

# GRADE LEVEL CONTENT EXPECTATIONS

# 1

 SCIENCE  
v.1.09

SCIENCE PROCESSES

PHYSICAL SCIENCE

LIFE SCIENCE

EARTH SCIENCE

## Purpose & Overview

In 2004, the Michigan Department of Education embraced the challenge of creating Grade Level Content Expectations in response to the Federal No Child Left Behind Act of 2001. This act mandated the existence of a set of comprehensive state grade level assessments in mathematics and English language arts that are designed based on rigorous grade level content. In addition, assessments for science in elementary, middle, and high school were required. To provide greater clarity for what students are expected to know and be able to do by the end of each grade, expectations for each grade level have been developed for science.

In this global economy, it is essential that Michigan students possess personal, social, occupational, civic, and quantitative literacy. Mastery of the knowledge and essential skills defined in Michigan's Grade Level Content Expectations will increase students' ability to be successful academically, and contribute to the future businesses that employ them and the communities in which they choose to live.

Reflecting best practices and current research, the Grade Level Content Expectations provide a set of clear and rigorous expectations for all students, and provide teachers with clearly defined statements of what students should know and be able to do as they progress through school.

## Development

In developing these expectations, the K-7 Scholar Work Group depended heavily on the *Science Framework for the 2009 National Assessment of Educational Progress* (National Assessment Governing Board, 2006) which has been the gold standard for the high school content expectations. Additionally, the *National Science Education Standards* (National Research Council, 1996), the Michigan Curriculum Framework in Science (2000 version), and the *Atlas for Science Literacy, Volumes One* (AAAS, 2001) and *Two* (AAAS, 2007), were all continually consulted for developmental guidance. As a further resource for research on learning progressions and curricular designs, *Taking Science to School: Learning and Teaching Science in Grades K-8* (National Research Council, 2007) was extensively utilized. The following statement from this resource was a guiding principle:

"The next generation of science standards and curricula at the national and state levels should be centered on a few core ideas and should expand on them each year, at increasing levels of complexity, across grades K-8. Today's standards are still too broad, resulting in superficial coverage of science that fails to link concepts or develop them over successive grades."

Michigan's K-7 Scholar Work Group executed the intent of this statement in the development of "the core ideas of science...the big picture" in this document.

## Curriculum

Using this document as a focal point in the school improvement process, schools and districts can generate conversations among stakeholders concerning current policies and practices to consider ways to improve and enhance student achievement. Together, stakeholders can use these expectations to guide curricular and instructional decisions, identify professional development needs, and assess student achievement.

## Assessment

The Science Grade Level Content Expectations document is intended to be a curricular guide with the expectations written to convey expected performances by students. Science will continue to be assessed in grades five and eight for the Michigan Educational Assessment Program (MEAP) and MI-Access.

## Preparing Students for Academic Success

In the hands of teachers, the Grade Level Content Expectations are converted into exciting and engaging learning for Michigan's students. As educators use these expectations, it is critical to keep in mind that content knowledge alone is not sufficient for academic success. Students must also generate questions, conduct investigations, and develop solutions to problems through reasoning and observation. They need to analyze and present their findings which lead to future questions, research, and investigations. Students apply knowledge in new situations, to solve problems by generating new ideas, and to make connections between what they learn in class to the world around them.

Through the collaborative efforts of Michigan educators and creation of professional learning communities, we can enable our young people to attain the highest standards, and thereby open doors for them to have fulfilling and successful lives.

## Understanding the Organizational Structure

The science expectations in this document are organized into disciplines, standards, content statements, and specific content expectations. The content statements in each science standard are broader, more conceptual groupings. The skills and content addressed in these expectations will, in practice, be woven together into a coherent, science curriculum.

To allow for ease in referencing expectations, each expectation has been coded with a discipline, standard, grade-level, and content statement/expectation number.

For example, **P.FM.02.34** indicates:

**P** - Physical Science Discipline

**FM**-Force and Motion Standard

**02**-Second Grade

**34**-Fourth Expectation in the Third Content Statement

Content statements are written and coded for Elementary and Middle School Grade Spans. Not all content expectations for the content statement will be found in each grade.

## Why Create a 1.09 Version of the Expectations?

The Office of School Improvement is committed to creating the best possible product for educators. This commitment served as the impetus for revision of the 12.07 edition. This new version, v.1.09, refines and clarifies the original expectations, while preserving their essence and original intent and reflects the feedback from educators across the state during the past year.

