

# IMPORTANT NOTICE

Please note that teachers may access the complete  
Science Course of Study through our web site

[www.medina-esc.org](http://www.medina-esc.org)

Click on the link **Course of Study** on our home page  
Then select the Science link  
You will have access to all grade levels.

It is sound educational practice for teachers to be aware of what is  
taught in the grade level before, as well as the grade level after  
their assigned grade level.



# Medina County Schools

## Science Course of Study

Grades:  
Pre-Kindergarten  
Through Twelve

Medina County Schools'



Educational Service Center

William J. Koran  
Superintendent

2009



Science  
Graded Course of Study  
PreK-12

William J. Koran, Superintendent

Approved by:  
Governing Board of the Medina County Schools'  
Educational Service Center  
2009

Mission Statement

The Medina County Schools'  
Educational Service Center  
will be the leader in providing  
services and products that promote  
excellence in education.

# Acknowledgements

The Medina County Schools' Educational Service Center wishes to acknowledge the contributions to the Science Course of Study made by the following:

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Layout and Word Processing  
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The Ohio Department of Education  
Office of Curriculum and Instruction

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# SCIENCE

## PHILOSOPHY AND GUIDING ASSUMPTIONS

### (Program Philosophy)

Ohio's science content standards serve as a basis for what all students should know and be able to do by the time they graduate from high school. The vision for the broad learning goals of Ohio's science academic content standards provides for a scientifically literate citizen. These standards, benchmarks and grade-level indicators are intended to provide Ohio's educators with a set of common expectations upon which to base science curriculum.

#### **Philosophy of Ohio's Science Academic Content Standards**

The intent of Ohio's science academic content standards is to:

- Help students develop an understanding of the unity and diversity of the natural (empirical) world;
- Foster an understanding of the nature of science, the development of science processes, the principles of science, and the connections between the physical, life, and Earth and space sciences;
- Prepare students to use appropriate scientific processes and principles in making personal decisions;
- Enable students to engage intelligently in public discourse about matters of scientific and technological concern; and
- Increase their future economic productivity through the use of scientific knowledge, understanding and skills in their careers.

#### **Assumptions for Science Content Standards**

Ohio's academic content standards:

- Set high expectations and provide strong support for science achievement by **all** students;
- Represent scientific knowledge and skills needed to make a successful transition to post-secondary education, the workplace and daily life;
- Reflect sound application of research on how students learn science concepts and processes;
- Align with the national science education standards documents;

**SCIENCE**  
**PHILOSOPHY AND GUIDING ASSUMPTIONS (Cont.)**  
**(Program Philosophy)**

- Provide balance among conceptual understanding, procedural knowledge and skills, and application and problem-solving;
- Address scientific content knowledge and processes including technological design, scientific ways of knowing, inquiry, communication, representation, and connections across the domains of science;
- Apply scientific knowledge and processes to individual and societal issues;
- Focus on important scientific concepts that are well-articulated through benchmarks and grade-level indicators;
- Represent rigorous progression across grades and in-depth study within each grade;
- Incorporate use of technology by **all** students in learning science and developing an understanding about the nature of science and technology including technological design;
- Serve as the basis for classroom and statewide assessments;
- Emphasize the nature, connections and historical development of scientific knowledge in the physical, life, and Earth and space sciences.

## SCIENCE FOR YOUNG CHILDREN

It is instinctive for the young child to search out, describe, and explain patterns of events experienced in the natural and physical world. Children develop an understanding of science as they investigate and interact with real objects and phenomena. They are natural scientists—curious, observant, and questioning. Their knowledge of science grows out of an attempt to find meaning in their environment and by relating new experiences to prior knowledge and personal experience.

Science content is more than isolated facts such as the stages in the life of a butterfly or the life cycle of a plant. Although scientific facts are important, it is how the information is organized into meaningful concepts and ideas that is of significance for the learner. For example, learning about the development of a butterfly should lead to the big ideas that all living things develop in a series of stages called a life cycle.

The process of science is learned through active engagement. Preschool children learn science by exploring the world around them. When provided an environment with varied materials, they try out things to see how they work, they experiment, they manipulate, they are curious and they ask questions. As they seek answers to their questions, opportunities are provided for hypothesizing and predicting, observing, collecting data over time, formulating conclusions. Through active engagement in authentic and meaningful science experiences, they learn to enjoy and appreciate their surroundings.

