (e.g., direction, leading to circular motion) depends on the strength of the push or pull.**

*4.S.12 Explain and/or predict the motion of objects and/or describe the effects of some objects on other objects.*

- 2. Describe that how fast things move varies greatly (e.g., some things are so slow that their journey takes a long time (plant movement toward light; others move too fast for people to see them easily (cartoon flip books, tuning forks).**

- 3. Describe how electrically charged materials and magnets attract and repel each other and certain kinds of other materials.**

*4.S.12 Explain and/or predict the motion of objects and/or describe the effects of some objects on other objects.*

- 4. Recognize the earth's gravity pulls a thrown or dropped object towards the earth, and that there are contact forces and non-contact forces.**

*4.S.12 Explain and/or predict the motion of objects and/or describe the effects of some objects on other objects.*

- 5. Predict what will change and what will remain unchanged when an object experiences a force such as friction.**

*4.S.12 Explain and/or predict the motion of objects and/or describe the effects of some objects on other objects.*

## Scientific Inquiry

Students demonstrate an understanding of the use of the processes of scientific inquiry to ask questions, gather and analyze information, make inferences and predictions, and create, modify, and possibly discard some explanations. This includes students demonstrating an understanding of how to ask valid questions that can be investigated scientifically about the natural world and develop an action plan to discover the answers.

**1. Demonstrate the understanding that length can be thought of as unit lengths joined together and weight can be thought of as a collection of units (standard).**

**2. Discuss observations and measurements made by other people.**

*4.S.8 Evaluate observations and measurements made by other persons.*

**3. Read and interpret simple tables and graphs produced by self/others.**

*4.S.8 Evaluate observations and measurements made by other persons.*

**4. Use oral, written, and pictorial representation to communicate their work.**

**5. Record and organize observations made (e.g., journals, charts, tables).**

*4.S.2 Select instruments to make observations and/or organize observations of an event, object, or organism.*

**6. Identify and apply science safety procedures.**

*4.S.9 Demonstrate an understanding of safe use of materials and/or devices in science activities.*

*CH-UH indicators in support of the OPT*

**7. Conduct simple experiments to answer questions.**

*4.S.6 Evaluate a simple procedure to carry out an exploration.*

**8. Measure mass, length, and volume using metric units.**

*4.S.3 Identify and/or compare the mass, dimensions, and volume of familiar objects in standard and/or nonstandard units.*

**9. Identify resources and tools used for exploring scientific phenomena.**

*4.S.7 Identify and/or discuss the selection of resources and tools used for exploring scientific phenomena.*

## Science and Technology

Students demonstrate an understanding of how scientific knowledge is used to create needed technologies to solve everyday problems and how technologies are used to expand scientific knowledge. This includes students demonstrating an understanding of the differences between natural and human-made objects; how scientific knowledge is used to create and improve design; technology design and implementing technological problem-solving procedures using appropriate tools and methods; analyzing risks and benefits; and of tradeoffs of using technology.

1. Demonstrate the understanding that when using technology, results can be helpful or harmful, and these results may affect the individual, family, and community.

## Scientific Ways of Knowing

Students demonstrate an understanding of how social and historical perspectives relate to the contributions that many people make to the development of more reliable and comprehensive understandings of the natural world. This includes demonstrating an understanding that there are different ways to carry out scientific investigation; valid investigations can be repeated by many people with similar results; and scientific discovery is an ongoing process that will change ideas with new discoveries.

1. Recognize that there are many careers in science.
2. Recognize how men and women of all countries and cultures have contributed to the development of science (e.g., student literature).

# Science Grade Level Indicators

## Earth and Space Sciences

**Demonstrate an understanding of how Earth systems and processes interact to sustain the habitability of Earth. This includes students demonstrating an understanding of the composition and formation of the universe, the solar system and Earth; properties and the interconnected nature of Earth's systems; energy transfer in Earth systems; processes that shape Earth and Earth's history; and how the concepts and principles of energy, matter, motion and forces explain Earth systems, the solar system and the universe.**

- 1. Compare how waves, wind, water, and ice shape and reshape the earth's land surface by eroding rock and soil in some areas and depositing them in other areas.**

*4.S.15 Identify evidence and show examples of changes in the earth's surface.*

- 2. Identify how freezing, thawing, and plant growth reshape the land surface by weathering rock.**

*4.S.15 Identify evidence and show examples of changes in the earth's surface.*

- 3. Describe evidence of changes on the earth's surface (e.g., volcanoes, earthquakes/cracks/faults, mountain building, erosion, deposition, and weathering).**

*4.S.15 Identify evidence and show examples of changes in the earth's surface.*

- 4. Living organisms contribute to the weathering of rocks and can affect the rate of erosion (e.g., lichens, tree roots).**

*4.S.15 Identify evidence and show examples of changes in the earth's surface.*

- 5. Explain air surrounds us, takes up space and moves around us as wind.**

- 6. Identify how water exists in the air in different forms (e.g., in clouds and fog as tiny droplets; in rain, snow and hail) and changes from one form to another through various processes (e.g., freezing/ condensation, precipitation, evaporation).**

*4.S.5 Analyze a series of events and/or simple daily or seasonal cycles and predict the next likely occurrence in the sequence.*

- 7. Analyze how weather changes from day to day and over the seasons. Weather can be described by measurable quantities such as temperature, wind direction and speed, and precipitation.**

*4.S.13 Make predictions about the weather from observed conditions and weather maps.*

**8. Trace how weather patterns generally move from west to east in the United States.**

*4.S.13 Make predictions about the weather from observed conditions and weather maps.*

**9. Record local weather information on a calendar or map and describe changes over a period of time (e.g., temperature, precipitation symbols, cloud conditions).**

*4.S.13 Make predictions about the weather from observed conditions and weather maps.*

*CH-UH indicators in support of the OPT*

**10. Identify and/or describe the relationship between human activity and the environment.**

*4.S.14 Identify and/or describe the relationship between human activity and the environment.*

**11. Interpret and predict the weather.**

*4.S.13 Make predictions about the weather from observed conditions and weather maps.*

## Life Sciences

**Students demonstrate an understanding of how living systems function and how they interact with the physical environment. This includes students demonstrating an understanding of the flow of matter and energy in living systems; the characteristics, structure, and function of cells and organisms; principles of heredity; and biological evolution and the diversity and interdependence of life.**

**1. Classify common plants according to their characteristics (e.g., tree leaves, flowers, seeds, tubers, and bulbs).**

*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*

**2. Describe the life cycles of different plants from germination, developing into adults, reproducing, and dying.**

*4.S.5 Analyze a series of events and/or simple daily or seasonal cycles and predict the next likely occurrence in the sequence.*

**3. Analyze plant adaptations that serve specific functions: growth, survival, and reproduction.**

*4.S.17 Identify ways in which organisms react to changing environments.*

**4. Compare how individuals of the same kind differ in their characteristics and sometimes the differences give individuals an advantage in survival. (e.g., animals with the most fat may survive bad winters, the faster antelope may out run the cheetah).**