## Elementary (K-4) Science Organizational Structure

Discipline 1 Science Processes	Discipline 2 Physical Science	Discipline 3 Life Science	Discipline 4 Earth Science
<b>Standards and Statements</b> <i>(and number of Content Expectations in each Statement)</i>			
<b>Inquiry Process (IP)</b> <b>Inquiry Analysis and Communication (IA)</b> <b>Reflection and Social Implications (RS)</b>	<b>Force and Motion (FM)</b> Position (2) Gravity (2) Force (8) Speed (3) <b>Energy (EN)</b> Forms of Energy (2) Light Properties (2) Sound (2) Energy and Temperature (3) Electrical Circuits (2) <b>Properties of Matter (PM)</b> Physical Properties (8) States of Matter (3) Magnets (4) Material Composition (1) Conductive and Reflective Properties (3) <b>Changes in Matter (CM)</b> Changes in State (1)	<b>Organization of Living Things (OL)</b> Life Requirements (6) Life Cycles (2) Structures and Functions (2) Classification (2) <b>Heredity (HE)</b> Observable Characteristics (3) <b>Evolution (EV)</b> Environmental Adaptation (2) Survival (2) <b>Ecosystems (EC)</b> Interactions (1) Changed Environment Effects (1)	<b>Earth Systems (ES)</b> Solar Energy (2) Weather (4) Weather Measurement (2) Natural Resources (4) Human Impact (2) <b>Solid Earth (SE)</b> Earth Materials (4) Surface Changes (2) Using Earth Materials (2) <b>Fluid Earth (FE)</b> Water (4) Water Movement (2) <b>Earth in Space and Time (ST)</b> Characteristics of Objects in the Sky (2) Patterns of Objects in the Sky (5) Fossils (2)

### Science Processes: Inquiry Process, Inquiry Analysis and Communication, Reflection, and Social Implications

Students entering the first grade should have an understanding of the five senses and how the use of their senses helps in science observations and investigations. The continued use of high interest subject matter piqued by their natural curiosity will further develop student understanding and skills in making observations, generating questions, planning and conducting simple investigations, meaning-making, and presentation of findings.

In addition to the skills the students acquired in their kindergarten experience, first grade students will recognize the importance of multiple trials in their investigations before drawing conclusions or presenting findings.

The first grade students, in all three science content disciplines, physical, life, and Earth, will be required to make careful and purposeful observations in order to raise questions, investigate, and make meaning of their findings.

### **Physical Science: Properties of Matter**

The first grade physical science experience is intended to develop the young learners' skills in using the senses to sort objects according to their observable physical attributes (color, shape, size, sinking, floating, texture). Young children begin their study of matter by examining and describing objects and their behavior. First grade students will also begin to study states of matter and particularly states of water as found on Earth. They explore water primarily in its liquid state and solid state. The Grade Level Content Expectations do not hold the first grade student responsible for a complete understanding of water in its gaseous state. The introduction of the three states of water on Earth is appropriate at this level; however, developing a complete knowledge base in states of matter requires many experiences over multiple grade levels, providing opportunities to continue children's explorations focused on observations and simple investigations. Elementary students have difficulty understanding that the water they see in a boiling pot evaporates into a gas. A common misconception is that it disappeared or went away. In subsequent grades students will be given the opportunity to conduct simple investigations with heating and evaporation that will help familiarize them with evaporation and gas as a state of matter.

The final area of study in the physical sciences is the observation of magnets and the interaction with magnetic and non-magnetic materials. The study of magnets also provides the opportunity for the young learners to build on their kindergarten experience of pushes and pulls that are required in the motion of an object. The magnets can be used to demonstrate pushes and pulls that are not in direct contact with the moving object, yet provide the force needed for motion.

### **Life Science: Organization of Living Things and Heredity**

The first grade life science curriculum builds on the students' prior knowledge of living and non-living things and the basic needs of all living things. Students are provided with the opportunity to explore and identify the needs of animals and describe the animal life cycle (egg, young, adult; egg, larva, pupa, adult).

Through their study of living things in the classroom, first grade students begin to make connections between young and adult, and are able to make simple identification of characteristics that are passed from parents to young (body coverings, beak shape, number of legs, body parts). They also develop the ability to match young animals with their parent based on similar characteristics (puppies/dogs, kittens/cats, calves/cows, chicks/chickens).