The science curriculum provides for a balance among the three broad disciplines of life science, physical science, and earth/space science. Thematic units or topics of study, arising from the interests of children, are used to plan meaningful experiences in which children explore ideas, manipulate materials, and engage in conversations to construct their own understanding relative to science.

Children need opportunities to present their views to other children and adults through their drawings, constructions and verbal exchanges. By exchanging opinions with others, children begin to move from an egocentric point of view and compare their views with those of others. Their concepts about the natural world are expanded and enhanced through sharing of experiences.

## **OHIO'S PreK-12 SCIENCE STANDARDS (Program Goals)**

### **Earth and Space Sciences for Early Childhood**

Young children are naturally interested in everything they see around them-soil, rocks, streams, rain, sand and shells. Science should include experiences that provide for the study of earth's materials, and the discovery of their patterns and changes over time. Since children cannot directly interact with sky or space, learning experiences with the sky or space are based on observing it. Preschool children learn about the earth and space when they play shadow tag, talk about things they do during the day and at night, add water to dirt while making mud pies and paint with water on the sidewalk and notice that the pictures soon disappear. Continuous opportunities to clean up their immediate space, the playground and to collect and recycle materials support young learners' understanding about their role in respecting, protecting, preserving and caring for the natural world and environment. Children are very interested in the outdoor environment, naturally use it as a laboratory for learning and enjoy drawing or charting what they see and think.

### **Earth and Space Sciences**

Students demonstrate an understanding about how Earth systems and processes interact in the geosphere resulting in the habitability of Earth. This includes demonstrating an understanding of the composition of the universe, the solar system and Earth. In addition, it includes understanding the properties and the interconnected nature of Earth's systems, processes that shape Earth and Earth's history. Students also demonstrate an understanding of how the concepts and principles of energy, matter, motion and forces explain Earth systems, the solar system and the universe. Finally, they grasp an understanding of the historical perspectives, scientific approaches and emerging scientific issues associated with Earth and space sciences.

### **Life Sciences for Early Childhood**

Life Science is about living things. Young children should be provided direct experience with living things, their life cycle and their habitats. Although understanding is emerging, children develop concepts of living and nonliving things, the behavior and needs of living things and respect for living things. Key ideas emerge from exploring the immediate environment. Therefore, a preschooler in Ohio might explore familiar plants and animals native to their area, studying how living things get food, their characteristics and how they change as they grow.

## OHIO'S PreK-12 SCIENCE STANDARDS (Cont.)

### **Life Sciences**

Students demonstrate an understanding of how living systems function and how they interact with the physical environment. This includes an understanding of the cycling of matter and flow of energy in living systems. An understanding of the characteristics, structure and function of cells, organisms and living systems will be developed. Students will also develop a deeper understanding of the principles of heredity, biological evolution, and the diversity and interdependence of life. Students demonstrate an understanding of different historical perspectives, scientific approaches and emerging scientific issues associated with the life sciences.

### **Physical Sciences for Early Childhood**

Physical science is about the physical properties of materials and objects. Through exploration of materials, children learn about weight, shape, size, color, and temperature. They explore how things move and change. Beginning concepts develop as young children act on objects to produce a desired effect, put objects together to form new constructions of various kinds and draw conclusions about how the desired effect was produced. When children make a block ramp to race cars, look through a kaleidoscope or pick up objects with magnets, they are learning about the physical properties of objects.

### **Physical Sciences**

Students demonstrate an understanding of the composition of physical systems and the concepts and principles that describe and predict physical interactions and events in the natural world. This includes demonstrating an understanding of the structure and properties of matter, the properties of materials and objects, chemical reactions and the conservation of matter. In addition, it includes understanding the nature, transfer and conservation of energy; motion and the forces affecting motion; and the nature of waves and interactions of matter and energy. Students demonstrate an understanding of the historical perspectives, scientific approaches and emerging scientific issues associated with the physical sciences.

### **Science and Technology For Early Childhood**

For young children, central ideas and skills related to science technology include identifying simple and familiar tools such as a magnifying glass or hammer, the use of appropriate tools to explore objects and phenomena or solve a problem and exploring creative uses for materials or objects. When preschool children appropriately use hammer and a magnifying glass or use paper towel roll as a telescope, they are learning about the importance and use of science technology.