*CH-UH indicators in support of the OPT*

**5. Understand the basic needs of living things.**

*4.S.16 Demonstrate an understanding of the basic needs of living things.*

**6. Justify Living and Non-living things based on the six characteristics of living things.**

*4.S.18 Distinguish between living and nonliving things and provide justification for these distinctions.*

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# Science Grade Level Indicators

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- 7. Explain how food provides energy and materials for growth and repair of body parts. Vitamins and minerals, present in small amounts in foods, are essential to keep everything working well. As people grow up, the amounts and kinds of food and exercise needed by the body may change.**

*4.S.19 Analyze and/or evaluate various nutritional plans for humans.*

- 8. Analyze and/or evaluate various nutritional plans for humans.**

*4.S.19 Analyze and/or evaluate various nutritional plans for humans.*

- 9. Identify ways in which organisms react to changing environments.**

*4.S.17 Identify ways in which organisms react to changing environments.*

## Physical Sciences

Students demonstrate an understanding of how physical systems are put together and the concepts and principles that describe and predict physical interactions and events in the natural world. This includes students demonstrating an understanding of the structure and properties of matter and the properties of materials and objects; chemical reactions and the conservation of matter; nature, transfer and conservation of energy; motions and the forces causing motions; nature of waves and interactions of matter and energy.

- 1. Explain how different materials can be made from the same basic substances(e.g., bread, cake, cookies made from flour, sugar), but the properties of the new material may be different from the original materials.**
- 2. Identify characteristics of a simple physical change (e.g., heating or cooling can change water from one state to**  
*4.S.11 Identify characteristics of a simple physical change.*
- 3. Identify characteristics of a simple chemical change. When a new material is made by combining two or more materials, it has chemical properties that are different from the original materials (e.g., burning paper, rusting steel wool).**
- 4. Explain that all materials are composed of fundamental parts that are too small to be seen without magnification.**
- 5. Describe objects by the properties of the materials from which they are made, and that these properties can be used to separate or sort a group of objects or materials (e.g., paper, glass, plastic, metal ).**  
*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*
- 6. Explain that matter has different states (i.e., solid, liquid, and gas) and that each state has distinct physical properties.**  
*4.S.11 Identify characteristics of a simple physical change.*

*CH-UH indicators in support of the OPT*

- 7. Understand Newton’s three laws of motion.**

*4.S.12 Explain and/or predict the motion of objects and/or describe the effects of some objects on other objects.*

**8. Identify the six simple machines.**

*4.S.10 Explain the operation of a simple mechanical device.*

**9. Explain the operation of a simple mechanical device.**

*4.S.10 Explain the operation of a simple mechanical device.*

**10. Describe how each simple machine is used.**

*4.S.10 Explain the operation of a simple mechanical device.*

# Science Grade Level Indicators

## Scientific Inquiry

Students demonstrate an understanding of the use of the processes of scientific inquiry to ask questions, gather and analyze information, make inferences and predictions, and create, modify, and possibly discard some explanations. This includes students demonstrating an understanding of how to ask valid questions that can be investigated scientifically about the natural world and develop an action plan to discover the answers.

- 1. Demonstrate the understanding that length can be thought of as unit lengths joined together, area as a collection of unit squares, and weight can be thought of as a collection of units (standard).**
- 2. Make and use inferences of a cycle, pattern, object, and/or event.**

*4.S.5 Analyze a series of events and/or simple daily or seasonal cycles and predict the next likely occurrence in the sequence.*
- 3. Analyze a series of events and/or simple daily or seasonal cycles, describe the patterns, and predict the next likely occurrence.**

*4.S.5 Analyze a series of events and/or simple daily or seasonal cycles and predict the next likely occurrence in the sequence.*
- 4. Create categories and use simple keys to organize objects, organisms, events, and observations.**

*4.S.1 Create and use categories to organize a set of objects, organisms or phenomena.*  
*4.S.4 Use a simple key to distinguish between objects.*
- 5. Begin to formulate instructions that others can follow in carrying out a procedure in ways that allow others to repeat investigation.**

*4.S.6 Evaluate a simple procedure to carry out an exploration.*
- 6. Develop, design, and conduct simple experiments to answer questions.**

*4.S.6 Evaluate a simple procedure to carry out an exploration.*
- 7. Recognize when comparisons may not be fair because some conditions are not kept the same.**

*4.S.6 Evaluate a simple procedure to carry out an exploration.*

**8. Use carefully recorded data and/or repeated trials to help others understand investigations.**

*4.S.2 Select instruments to make observations and/or organize observations of an event, object, or organism.*

*CH-UH indicators in support of the OPT*

**9. Demonstrate an understanding of safe use of materials and/or devices in science activities.**

*4.S.9 Demonstrate an understanding of safe use of materials and/or devices in science activities.*

**10. Choose appropriate tools with which to do an experiment.**

*4.S.7 Identify and/or discuss the selection of resources and tools used for exploring scientific phenomena.*

**11. Identify and/or compare the mass, dimension, and volume of familiar objects in standard and/or non-standard units.**

*4.S.3 Identify and/or compare the mass, dimensions, and volume of familiar objects in standard and/or nonstandard units.*

**12. Read charts, data, and tables and draw conclusions from the data that is read.**

*4.S.2 Select instruments to make observations and/or organize observations of an event, object, or organism.*

## **Science and Technology**

**Students demonstrate an understanding of how scientific knowledge is used to create needed technologies to solve everyday problems and how technologies are used to expand scientific knowledge. This includes students demonstrating an understanding of the differences between natural and human-made objects; how scientific knowledge is used to create and improve design; technology design and implementing technological problem-solving procedures using appropriate tools and methods; analyzing risks and benefits; and of tradeoffs of using technology.**

- 1. Summarize how agricultural technology has improved human lives (e.g., in order to grow well, plants need enough warmth, light, and water, and must be protected from weeds and pests that can harm them).**
- 2. Demonstrate an understanding of areas in which technology has improved human lives (e.g., transportation, communication, nutrition, sanitation, health care, agriculture, entertainment).**
- 3. Investigate how technology and inventions change to meet peoples' needs and wants.**

## Scientific Ways of Knowing

Students demonstrate an understanding of how social and historical perspectives relate to the contributions that many people make to the development of more reliable and comprehensive understandings of the natural world. This includes demonstrating an understanding that there are different ways to carry out scientific investigation; valid investigations can be repeated by many people with similar results; and scientific discovery is an ongoing process that will change ideas with new discoveries.