### **Earth Science: Earth Systems, Weather, and Solid Earth**

The Earth science content expectations for first grade focus on two main ideas. The first concept is the importance of the sun providing the warmth and light necessary for plant and animal life, and how plant and animal life are dependent on a variety of Earth materials. The students enter first grade with the basic ability to identify simple Earth materials and recognize that some Earth materials are necessary to grow plants. Building on their prior knowledge, the students will be given the opportunity to demonstrate and describe the importance of sun, air, and soil to plant and animal life.

The second main idea in first grade Earth science focuses on the study of weather and how it changes from day to day and over the seasons. The young learners are given the opportunity to observe, record, and measure weather conditions over a period of time. Student understanding of weather can be obtained through observations, descriptions, and finding patterns. The first grade Earth science content expectations also include the study of severe weather events and precautions that should be taken to ensure their safety if severe weather should occur.

## First Grade Science Standards, Statements, and Expectations

*Note: The number in parentheses represents the number of expectations.*

### Discipline 1: Science Processes (S)

#### Standard: Inquiry Process (IP)

1 Statement (6)

#### Standard: Inquiry Analysis and Communication (IA)

1 Statement (3)

#### Standard: Reflection and Social Implications (RS)

1 Statement (2)

### Discipline 2: Physical Science (P)

#### Standard: Properties of Matter (PM)

Physical Properties (1)

States of Matter (2)

Magnets (2)

### Discipline 3: Life Science (L)

#### Standard: Organization of Living Things (OL)

Life Requirements (1)

Life Cycles (1)

#### Standard: Heredity (HE)

Observable Characteristics (2)

### Discipline 4: Earth Science (E)

#### Standard: Earth Systems (ES)

Solar Energy (2)

Weather (4)

Weather Measurement (2)

#### Standard: Solid Earth (SE)

Earth Materials (1)

## SCIENCE PROCESSES | Inquiry Process

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***K-7 Standard S.IP:*** Develop an understanding that scientific inquiry and reasoning involves observing, questioning, investigating, recording, and developing solutions to problems.

**S.IP.E.1 Inquiry involves generating questions, conducting investigations, and developing solutions to problems through reasoning and observation.**

**S.IP.01.11** Make purposeful observation of the natural world using the appropriate senses.

**S.IP.01.12** Generate questions based on observations.

**S.IP.01.13** Plan and conduct simple investigations.

**S.IP.01.14** Manipulate simple tools (for example: hand lens, pencils, rulers, thermometers, rain gauges, balances, non-standard objects for measurement) that aid observation and data collection.

**S.IP.01.15** Make accurate measurements with appropriate (non-standard) units for the measurement tool.

**S.IP.01.16** Construct simple charts from data and observations.

### **Inquiry Analysis and Communication**

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***K-7 Standard S.IA:*** Develop an understanding that scientific inquiry and investigations require analysis and communication of findings, using appropriate technology.

**S.IA.E.1 Inquiry includes an analysis and presentation of findings that lead to future questions, research, and investigations.**

**S.IA.01.12** Share ideas about science through purposeful conversation.

**S.IA.01.13** Communicate and present findings of observations.

**S.IA.01.14** Develop strategies for information gathering (ask an expert, use a book, make observations, conduct simple investigations, and watch a video).

### **Reflection and Social Implications**

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***K-7 Standard S.RS:*** Develop an understanding that claims and evidence for their scientific merit should be analyzed. Understand how scientists decide what constitutes scientific knowledge. Develop an understanding of the importance of reflection on scientific knowledge and its application to new situations to better understand the role of science in society and technology.

**S.RS.E.1 Reflecting on knowledge is the application of scientific knowledge to new and different situations. Reflecting on knowledge requires careful analysis of evidence that guides decision-making and the application of science throughout history.**

**S.RS.01.11** Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.

**S.RS.01.12** Recognize that science investigations are done more than one time.

**PHYSICAL SCIENCE****Properties of Matter**

**K-7 Standard P.PM:** *Develop an understanding that all matter has observable attributes with physical and chemical properties that are described, measured, and compared. Understand that states of matter exist as solid, liquid, or gas; and have physical and chemical properties. Understand all matter is composed of combinations of elements, which are organized by common attributes and characteristics on the Periodic Table. Understand that substances can be classified as mixtures or compounds and according to their physical and chemical properties.*

**P.PM.E.1 Physical Properties- All objects and substances have physical properties that can be measured.**

**P.PM.01.11** Demonstrate the ability to sort objects according to observable attributes such as color, shape, size, sinking or floating.