### **Science and Technology**

Students recognize that science and technology are interconnected and that using technology involves assessment of the benefits, risks and costs. Students should build scientific and technological knowledge, as well as the skill required to design and construct devices. In addition, they should develop the processes to solve problems and understand that problems may be solved in several ways.

## **OHIO'S PreK-12 SCIENCE STANDARDS (Cont.) (Program Goals)**

### **Scientific Inquiry for Early Childhood**

Preschool children learn science by exploring the world around them. They develop an understanding of science as they investigate and interact with real objects and phenomena. Children should be provided with a variety of simple equipment/materials and opportunities for playing, questing, exploring, demonstrating, investigating and experimenting. Through scientific processes of inquiry or seeking answers based on their curiosities, young children predict, observe collect or chart information over time, represent and formulate conclusions. Sharing books and stories, engaging in conversations and play provide varied opportunities for exploration, discovery and the communication of findings.

### **Scientific Inquiry**

Students develop scientific habits of mind as they use the processes of scientific inquiry to ask valid questions and to gather and analyze information. They understand how to develop hypotheses and make predictions. They are able to reflect on scientific practices as they develop plans of action to create and evaluate a variety of conclusions. Students are also able to demonstrate the ability to communicate their findings to others.

### **Scientific Ways of Knowing for Early Childhood**

Early impressions about who learns and does science appear to be persistent and lasting. For young children, science should be experienced in ways that actively engage young learners in the construction of ideas and explanations of doing science. Children's ideas and explanations, whether accurate or not, should be valued and serve as a basis for further investigation and discovery. Science should be modeled as an activity for all learners, where individually and collectively contribute to a growing understanding of the natural world.

### **Scientific Ways of Knowing**

Students realize that the current body of scientific knowledge must be based on evidence, be predictive, logical, subject to modification and limited to the natural world. This includes demonstrating an understanding that scientific knowledge grows and advances as new evidence is discovered to support or modify existing theories, as well as to encourage the development of new theories. Students are able to reflect on ethical scientific practices and demonstrate an understanding of how the current body of scientific knowledge reflects the historical and cultural contributions of women and men who provide us with a more reliable and comprehensive understanding of the natural world.

## SCOPE AND SEQUENCE

### **Kindergarten**

Kindergarten provides students with the opportunity to develop the scientific skills of wondering, questioning, investigating and communicating to enable them to begin to develop a sense of the world. Kindergartners learn through discovery about changes on Earth, in the sky, plants, animals, their habitats and non-living things in their local community. Through hands-on exploration, students learn the characteristics of objects, tools, materials, how they move, and whether or not they are natural or man-made. Students explore the different ways people learn about science and interact with living things and the environment to promote respect for nature. To complete this year, students show knowledge of scientific concepts through demonstration of verbal and non-verbal skills and activities.

### **Grade One**

Science instruction in the first grade builds upon the science skills developed in kindergarten and from the child's life experiences. Students have increasing opportunities to explore how living things change, how they interact with their environment and how they acquire food. Students discover that many objects are made of different parts and characteristics. Students learn ways objects change, move, the materials of which they are composed and their physical properties. Students recognize and realize that natural resources are limited and can be extended by recycling or decreasing use. First-graders explore ways people learn about science through questioning, comparing, investigating and observing to conclude year one.

### **Grade Two**

Second-graders continue to relate science concepts and skills to their life experiences. They compare similarities and differences between people, animals and plants. Living system functions and the interactions they have with their physical environment are explained. Focus is placed upon habits, and the interdependence and survival of plants and animals in Ohio. Weather changes both short term and long term are observed, described and measured. Second-graders discover how cycles are present in their everyday lives through investigations of Earth and sky, sound and light, and plants and animals. Students recognize the purpose, process and effects of technology, simple equipment and instruments used in learning about science. Students develop an awareness of repeated scientific investigations and understand that under the same conditions the results are similar or the same, which will build skills for grade two.