### 1. Distinguish between fact and opinion.

*4.S.2 Select instruments to make observations and/or organize observations of an event, object, or organism.*

### 2. Observe the results and data from an investigation and make a reasonable explanation or conclusion.

*4.S.8 Evaluate observations and measurements made by other persons.*

## Earth and Space Sciences

**Demonstrate an understanding of how Earth systems and processes interact to sustain the habitability of Earth. This includes students demonstrating an understanding of the composition and formation of the universe, the solar system and Earth; properties and the interconnected nature of Earth's systems; energy transfer in Earth systems; processes that shape Earth and Earth's history; and how the concepts and principles of energy, matter, motion and forces explain Earth systems, the solar system and the universe.**

**1. Describe how night and day are caused by the earth's rotation.**

*6.S.11 Describe simple cycles of the earth, sun, and moon.*

**2. Explain how earth is one of several planets that orbit the sun and the moon orbits the earth.**

*6.S.11 Describe simple cycles of the earth, sun, and moon.*

**3. Describe how shadows change with the position of the sun in the sky during the day.**

*6.S.11 Describe simple cycles of the earth, sun, and moon.*

**4. Describe the characteristics of planet earth (e.g., third planet from the sun, three-fourths covered by a relatively thin layer of water "some of it frozen" and the entire planet surrounded by a thin blanket of air ).**

**5. Recognize that the supply of many resources is limited. If used, resources can be extended through reducing, reusing, and recycling.**

*6.S.9 provide examples of transformation and/or conservation of matter and energy in simple physical systems*

**6. Analyze how the benefits of the earth's resources (e.g., fresh water, air, soil and trees) can be reduced by using them wastefully or by deliberately or inadvertently destroying them (e.g., cleaning up polluted air water or soil or restoring depleted soil, forests, or fishing grounds can be very difficult and costly).**

*CH-UH indicators in support of the OPT*

**7. Know that like all planets and stars, the earth is approximately spherical in shape.**

*6.S.10 Identify simple patterns in physical phenomena.*

**8. Know that planets change their position against the background of stars.**

*6.S.10 Identify simple patterns in physical phenomena.*

**9. Describe how a large light source at a great distance looks like a small light source that is much closer.**

*6.S.10 Identify simple patterns in physical phenomena.*

## Life Sciences

**Students demonstrate an understanding of how living systems function and how they interact with the physical environment. This includes students demonstrating an understanding of the flow of matter and energy in living systems; the characteristics, structure, and function of cells and organisms; principles of heredity; and biological evolution and the diversity and interdependence of life.**

- 1. Explain how organisms are made of cells (many organisms are made of a single cell; others, including plants and animals, are made of many cells), which are the fundamental units of life, whose details are usually only visible through a microscope.**
- 2. Identify different body tissues and organs and that they are made up of different kinds of cells. (e.g., fat, smooth muscle, skeletal muscle, heart, intestine)**
- 3. Explain that living organisms have distinct structures and body systems that serve specific functions in growth, survival, and reproduction (e.g., various body structures for walking, flying, or swimming).**

*6.S.15 Compare and/or contrast the diversity of ways in which living things meet their needs.*
- 4. Trace the organization of simple food chains and food webs (e.g., green plants (producers) make their own food with sunlight, water, and air; some animals eat the plants (herbivores); some animals eat the animals that eat the plants (carnivores), some animals eat plants and animals (omnivores), and some organisms - primarily, bacteria, fungi, worms and some insects - (decomposers) eat dead organisms or waste materials).**

*6.S.14 Trace the transmission of energy in a small, simple ecosystem and/or identify the roles of organisms in the energy movement in an ecosystem.*
- 5. Summarize that organisms can survive only in environments in which their needs (e.g., food, water, air, and a way to dispose of waste) can be met. The world has different environments, and distinct environments support the life of different types of organisms.**

*6.S.15 Compare and/or contrast the diversity of ways in which living things meet their needs.*

**6. Explain how populations have limits to growth determined by space, food, and number of predators.**

*6.S.15 Compare and/or contrast the diversity of ways in which living things meet their needs.*

**7. Support how an organism's patterns of behavior are related to the nature of that organism's environment, including the kinds and numbers of other organisms present, the availability of food and resources, and the changing physical characteristics of the environment.**

*6.S.15 Compare and/or contrast the diversity of ways in which living things meet their needs.*

**8. Analyze how all organisms (including humans) cause changes in their environments, and these changes can be beneficial or detrimental. (e.g., beaver ponds, earthworm burrows, squirrels hiding nuts, grasshoppers eating all plants, caterpillars eating too many leaves in a forest).**

*6.S.17 Analyze the impacts of human activity on the ecosystems of the earth.*

## Physical Sciences

Students demonstrate an understanding of how physical systems are put together and the concepts and principles that describe and predict physical interactions and events in the natural world. This includes students demonstrating an understanding of the structure and properties of matter and the properties of materials and objects; chemical reactions and the conservation of matter; nature, transfer and conservation of energy; motions and the forces causing motions; nature of waves and interactions of matter and energy.

1. Compare the ways the temperature of an object can be raised (e.g., rubbing, burning, bending, and cutting).
2. Trace how thermal energy can transfer from one object to another by conduction.  
*6.S.9 provide examples of transformation and/or conservation of matter and energy in simple physical systems*
3. Support the fact that a warmer object can warm a cooler one by contact or at a distance.  
*6.S.9 provide examples of transformation and/or conservation of matter and energy in simple physical systems*
4. Explain how some materials conduct heat much better than others (e.g., metal, wood, glass) do.  
*6.S.9 provide examples of transformation and/or conservation of matter and energy in simple physical systems*
5. Describe how electrical current in a circuit produces magnetic forces.
6. Trace how electrical current flows by creating a simple electric circuit that will light two bulbs.
7. Explain that light and sound can be reflected, refracted, or absorbed.
8. Describe observations of the bending of light (e.g., a prism, a glass of water).
9. Describe how changing the rate of vibration can vary the pitch of the sound.
10. Explore how light and sound energy travel in waves.

## Scientific Inquiry

Students demonstrate an understanding of the use of the processes of scientific inquiry to ask questions, gather and analyze information, make inferences and predictions, and create, modify, and possibly discard some explanations. This includes students demonstrating an understanding of how to ask valid questions that can be investigated scientifically about the natural world and develop an action plan to discover the answers.

- 1. Use simple instruments to make observations (rulers, thermometers, watches, balances, spring scales, magnifiers, microscopes, calculators, and other appropriate tools) and to conduct investigations and communicate findings.**
- 2. Evaluate observations and measurements made by other persons, and identify reasons for any discrepancies.**  
*6.S.5 Evaluate conclusions based on scientific data.*
- 3. Choose appropriate metric units to measure length, volume, and mass.**
- 4. Use evidence and observations to explain and communicate the results of investigations.**  
*6.S.5 Evaluate conclusions based on scientific data.*
- 5. Identify one or two variables in a simple experiment or investigation.**
- 6. Identify potential hazards and/or precautions involved in scientific investigations.**  
*6.S.2 Identify the potential hazards and/or precautions involved in scientific investigations.*
- 7. Explain why results of an experiment are sometimes different (e.g., sometimes this is because of unexpected differences in the things being investigated, unrealized differences in the methods used, or in the circumstances in which the investigation was carried out, and sometimes just because of uncertainties or errors in observations).**  
*6.S.5 Evaluate conclusions based on scientific data.*
- 8. Demonstrate the understanding that scientists use different kinds of ongoing investigations (e.g., observations of things or events in nature, data collection, controlled experiments), depending on the questions they are trying to answer.**

## Science and Technology

Students demonstrate an understanding of how scientific knowledge is used to create needed technologies to solve everyday problems and how technologies are used to expand scientific knowledge. This includes students demonstrating an understanding of the differences between natural and human-made objects; how scientific knowledge is used to create and improve design; technology design and implementing technological problem-solving procedures using appropriate tools and methods; analyzing risks and benefits; and of tradeoffs of using technology.