**P.PM.E.2 States of Matter- Matter exists in several different states: solids, liquids and gases. Each state of matter has unique physical properties. Gases are easily compressed but liquids and solids do not compress easily. Solids have their own particular shapes, but liquids and gases take the shape of the container.**

**P.PM.01.21** Demonstrate that water as a solid keeps its own shape (ice).

**P.PM.01.22** Demonstrate that water as a liquid takes on the shape of various containers.

**P.PM.E.3 Magnets- Magnets can repel or attract other magnets. Magnets can also attract magnetic objects. Magnets can attract and repel at a distance. \***

**P.PM.01.31** Identify materials that are attracted by magnets.

**P.PM.01.32** Observe that like poles of a magnet repel and unlike poles of a magnet attract.

**LIFE SCIENCE****Organization of Living Things**

**K-7 Standard L.OL:** *Develop an understanding that plants and animals (including humans) have basic requirements for maintaining life which include the need for air, water, and a source of energy. Understand that all life forms can be classified as producers, consumers, or decomposers as they are all part of a global food chain where food/energy is supplied by plants which need light to produce food/energy. Develop an understanding that plants and animals can be classified by observable traits and physical characteristics. Understand that all living organisms are composed of cells and they exhibit cell growth and division. Understand that all plants and animals have a definite life cycle, body parts, and systems to perform specific life functions.*

\* Revised expectations marked by an asterisk.

**L.OL.E.1 Life Requirements- Organisms have basic needs. Animals and plants need air, water, and food. Plants also require light. Plants and animals use food as a source of energy and as a source of building material for growth and repair.**

**L.OL.01.13** Identify the needs of animals.

**L.OL.E.2 Life Cycles- Plants and animals have life cycles. Both plants and animals begin life and develop into adults, reproduce, and eventually die. The details of this life cycle are different for different organisms.**

**L.OL.01.21** Describe the life cycle of animals including the following stages: egg, young, adult; egg, larva, pupa, adult.

## **Heredity**

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**K-7 Standard L.HE:** *Develop an understanding that all life forms must reproduce to survive. Understand that characteristics of mature plants and animals may be inherited or acquired and that only inherited traits are passed on to their young. Understand that inherited traits can be influenced by changes in the environment and by genetics.*

**L.HE.E.1 Observable Characteristics- Plants and animals share many, but not all, characteristics of their parents.**

**L.HE.01.11** Identify characteristics (for example: body coverings, beak shape, number of legs, body parts) that are passed on from parents to young.

**L.HE.01.12** Classify young animals based on characteristics that are passed on from parents (for example: dogs/puppies, cats/kittens, cows/calves, chicken/chicks).

## **EARTH SCIENCE**

### **Earth Systems**

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**K-7 Standard E.ES:** *Develop an understanding of the warming of the Earth by the sun as the major source of energy for phenomenon on Earth and how the sun's warming relates to weather, climate, seasons, and the water cycle. Understand how human interaction and use of natural resources affects the environment.*

**E.ES.E.1 Solar Energy- The sun warms the land, air and water and helps plants grow.**

**E.ES.01.11** Identify the sun as the most important source of heat which warms the land, air, and water of the Earth.

**E.ES.01.12** Demonstrate the importance of sunlight and warmth in plant growth.

**E.ES.E.2 Weather- Weather changes from day to day and over the seasons.**

**E.ES.01.21** Compare daily changes in the weather related to temperature (cold, hot, warm, cool); cloud cover (cloudy, partly cloudy, foggy); precipitation (rain, snow, hail, freezing rain); wind (breezy, windy, calm).

**E.ES.01.22** Describe and compare weather related to the four seasons in terms of temperature, cloud cover, precipitation, and wind.

**E.ES.01.23** Describe severe weather characteristics. \*

**E.ES.01.24** Describe precautions that should be taken for human safety during severe weather conditions (thunder and lightning, tornadoes, strong winds, heavy precipitation). \*

**E.ES.E.3 Weather Measurement- Scientists use tools for observing, recording, and predicting weather changes.**

**E.ES.01.31** Identify the tools that might be used to measure temperature, precipitation, cloud cover, and wind.

**E.ES.01.32** Observe and collect data of weather conditions over a period of time.

\* Revised expectations marked with an asterisk.