### **Grade Three**

The scientific skills of observation, measuring and classification serve as focal points for the third grade. Students learn to read and interpret simple tables and graphs, conduct safe investigations in which they collect and analyze data, and communicate the results. Third-graders explore the properties and composition of rocks and soils and the interaction of forces and motion. They also compare the life cycles of animals, classifications of animals according to their characteristics, descriptions of their habitat and adaptations to their environment. Students examine results of technology and explore careers in science, as well as scientific contributions from a diversity of cultures.

## **SCOPE AND SEQUENCE (Cont.)**

### **Grade Four**

Fourth-graders continue to safely conduct investigations, choose appropriate tools, measure, collect, formulate conclusions and communicate findings. They draw inferences from simple experiments and study the physical and chemical changes of matter. Properties of materials and the discovery of new materials formed by combining two or more materials are explored. Students expand the study of life cycles of plants by examining characteristics, growth and functions. Students gather information on the weather and its patterns and how weather impacts the Earth's surface, land, air and water. They explore how utilizing technology affects human lives and how technology and inventions change to meet

### **Grade Five**

Earth and space sciences are investigated in more detail in grade five. Earth's characteristics, resources and location in the solar system are identified and their implications explored. Students also learn about the interrelationship of organisms and ecosystems and simple food chains and food webs. Energy and energy transfer through an electrical current are addressed. Fifth-graders describe and illustrate the design process and describe the positive and negative impacts of human activity and technology on the environment. Students observe, measure and collect data when conducting a scientific investigation; students use this information to formulate inferences and conclusions; and students develop skills to communicate the results.

### **Grade Six**

Students in grade six continue to conduct investigations and begin to apply mathematical skills in evaluating and analyzing variables of data. They identify basic skills of the scientific inquiry process, such as how thinking scientifically is helpful in daily life and how technological advances affect the quality of life. Students research how men and women of other countries and cultures contribute to science. Sixth-grade students identify rocks, their distinct properties and formation and characteristic properties of the minerals that form them. They learn to recognize that a cell continually divides to create new cells, reproduction of cells occur, similar cells have special functions, and characteristics of an organism are a result of inherited traits. Students acquire knowledge of the uses, properties and chemical processes of the small particles that compose matter. They learn the renewable and nonrenewable sources of energy as part of the grade six indicators.

## **SCOPE AND SEQUENCE (Cont.)**

### **Grade Seven**

Students learn to describe interactions of matter and energy throughout the lithosphere, hydrosphere and atmosphere. They continue to develop skills of scientific inquiry, explain how matter can change forms and describe how energy is potential or kinetic and takes many forms. Students apply math skills to evaluate and analyze variables and data from investigations as they draw conclusions from scientific evidence. Seventh-grade students are able to recognize that technology can create environmental and economic conflicts, affect the quality of life, and that science and technology cannot answer all questions and cannot solve all human problems. Students access knowledge to explain how energy entering the ecosystems, such as sunlight, supports the life of organisms through photosynthesis and the transfer of energy through the interactions of organisms and the environment.

### **Grade Eight**

Students in the eighth grade explore space and plate tectonics as they continue to draw conclusions from scientific evidence that support theories related to the change of Earth's surface. They acquire knowledge to describe how positions and motions of objects in the universe cause predictable and cyclic events. Students explain that the universe is composed of vast amounts of matter and that it is held together by gravitational force. They explore equipment to study the universe - telescopes, probes, satellites and spacecraft. Motion of objects, effects of forces on objects, and how waves (sound, water and earthquake) transfer energy are explored. Students will be able to explain how extinction of a species occurs when the environment changes and its adaptive characteristics are insufficient to allow survival. Students design a solution to a problem or design and build a product, given certain constraints. Technological influences on the quality of life are also explored in this grade level.

### **Grade Nine**

The ninth-grade year addresses physical science and related principles in Earth and space sciences. Physical science concepts include the nature of matter and energy; identifiable physical properties of substances; and properties of forces that act on objects. Ninth-graders learn about forces and motions, structures and properties of atoms, how atoms react with each other to form other substances, and how molecules react with each other or other atoms. Earth and space science topics include processes that move and shape Earth, Earth's interaction with the solar system, and gravitational forces and weather. Students continue to develop a deeper understanding of the processes of scientific inquiry and how these processes use evidence to support conclusions based on logical reasoning. Students investigate ways in which science and technologies combine to meet human needs and solve human problems. Ninth-graders trace the historical development of scientific theories and ideas, explore scientific theories and develop their scientific literacy to become knowledgeable citizens.