- 1. Describe how people try to conserve energy in order to slow down the depletion of energy sources, save money, and/or reduce pollution.**  
*6.S.17 Analyze the impacts of human activity on the ecosystems of the earth.*
- 2. Explain how it is sometimes possible to use materials in discarded products to make new products, but knows that materials differ widely in the ease with which they can be recycled.**  
*6.S.17 Analyze the impacts of human activity on the ecosystems of the earth.*
- 3. Debate positive and negative impacts of human activity and technology on the environment.**  
*6.S.4 Identify the positive and/or negative impacts of technology on human activity.*
- 4. Describe, illustrate, and assess the design process (identifying the problem, designing a solution, and evaluating a design).**

## Scientific Ways of Knowing

Students demonstrate an understanding of how social and historical perspectives relate to the contributions that many people make to the development of more reliable and comprehensive understandings of the natural world. This includes demonstrating an understanding that there are different ways to carry out scientific investigation; valid investigations can be repeated by many people with similar results; and scientific discovery is an ongoing process that will change ideas with new discoveries.

**1. Demonstrate the understanding that conclusions and facts change as new knowledge is gained.**

*6.S.5 Evaluate conclusions based on scientific data.*

**2. Develop descriptions, explanations, predictions and models using evidence to defend/support findings.**

*6.S.3 Make inferences from observation of phenomena and/or events.*

**3. Demonstrate the understanding that an experiment must be replicated by different persons or at different times or places and yield consistent results before the results are accepted.**

*6.S.5 Evaluate conclusions based on scientific data.*

**4. Debate positive and negative impacts of human activity on the environment.**

*6.S.17 Analyze the impacts of human activity on the ecosystems of the earth.*

## Earth and Space Sciences

**Demonstrate an understanding of how Earth systems and processes interact to sustain the habitability of Earth. This includes students demonstrating an understanding of the composition and formation of the universe, the solar system and Earth; properties and the interconnected nature of Earth's systems; energy transfer in Earth systems; processes that shape Earth and Earth's history; and how the concepts and principles of energy, matter, motion and forces explain Earth systems, the solar system and the universe.**

**1. Know that fossils provide important evidence of how life and environmental conditions have changed.**

*6.S.3 Make inferences from observation of phenomena and/or events.*

**2. Know how to identify minerals by their characteristic properties.**

*6.S.12 Identify characteristics and/or patterns in rocks and soil.*

**3. Knows that rocks are made of one or more minerals.**

*6.S.12 Identify characteristics and/or patterns in rocks and soil.*

**4. Know the rock cycle and that there are sedimentary, igneous and metamorphic rocks which have distinct properties (e.g., color, texture) and are formed in different ways.**

*6.S.12 Identify characteristics and/or patterns in rocks and soil.*

**5. Know that sedimentary rock is usually deposited in layers with the oldest layers on the bottom and the youngest layers on the top. Thousands of layers of sedimentary rocks confirm the long history of the changing surface of the earth.**

*6.S.12 Identify characteristics and/or patterns in rocks and soil.*

*CH-UH indicators in support of the OPT*

**6. Know that the sun's gravitational pull holds the earth and other planets in their orbits, just as the planets' gravitational pull keeps their moons in orbit around them.**

*6.S.7 Predict the influence of the motion of some objects on other objects.*

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# Science Grade Level Indicators

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- 7. Explain and give examples of how a force acts toward a single center, the object's path may curve into an orbit around the center.**

*6.S.7 Predict the influence of the motion of some objects on other objects.*

- 8. Describe and predict how an unbalanced force acting on an object changes its speed or path of motion, or both.**

*6.S.7 Predict the influence of the motion of some objects on other objects.*

- 9. Explain how the moon's orbit around the earth once in about 28 days changes what part of the moon the sun and how much of that part can be seen from the earth light. These different shapes known as phases of the moon.**

*6.S.11 Describe simple cycles of the earth, sun, and moon.*

- 10. Know that the sun is many thousands of times closer to the earth than any other star. Light from the sun takes a few minutes to reach the earth.**

*6.S.3 Make inferences from observation of phenomena and/or events.*

- 11. Demonstrate an understanding of the cycling of resources on earth, such as carbon, nitrogen, and/or water.**

*6.S.13 Demonstrate an understanding of the cycling of resources on earth, such as carbon, nitrogen, and/or water.*

- 12. Identify characteristics and/or patterns in soil.**

*6.S.12 Identify characteristics and/or patterns in rocks and soil.*

## Life Sciences

**Students demonstrate an understanding of how living systems function and how they interact with the physical environment. This includes students demonstrating an understanding of the flow of matter and energy in living systems; the characteristics, structure, and function of cells and organisms; principles of heredity; and biological evolution and the diversity and interdependence of life.**

- 1. Know that, many of the basic functions of organisms are carried out within cells. The way in which cells function is similar in all living organisms.**  
*6.S.15 Compare and/or contrast the diversity of ways in which living things meet their needs.*
- 2. Know that multicellular organisms have a variety of specialized cells, tissues, organs, and organ systems that perform specialized functions**  
*6.S.15 Compare and/or contrast the diversity of ways in which living things meet their needs.*
- 3. Know that plant cells differ somewhat from animal cells (e.g., cell wall, chloroplast).**  
*6.S.15 Compare and/or contrast the diversity of ways in which living things meet their needs.*
- 4. Know that energy entering ecosystems as sunlight is transferred to chemical energy through photosynthesis by producers.**  
*6.S.14 Trace the transmission of energy in a small, simple ecosystem and/or identify the roles of organisms in the energy movement in an ecosystem.*
- 5. Understand that energy flows through ecosystems in one direction from photosynthetic organisms to herbivores to carnivores and decomposers.**  
*6.S.14 Trace the transmission of energy in a small, simple ecosystem and/or identify the roles of organisms in the energy movement in an ecosystem.*
- 6. Know that over a long time matter is transferred from one organism to another repeatedly and between organisms and their physical environment. As in all material systems, the total amount of matter remains constant, even through its form and location change.**  
*6.S.14 Trace the transmission of energy in a small, simple ecosystem and/or identify the roles of organisms in the energy movement in an ecosystem.*

- 7. Know that cells convert energy obtained from food to carry on the many functions needed to sustain life (e.g., production of materials the cell needs).**

*6.S.14 Trace the transmission of energy in a small, simple ecosystem and/or identify the roles of organisms in the energy movement in an ecosystem.*

*CH-UH indicators in support of the OPT*

- 8. Analyze behaviors and/or activities that positively or negatively influence human health.**

*6.S.16 Analyze behaviors and/or activities that positively or negatively influence human health.*

- 9. Analyze the impacts of human activity on the ecosystems of the earth.**

*6.S.17 Analyze the impacts of human activity on the ecosystems of the earth.*

## Physical Sciences

Students demonstrate an understanding of how physical systems are put together and the concepts and principles that describe and predict physical interactions and events in the natural world. This includes students demonstrating an understanding of the structure and properties of matter and the properties of materials and objects; chemical reactions and the conservation of matter; nature, transfer and conservation of energy; motions and the forces causing motions; nature of waves and interactions of matter and energy.

