

# GRADE LEVEL CONTENT EXPECTATIONS

# 3

 SCIENCE

v.1.09

## Welcome to Michigan's K-7 Grade Level Content Expectations

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 continue building their inquiry and investigation skills through the use of observations and data collection. This learning requires using measurement with appropriate units of measure and conducting simple and fair investigations. Students use their data as evidence to separate fact from opinion, and compare and contrast different sets of data from multiple trials. In the application of what students discover through their investigations, they begin to describe the effect of humans and other organisms on the balance of the natural world and how people contribute to the advancement of science.

The content expectations for third grade science students present high interest content that leads to investigations, data collection, raising questions, and the identification of current problems in the environment that society faces on Earth.

### **Physical Science: Motion of Objects, Energy, and Properties of Matter**

The previous grades have provided the students with an introduction to the understanding of motion (kindergarten), and properties of matter (first grade and second grade). The study of motion asks for students to compare and contrast motion in terms of direction and speed of an object. Using force as a push or a pull from the kindergarten expectations now builds toward the idea that when an object does not move in response to a force, it is because another force is acting on it. The force of gravity as the force that pulls objects towards the Earth is the foundation of this learning.

The third grade science content expectations introduce the concept of energy through the study of light and sound. Students explore light and how light travels in a straight path, how shadows are made, and the behavior of light through water. Students discover that different objects interact differently with light; objects can reflect, absorb, or refract light. Objects can also absorb heat energy when exposed to light. Properties of sound are also introduced in the third grade curriculum. Students are given the opportunity to explore how different pitches are produced and sound as a result of vibrations.

### **Life Science: Organization of Living Things, Evolution**

The third grade life science curriculum combines the previous studies of animals and plants from the first and second grades. These studies build toward an understanding of the complex interactions among living and nonliving things and the diversity of life. Children explore the functions of structures in plants and animals that help them to survive in their environment, establish the initial association of organisms within their environments, and develop ideas regarding the dependence of living things on various aspects of behavior within their environment.

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

Initially, the third grade students explore natural causes of change on the Earth's surface, different types of Earth materials (rocks, minerals, clay, boulders, gravel, sand, and soil), and identify those materials used to construct common objects. The skills students need to understand and apply their scientific knowledge and develop an awareness of the effects of humans and other organisms on the environment are a primary focus in the third grade Earth science instruction. Students explore natural resources (renewable and non-renewable), and describe how humans protect and harm the environment. Children are asked to employ causal reasoning between human activities and the impact on the environment.

The common idea of the dependency of life on the environment and the effects of humans and other living organisms on the environment, provides the opportunity for students to apply their knowledge to current environmental problems and what the third grader can do to protect the environment.

## Third 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 (5)

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

1 Statement (7)

### Discipline 2: Physical Science (P)

#### Standard: Force and Motion (FM)

Gravity (1)

Force (4)

Speed (3)

#### Standard: Energy (EN)

Forms of Energy (1)

Light Properties (2)

Sound (2)

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

Conductive and Reflective Properties (2)

### Discipline 3: Life Science (L)

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

Structures and Functions (2)

Classification (2)

#### Standard: Evolution (EV)

Environmental Adaptation (2)

### Discipline 4: Earth Science (E)

#### Standard: Earth Systems (ES)

Natural Resources (4)

Human Impact (2)

#### Standard: Solid Earth (SE)

Earth Materials (2)

Surface Changes (1)

Using Earth Materials (2)

## 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.03.11** Make purposeful observation of the natural world using the appropriate senses.

**S.IP.03.12** Generate questions based on observations.

**S.IP.03.13** Plan and conduct simple and fair investigations.

**S.IP.03.14** Manipulate simple tools that aid observation and data collection (for example: hand lens, balance, ruler, meter stick, measuring cup, thermometer, spring scale, stop watch/timer).

**S.IP.03.15** Make accurate measurements with appropriate units (centimeters, meters, Celsius, grams, seconds, minutes) for the measurement tool.