## **SCOPE AND SEQUENCE (Cont.)**

### **Grade 10**

The 10<sup>th</sup> grade year emphasizes the concepts, principles and theories that enable people to understand the living environment. Students study life science concepts such as cells and their structure and function, the genetic and molecular bases of inheritance, biological evolution, and the diversity and interdependence of life. Students explain the Earth's history using geologic evidence, identifying the Earth's resources, and exploring processes that shape the Earth. The flow of energy and the cycling of matter through biological and ecological systems are addressed in the 10<sup>th</sup> grade. Embedded throughout this study are the basic science processes of inquiry, modeling investigations and the nature of science. Students learn to trace the historical development of scientific theories, ideas, ethical guidelines in science, the interdependence of science and technology, and the study of emerging issues to become scientifically literate citizens.

### **Grade 11**

In grade 11 students draw on their previous experience and connect Earth, space, life and physical sciences into a coherent study of the environment. Emphasis is placed on the interactions between humans and Earth, ecosystems, biological evolution, populations and diversity. Students also explore matter and energy relationships. The human interactions with science and technology are discussed, as well as how man has modified current ecosystems and natural systems. Students have the opportunity to use basic science processes of inquiry, scientific investigation, and the nature of science to examine past events, current situations, and to develop and revise scientific predictions, ideas or theories.

### **Grade 12**

Grade 12 focuses on advanced topics in biological and physical sciences. Biological topic clusters include cell specialization, biotechnology, DNA and evolutionary theory. In the physical sciences, students study equilibrium of systems, electromagnetic radiation, isotopes, radioactive decay, concepts of forces and motion as applied to large and small objects and energy levels. Integrated with these topics are historical perspectives, the process of inquiry, nature of science, ethical practices and use of appropriate technology. Twelfth-graders learn to apply principles of forces and motion to mathematically analyze, describe and predict the net effects of forces and motion of objects or systems. Students explore science research, scientific literature, and the relationship of science and society.

# FORMATTING EXPLANATION

**Standard:** Academic Standard is the overarching goal and describes what the students should know and be able to do.

## STANDARD 3: PHYSICAL SCIENCES

Grade 2

Grade Level or Discrete Course

Students demonstrate an understanding of the composition of physical systems and the concepts and principles that describe and predict the behavior of matter, the properties

Description of the Academic Content Standard.

and events in the natural world. This includes demonstrating an understanding of the structure and behavior of matter, the properties of materials and objects, chemical reactions and the conservation of matter. In addition, it includes understanding the nature, transfer and conservation of energy; motion and the forces affecting motion; and the nature of waves and interactions of matter and energy. Students demonstrate an understanding of the historical perspectives, scientific approaches and emerging scientific issues associated

Ohio Benchmarks  
Grade 2

Instructional  
Organization

Grade Level Indicators

Notes

<p>A. Discover that many objects are</p> <p><b>Benchmark:</b> Checkpoint of progress; a performance objective.</p>		<p>No indicators present for this benchmark.</p>	<p>Vocabulary</p>
<p>made of parts that have different characteristics. Describe these characteristics and recognize ways an object may change.</p>	<p>SC.3.B.2.1 <i>Forces and Motion</i></p>	<p>1. Explore how things make sound (e.g., rubber bands, tuning fork and strings). 3. Explore with flashlights and shadows that light travels in a straight line until it strikes an object.</p>	<p>Assessments</p>
<p>B.</p> <p><b>Organizers:</b> Subject organizers</p>	<p>SC.3.C.2.2 <i>Forces and Motion</i></p>	<p>2. Explore and describe sounds (e.g., high, low, loud, soft, fast, slow, high-pitched, low-pitched, etc.).</p> <p><b>Instructional organizer code:</b> SC = (Science) 3 = (Standard) B = (Benchmark) 2 = (Grade level or Discrete Course) 1 = (Grade Level Indicator)</p>	<p>Resources/Remediation/ Enrichment</p>
<p>Recognize that light, sound and objects move in different ways.</p>			
<p>C. Recognize sources of energy and their uses.</p>			