**1. Demonstrate understanding that equal volumes of different substances usually have different masses.**

*6.S.10 Identify simple patterns in physical phenomena.*

**2. Know that in a chemical change new substances are formed with different properties than the original substance (e.g., rusting, vinegar with limestone, burning ).**

*6.S.8 Propose and/or evaluate an investigation of simple physical and/or chemical changes.*

**3. Understand that in a physical change, the properties of a substance remain unchanged.**

*6.S.8 Propose and/or evaluate an investigation of simple physical and/or chemical changes.*

**4. Know that chemical reactions occur all around us (e.g., in the human body, in cooking, industry).**

*6.S.8 Propose and/or evaluate an investigation of simple physical and/or chemical changes.*

*CH-UH indicators in support of the OPT*

**5. Recognize the advantages/or disadvantages to the used in the operation of simple technological devices**

*6.S.6 Recognize the advantages/or disadvantages to the used in the operation of simple technological devices.*

**6. Predict the influence of the motion of some objects on other objects.**

*6.S.7 Predict the influence of the motion of some objects on other objects.*

**7. Provide examples of transformation and/or conservation of matter and energy in simple physical systems**

*6.S.9 Provide examples of transformation and/or conservation of matter and energy in simple physical systems*

## Scientific Inquiry

Students demonstrate an understanding of the use of the processes of scientific inquiry to ask questions, gather and analyze information, make inferences and predictions, and create, modify, and possibly discard some explanations. This includes students demonstrating an understanding of how to ask valid questions that can be investigated scientifically about the natural world and develop an action plan to discover the answers.

- 1. Demonstrate the understanding that there is no fixed procedure for guiding scientific investigations. Those investigations may involve formulating questions, making observations, collecting data, and drawing logical conclusions).**

*6.S.5 Evaluate conclusions based on scientific data.*

- 2. Understand that a single example can never prove that something is always correct, but sometimes a single example can disprove something.**

*6.S.5 Evaluate conclusions based on scientific data.*

*CH-UH indicators in support of the OPT*

- 3. Notice and criticize the reasoning in arguments in which fact and opinion are intermingled or the conclusions do not follow logically from the evidence given.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 4. Understand that some investigations usually involve the collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected evidence.**

*6.S.3 Make inferences from observation of phenomena and/or events.*

- 5. Explain how hypotheses are valuable, even if they turn out not to be true, if they lead to fruitful investigations.**

*6.S.3 Make inferences from observation of phenomena and/or events.*

- 6. Recognize that hypotheses are valuable, even if they turn out not to be true, if they lead to fruitful investigations.**

*6.S.5 Evaluate conclusions based on scientific data.*

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# Science Grade Level Indicators

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- 7. Understand that often different explanations can be given for the same evidence, and it is not always possible to tell which is correct.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 8. Understand how attending closely to any one input of information usually reduces the ability to attend to others at the same time.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 9. Know that what people expect to observe often affects what they actually do observe. Strong beliefs about what should happen in particular circumstances can prevent them from detecting other results.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 10. Understand how different models can be used in science represent the same thing. What kind of model to use and how complex it should be depends on its purpose. Choosing a useful model is one of the instances in which intuition and creativity come into play in, mathematics and engineering.**

*6.S.3 Make inferences from observation of phenomena and/or events.*

- 11. Explain how usually there is no one way to solve a mathematical problem; different methods have different advantages and disadvantages.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 12. Show how arguments based on very small samples of data, biased samples, or samples for which there was no control sample may be inaccurate.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 13. Describe how the choice of materials for a job depends on their properties and how they interact with other materials. Similarly the usefulness of some manufactured parts of an object depends on how well they fit together with the other parts.**

*6.S.10 Identify simple patterns in physical phenomena.*

- 14. Use a simple key to classify objects, organisms, and/or phenomena.**

*6.S.1 Use a simple key to classify objects, organisms, and/or phenomena.*

**15. Identify the potential hazards and/or precautions involved in scientific investigations.**

*6.S.2 Identify the potential hazards and/or precautions involved in scientific investigations.*

## Science and Technology

Students demonstrate an understanding of how scientific knowledge is used to create needed technologies to solve everyday problems and how technologies are used to expand scientific knowledge. This includes students demonstrating an understanding of the differences between natural and human-made objects; how scientific knowledge is used to create and improve design; technology design and implementing technological problem-solving procedures using appropriate tools and methods; analyzing risks and benefits; and of tradeoffs of using technology.

1. **Explain that social needs, attitudes, and values influence the direction of technological development.**

*6.S.4 Identify the positive and/or negative impacts of technology on human activity.*

2. **Understand that technology influences the quality of life and the ways people act and interact through its product and processes (e.g., cancer, selective breeding).**
3. **Is aware that automation, including the use of robots, has changed manufacturing, including manual labor being replaced by high-tech, high skilled jobs.**
4. **Know that decisions about the use of products and systems can result in desirable or undesirable consequences (e.g., the choice of materials for a job depends on their properties and how they interact with other materials). Similarly, the usefulness of manufactured parts of an object depend on how well they fit together without the parts.**

*CH-UH indicators in support of the OPT*

5. **Describe how engineers, architects, and others who engage in design and technology use scientific knowledge to solve practical problems. But they usually have to take human values and limitations into account as well.**

*6.S.17 Analyze the impacts of human activity on the ecosystems of the earth.*

6. **Understand that technology is essential to science for such purposes as access to outer space and other remote locations, sample collection and treatment, measurement, data collection and storage, computation, and communication of information.**

*6.S.4 Identify the positive and/or negative impacts of technology on human activity.*

# Science Grade Level Indicators

## Scientific Ways of Knowing

Students demonstrate an understanding of how social and historical perspectives relate to the contributions that many people make to the development of more reliable and comprehensive understandings of the natural world. This includes demonstrating an understanding that there are different ways to carry out scientific investigation; valid investigations can be repeated by many people with similar results; and scientific discovery is an ongoing process that will change ideas with new discoveries.

1. Recognizes that hypothesis are valuable even when they are not supported.
2. Describe why it is important to keep clear, honest, and accurate records.  
*6.S.5 Evaluate conclusions based on scientific data.*
3. Knows the difference between description (e.g., observation and summary) and explanation (e.g., inference, prediction, significance, importance).
4. Demonstrate the understanding that science is not static, it constantly changes.
5. Demonstrate the understanding that science careers occur in a variety of settings.
6. Describe that the pursuit of scientific knowledge is beneficial for any career and for daily life.

*CH-UH indicators in support of the OPT*

7. Understand that some aspects of reasoning have fairly rigid rules for what makes sense; other aspects don't. If people have rules that always hold, and good information about a particular situation, then logic can help them figure out what is true about it.  
*6.S.3 Make inferences from observation of phenomena and/or events.*
8. Recognize that even with similar results, scientists may wait until an investigation has been repeated many times before accepting the results as correct.  
*6.S.5 Evaluate conclusions based on scientific data.*

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# Science Grade Level Indicators

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- 9. Understand that when similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant and it often takes further studies to decide.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 10. Explain how accurate record keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 11. Understand how scientific investigations usually involve the collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected evidence.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 12. Understand that scientific investigations usually involve the collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected evidence.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 13. Explain how different models can be used to represent the same thing. Choosing a useful model is one of the instances in which intuition and creativity come into play in science, mathematics, and engineering.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 14. Understand that scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory leads to looking at old observations in a new way.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 15. Infer how some scientific knowledge is very old and yet is still applicable today.**

*6.S.3 Make inferences from observation of phenomena and/or events.*

- 16. Recognize that scientists know about the danger of prior expectations to objectivity and take steps to try and avoid it when designing investigations and examining data. One safeguard is to have different investigators conduct independent studies of the same questions.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 17. Recognize that sometimes people invent a general rule to explain how something works by summarizing observations. But people tend to over generalize, imagining general rules on the basis of only a few observations.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 18. Understand how mathematicians often represent things with abstract ideas such as numbers or perfectly straight lines, and then work with those ideas alone. The "things" from which they abstract can be ideas themselves.**

*6.S.3 Make inferences from observation of phenomena and/or events.*

- 19. Understand that when mathematicians use logical rules to work with representations of things, the results may not be entirely valid for the things themselves.**

*6.S.5 Evaluate conclusions based on scientific data.*

- 20. Understand that the larger a well-chosen sample is, the more accurately it is likely to represent the whole. But there are many ways of choosing a sample that can make it unrepresentative of the whole.**

*6.S.10 Identify simple patterns in physical phenomena.*

## Earth and Space Sciences

**Demonstrate an understanding of how Earth systems and processes interact to sustain the habitability of Earth. This includes students demonstrating an understanding of the composition and formation of the universe, the solar system and Earth; properties and the interconnected nature of Earth's systems; energy transfer in Earth systems; processes that shape Earth and Earth's history; and how the concepts and principles of energy, matter, motion and forces explain Earth systems, the solar system and the universe.**

- 1. Explain that water evaporates from the earth's surface, rises and cools as it moves to higher elevations, condenses as rain or snow and falls to the surface where it collects in lakes, oceans, soil, and in rocks underground, or as ice (e.g., glaciers, ice caps)**

*10.S.9 Relate internal and external sources of energy in the Earth system to processes and cycles (e.g., air, water, land) occurring since the Earth's origin.*

- 2. Analyze how fresh water, limited in supply, is essential for life and also for most industrial processes. Rivers, lakes, and groundwater can be depleted or polluted, becoming unavailable or unsuitable for life.**

*10.S.15 Explain how living things interact with the living and non-living components of the environment.*

- 3. Knows that the atmosphere (air) and hydrosphere (water) have a limited capacity to absorb and recycle materials naturally (e.g., smoke, smog, sewage), resulting in decreased environmental quality.**

*10.S.9 Relate internal and external sources of energy in the Earth system to processes and cycles (e.g., air, water, land) occurring since the Earth's origin.*

- 4. Determine how data from weather station models contribute to a weather map (e.g., humidity, temperature, pressure, wind speed, and direction).**

*10.S.9 Relate internal and external sources of energy in the Earth system to processes and cycles (e.g., air, water, land) occurring since the Earth's origin.*

- 5. Read a weather map to interpret local, regional and national weather.**

*10.S.9 Relate internal and external sources of energy in the Earth system to processes and cycles (e.g., air, water, land) occurring since the Earth's origin.*

- 6. Explain how clouds affect weather.**

*10.S.9 Relate internal and external sources of energy in the Earth system to processes and cycles (e.g., air, water, land) occurring since the Earth's origin.*

- 7. Know how temperature and rainfall determine climatic zones (biomes) (e.g., desert, grasslands, forests, tundra, mountain).**

*10.S.9 Relate internal and external sources of energy in the Earth system to processes and cycles (e.g., air, water, land) occurring since the Earth's origin.*

- 8. Know that weather and climate involve the transfer of energy in and out of the atmosphere.**

*10.S.9 Relate internal and external sources of energy in the Earth system to processes and cycles (e.g., air, water, land) occurring since the Earth's origin.*

## Life Sciences

**Students demonstrate an understanding of how living systems function and how they interact with the physical environment. This includes students demonstrating an understanding of the flow of matter and energy in living systems; the characteristics, structure, and function of cells and organisms; principles of heredity; and biological evolution and the diversity and interdependence of life.**

**1. Know that organisms may interact with one another in symbiotic relationships (e.g., lichens).**

*10.S.15 Explain how living things interact with the living and non-living components of the environment.*

**2. Know that the number of organisms an ecosystem can support depends on adequate biotic (living) and abiotic (non-living) resources (e.g., light).**

*10.S.15 Explain how living things interact with the living and non-living components of the environment.*

**3. Investigate how an ecosystem is impacted by overpopulation.**

*10.S.15 Explain how living things interact with the living and non-living components of the environment.*

**4. Investigate how the overuse, misuse and wide use of resources impacts an ecosystem.**

*10.S.11 Relate changes in the form and distribution of matter to the cyclic and finite nature of resources within the closed Earth system.*

**5. Explain the ways that natural phenomena impact populations (e.g., forest fires, flood, drought, and hard winters).**

*10.S.15 Explain how living things interact with the living and non-living components of the environment.*

**6. Analyze how human activity and natural events impact the ecosystems of the earth.**

*10.S.11 Relate changes in the form and distribution of matter to the cyclic and finite nature of resources within the closed Earth system.*

**7. Analyze the behaviors and/or activities (e.g., exercising, smoking) that positively or negatively influence human health.**

*10.S.12 Analyze and compare regulatory processes (e.g., neural, endocrine, immune) in living things.*

- 8. Know that some environmental changes occur slowly while others occur rapidly. The different consequences of changing environments in small increments over long periods of time as compared with changing environments in large increments over short periods of time.**

*10.S.15 Explain how living things interact with the living and non-living components of the environment.*

## Physical Sciences

Students demonstrate an understanding of how physical systems are put together and the concepts and principles that describe and predict physical interactions and events in the natural world. This includes students demonstrating an understanding of the structure and properties of matter and the properties of materials and objects; chemical reactions and the conservation of matter; nature, transfer and conservation of energy; motions and the forces causing motions; nature of waves and interactions of matter and energy.

- 1. Know that energy in fossil fuels such as oil and coal comes from the sun indirectly, because the fuels come from plants that grew long ago.**

*10.S.11 Relate changes in the form and distribution of matter to the cyclic and finite nature of resources within the closed Earth system.*

- 2. Explain that energy from the sun (and the wind and water energy derived from it) is available indefinitely. Other sources of energy don't renew or renew only slowly.**

*10.S.7 Analyze transformations of energy and recognize its conservation (constancy) within a system.*

- 3. Know that electric energy can be produced by a variety of sources (e.g., solar, wind).**

*10.S.7 Analyze transformations of energy and recognize its conservation (constancy) within a system.*

- 4. Know examples of renewable and nonrenewable resources and describe how they can be mismanaged or depleted, becoming unavailable (e.g., fossil fuels, trees, water). Explain how conservation and recycling can slow down the depletion of resources.**

*10.S.11 Relate changes in the form and distribution of matter to the cyclic and finite nature of resources within the closed Earth system.*

- 5. Understand that electric circuits provide a means of transferring electrical energy. This electrical energy may be transformed into heat, light, sound and chemical energy.**

*10.S.8 Given that waves (e.g., sound, light) carry energy, compare and predict interactions of waves with matter.*

- 6. Understand how electric currents can produce magnetic forces.**

*10.S.8 Given that waves (e.g., sound, light) carry energy, compare and predict interactions of waves with matter.*

**7. Know that potential energy is due to position or configuration and kinetic energy due to is an energy of motion.**

*10.S.6 Describe and predict the effects of forces (e.g., elastic, gravitational, electric, magnetic) on objects and on the motion of objects within a system.*

## Scientific Inquiry

Students demonstrate an understanding of the use of the processes of scientific inquiry to ask questions, gather and analyze information, make inferences and predictions, and create, modify, and possibly discard some explanations. This includes students demonstrating an understanding of how to ask valid questions that can be investigated scientifically about the natural world and develop an action plan to discover the answers.

1. Understand that variables and controls can affect the results of an investigation, and that (ideally) one variable should be tested at a time, because it is not always possible to control all variables
2. Recognize and analyze alternative explanations and predictions; there may be more than one good way to interpret a given set of findings.
3. Identify faulty reasoning and statements that go beyond the evidence.
4. Distinguish between observation and inference.
5. Identify simple independent (manipulated) and dependent (responding or measured) variables.
6. Use graphs, tables, and charts to predict physical phenomena, and infer mathematical relationships among variables (e.g., speed, momentum).
7. Choose and safely use appropriate tools and instruments.
8. Use safety equipment appropriately in the science classroom.  
*6.S.2 Identify the potential hazards and/or precautions involved in scientific investigations.*
9. Use and devise a classification system for objects or a group of organisms.

10. Formulate and identify questions to guide scientific investigations that connect to science concepts, and can be answered through scientific investigations.
11. Construct a hypothesis to test a question.

## Scientific Ways of Knowing

Students demonstrate an understanding of how social and historical perspectives relate to the contributions that many people make to the development of more reliable and comprehensive understandings of the natural world. This includes demonstrating an understanding that there are different ways to carry out scientific investigation; valid investigations can be repeated by many people with similar results; and scientific discovery is an ongoing process that will change ideas with new discoveries.

1. Demonstrate the understanding that reproducibility of results is essential- disagreements of the results may lead to further evidence that resolves disagreements.
2. Explain that some scientific knowledge is very old and yet is still applicable today.
3. Explain that repetition of an experiment reduces bias.

## Earth and Space Sciences

**Demonstrate an understanding of how Earth systems and processes interact to sustain the habitability of Earth. This includes students demonstrating an understanding of the composition and formation of the universe, the solar system and Earth; properties and the interconnected nature of Earth's systems; energy transfer in Earth systems; processes that shape Earth and Earth's history; and how the concepts and principles of energy, matter, motion and forces explain Earth systems, the solar system and the universe.**

- 1. Know that most objects in the solar system are in regular and predictable motions that explain such phenomena as days, years, seasons, eclipses, tides, and moon cycles.**  
*10.S.10 Describe relationships among the Earth, other planets, and other objects in the solar system.*
- 2. Understand gravity is the force that keeps planets in orbit around the sun and governs the rest of the motion in the solar system.**  
*10.S.10 Describe relationships among the Earth, other planets, and other objects in the solar system.*
- 3. Know that comets are chunks of rock mixed with ice. Comets have elliptical orbits that carry them near the sun where radiation boils off frozen material from their surface and pushes it into a long, illuminated tail.**  
*10.S.10 Describe relationships among the Earth, other planets, and other objects in the solar system.*
- 4. Explain that chunks of rock move through space. Sometimes they enter planetary atmospheres where they either disintegrate due to friction or impact the surface. (e.g., meteors and meteoroids).**  
*10.S.10 Describe relationships among the Earth, other planets, and other objects in the solar system.*
- 5. Know that the universe consists of billions of galaxies, each containing billions of stars and are classified by shape.**  
*10.S.10 Describe relationships among the Earth, other planets, and other objects in the solar system.*
- 6. Know interstellar distances are calculated in light years (e.g., nearest galaxy is light years away).**  
*10.S.10 Describe relationships among the Earth, other planets, and other objects in the solar system.*

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# Science Grade Level Indicators

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- 7. Understand that light from the sun takes a few minutes to reach earth, but light from the nearest star takes a few years to arrive. Some distant galaxies are so far away that their light takes several billion years to reach earth. People on earth see them as they were long ago in the past.**

*10.S.10 Describe relationships among the Earth, other planets, and other objects in the solar system.*

- 8. Describe how stars formed early in the development of the universe when matter, clumped together by gravitational attractions, formed countless stars.**

*10.S.10 Describe relationships among the Earth, other planets, and other objects in the solar system.*

- 9. Name and identify tools used to study the universe such as telescopes, probes, satellites, and other spacecraft.**

*10.S.10 Describe relationships among the Earth, other planets, and other objects in the solar system.*

- 10. Know that folding, breaking, and uplifting can rearrange the rock layers so the youngest is not always found on top.**

*10.S.9 Relate internal and external sources of energy in the Earth system to processes and cycles (e.g., air, water, land) occurring since the Earth's origin.*

- 11. Know the earth's crust is divided into tectonic plates moving at extremely slow rates in response to movement in the mantle.**

*10.S.9 Relate internal and external sources of energy in the Earth system to processes and cycles (e.g., air, water, land) occurring since the Earth's origin.*

- 12. Know that major geological events (e.g., earthquakes, volcanic eruptions, and mountain building) result from plate**

*10.S.9 Relate internal and external sources of energy in the Earth system to processes and cycles (e.g., air, water, land) occurring since the Earth's origin.*

- 13. Know landforms are created through a combination of destructive (e.g., weathering and erosion) and constructive forces (e.g., crustal deformation, volcanic eruptions, hot spots, and deposition of sediment).**

*10.S.9 Relate internal and external sources of energy in the Earth system to processes and cycles (e.g., air, water, land) occurring since the Earth's origin.*

- 14. Relate that the processes involved in the rock cycle are directly related to the heat and forces that drive plate motions.**

*10.S.9 Relate internal and external sources of energy in the Earth system to processes and cycles (e.g., air, water, land) occurring since the Earth's origin.*

## Life Sciences

**Students demonstrate an understanding of how living systems function and how they interact with the physical environment. This includes students demonstrating an understanding of the flow of matter and energy in living systems; the characteristics, structure, and function of cells and organisms; principles of heredity; and biological evolution and the diversity and interdependence of life.**

- 1. Know evidence that supports the idea that there is unity among organisms despite the fact that some species look very different (e.g., similarity of internal structures such as cells and chemical processes, evidence of common ancestry).**

*10.S.13 Relate the chemical basis of life to heredity, diversity, species survival, adaptations, and extinction.*

- 2. Know that body cells divide into new cells with the same number of chromosomes and sex cells divide into new cells with half the number of chromosomes.**

*10.S.13 Relate the chemical basis of life to heredity, diversity, species survival, adaptations, and extinction.*

- 3. Understands that in asexual reproduction, all the traits come from a single parent; in sexual reproduction, an egg and sperm unite and some traits come from each parent, so the offspring is never identical to either of its parents; sexual reproduction allows for greater genetic diversity; asexual reproduction limits the spread of disadvantageous characteristics through a species.**

*10.S.14 Relate heredity of organisms to the long term survival of populations based on mutations, variations in populations, and changes in populations as a result of differential reproduction.*

- 4. Know that heredity traits can be determined by either one or many genes and may not show up in every generation.**

*10.S.14 Relate heredity of organisms to the long term survival of populations based on mutations, variations in populations, and changes in populations as a result of differential reproduction.*

- 5. Understand that biological diversity is developed through gradual processes over many generations as a result of the transmission of genetic characteristics.**

*10.S.14 Relate heredity of organisms to the long term survival of populations based on mutations, variations in populations, and changes in populations as a result of differential reproduction.*

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# Science Grade Level Indicators

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**6. Know that genes influence hereditary traits through the process of cell division.**

*10.S.13 Relate the chemical basis of life to heredity, diversity, species survival, adaptations, and extinction.*

**7. Know that there is great diversity among living organisms and the way they are placed into groups reflects their relationships and structures.**

*10.S.13 Relate the chemical basis of life to heredity, diversity, species survival, adaptations, and extinction.*

**8. Know that variations in structure, behavior, or physiology allow some organisms to enhance their reproductive success and survival in a particular environment.**

*10.S.15 Explain how living things interact with the living and non-living components of the environment.*

**9. Understand that diversity of species is developed through gradual processes over many generations.**

*10.S.14 Relate heredity of organisms to the long term survival of populations based on mutations, variations in populations, and changes in populations as a result of differential reproduction.*

**10. Understand that when the environment changes a species' characteristics affect its chances of survival.**

*10.S.15 Explain how living things interact with the living and non-living components of the environment.*

**11. Know that the variation of organisms within a species increases the likelihood that at least some members of a species will survive under changed environmental conditions.**

*10.S.15 Explain how living things interact with the living and non-living components of the environment.*

## Physical Sciences

Students demonstrate an understanding of how physical systems are put together and the concepts and principles that describe and predict physical interactions and events in the natural world. This includes students demonstrating an understanding of the structure and properties of matter and the properties of materials and objects; chemical reactions and the conservation of matter; nature, transfer and conservation of energy; motions and the forces causing motions; nature of waves and interactions of matter and energy.

**1. Recognize that the motion of an object is always judged and described by comparison to a reference point.**

*10.S.6 Describe and predict the effects of forces (e.g., elastic, gravitational, electric, magnetic) on objects and on the motion of objects within a system.*

**2. Demonstrate understanding that the motion of an object can be described by its position, direction and speed.**

*10.S.6 Describe and predict the effects of forces (e.g., elastic, gravitational, electric, magnetic) on objects and on the motion of objects within a system.*

**3. Demonstrate understanding that unbalanced force acting on an object changes its speed and/or direction.**

*10.S.6 Describe and predict the effects of forces (e.g., elastic, gravitational, electric, magnetic) on objects and on the motion of objects within a system.*

**4. Demonstrate understanding that gravity alone holds us to the earth's surface and explains the phenomenon of the tides.**

*10.S.6 Describe and predict the effects of forces (e.g., elastic, gravitational, electric, magnetic) on objects and on the motion of objects within a system.*

**5. Know that gravitation is a universal force that each mass exerts on another mass.**

*10.S.6 Describe and predict the effects of forces (e.g., elastic, gravitational, electric, magnetic) on objects and on the motion of objects within a system.*

**6. Know that the electric force is a universal force that exists between any two charged objects. Opposite charges attract while like charges repel.**

*10.S.6 Describe and predict the effects of forces (e.g., elastic, gravitational, electric, magnetic) on objects and on the motion of objects within a system.*

**7. Demonstrate understanding that waves transfer energy.**

*10.S.8 Given that waves (e.g., sound, light) carry energy, compare and predict interactions of waves with matter.*

**8. Demonstrate understanding that vibrations in materials produce wave-like disturbances that spread away from the source (e.g., sound, earthquake waves).**

*10.S.8 Given that waves (e.g., sound, light) carry energy, compare and predict interactions of waves with matter.*

## Scientific Inquiry

Students demonstrate an understanding of the use of the processes of scientific inquiry to ask questions, gather and analyze information, make inferences and predictions, and create, modify, and possibly discard some explanations. This includes students demonstrating an understanding of how to ask valid questions that can be investigated scientifically about the natural world and develop an action plan to discover the answers.

1. Introduce concepts of sample size and control, and understand how these affect scientific investigations.
2. Read, construct, and interpret data in various forms (e.g., tables, charts, graphs, diagrams, symbols) produced by self and others in both written and oral form.
3. Apply appropriate math skills to interpret quantitative data (e.g., mean, median, mode).

## Science and Technology

Students demonstrate an understanding of how scientific knowledge is used to create needed technologies to solve everyday problems and how technologies are used to expand scientific knowledge. This includes students demonstrating an understanding of the differences between natural and human-made objects; how scientific knowledge is used to create and improve design; technology design and implementing technological problem-solving procedures using appropriate tools and methods; analyzing risks and benefits; and of tradeoffs of using technology.

1. Appropriate technologies incorporate cultural and economic factors and differences.
2. Recognize decisions to develop and use technologies often put environmental and economic concerns in direct competition with each other.
3. Recognize that science can not answer some questions and technology can not solve some human problems.
4. Understand some constraints are unavoidable (e.g., economic, political, social, ethical, aesthetic, time, trade-offs), other constraints influence choices (e.g., different parts of the world have different amounts and kinds of energy resources to use and use them for different purposes).
5. Examine how science and technology have advanced through the contributions of many different people, in different cultures, and at different times in history.  
*6.S.4 Identify the positive and/or negative impacts of technology on human activity.*
6. Evaluate stages of product development, and technological design (e.g., identify a problem, create a solution, evaluate the solution) using criteria relevant to the purpose.

## Scientific Ways of Knowing

Students demonstrate an understanding of how social and historical perspectives relate to the contributions that many people make to the development of more reliable and comprehensive understandings of the natural world. This includes demonstrating an understanding that there are different ways to carry out scientific investigation; valid investigations can be repeated by many people with similar results; and scientific discovery is an ongoing process that will change ideas with new discoveries.

1. Demonstrate the understanding that scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory leads to looking at old observations in a new way.
2. Explain that subjects involved in research must be fully aware of possible risks and benefits associated with the research and must grant consent to participate. If the research subject is not able to grant consent (e.g., animal, inanimate) the researcher must be aware of possible risks and benefits. Promote the understanding of the researcher's responsibility for the safety of subjects in research (e.g., humans, animals, and inanimate objects).
3. Identify the effects of science on society and the effects of society on science.