**S.IP.03.16** Construct simple charts and graphs 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.03.11** Summarize information from charts and graphs to answer scientific questions.

**S.IA.03.12** Share ideas about science through purposeful conversation in collaborative groups.

**S.IA.03.13** Communicate and present findings of observations and investigations.

**S.IA.03.14** Develop research strategies and skills for information gathering and problem solving.

**S.IA.03.15** Compare and contrast sets of data from multiple trials of a science investigation to explain reasons for differences.

### **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 and within society.**

**S.RS.03.11** Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.

**S.RS.03.14** Use data/samples as evidence to separate fact from opinion.

**S.RS.03.15** Use evidence when communicating scientific ideas.

**S.RS.03.16** Identify technology used in everyday life.

**S.RS.03.17** Identify current problems that may be solved through the use of technology.

**S.RS.03.18** Describe the effect humans and other organisms have on the balance of the natural world.

**S.RS.03.19** Describe how people have contributed to science throughout history and across cultures.

## PHYSICAL SCIENCE

### Force and Motion

***K-7 Standard P.FM:*** Develop an understanding that the position and/or motion of an object is relative to a point of reference. Understand forces affect the motion and speed of an object and that the net force on an object is the total of all of the forces acting on it. Understand the Earth pulls down on objects with a force called gravity. Develop an understanding that some forces are in direct contact with objects, while other forces are not in direct contact with objects.

**P.FM.E.2 Gravity- Earth pulls down on all objects with a force called gravity. With very few exceptions, objects fall to the ground no matter where the object is on the Earth.**

**P.FM.03.22** Identify the force that pulls objects towards the Earth.

**P.FM.E.3 Force- A force is either a push or a pull. The motion of objects can be changed by forces. The size of the change is related to the size of the force. The change is also related to the weight (mass) of the object on which the force is being exerted. When an object does not move in response to a force, it is because another force is being applied by the environment.**

**P.FM.03.35** Describe how a push or a pull is a force.

**P.FM.03.36** Relate a change in motion of an object to the force that caused the change of motion.

**P.FM.03.37** Demonstrate how the change in motion of an object is related to the strength of the force acting upon the object and to the mass of the object.

**P.FM.03.38** Demonstrate when an object does not move in response to a force, it is because another force is acting on it.

**P.FM.E.4 Speed- An object is in motion when its position is changing. The speed of an object is defined by how far it travels in a standard amount of time. \***

**P.FM.03.41** Describe the motion of objects in terms of direction. \*

**P.FM.03.42** Identify changes in motion (change direction, speeding up, slowing down).

**P.FM.03.43** Relate the speed of an object to the distance it travels in a standard amount of time.

## **Energy**

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***K-7 Standard P.EN:*** Develop an understanding that there are many forms of energy (such as heat, light, sound, and electrical) and that energy is transferable by convection, conduction, or radiation. Understand energy can be in motion, called kinetic; or it can be stored, called potential. Develop an understanding that as temperature increases, more energy is added to a system. Understand nuclear reactions in the sun produce light and heat for the Earth.

**P.EN.E.1 Forms of Energy- Heat, electricity, light, and sound are forms of energy.**

**P.EN.03.11** Identify light and sound as forms of energy.

**P.EN.E.2 Light Properties- Light travels in a straight path. Shadows result from light not being able to pass through an object. When light travels at an angle from one substance to another (air and water), it changes direction. \***

**P.EN.03.21** Demonstrate that light travels in a straight path and that shadows are made by placing an object in a path of light. \*

**P.EN.03.22** Observe what happens to light when it travels from air to water (a straw half in the water and half in the air looks bent). \*

**P.EN.E.3 Sound- Vibrating objects produce sound. The pitch of sound varies by changing the rate of vibration.**

**P.EN.03.31** Relate sounds to their sources of vibrations (for example: a musical note produced by a vibrating guitar string, the sounds of a drum made by the vibrating drum head).

**P.EN.03.32** Distinguish the effect of fast or slow vibrations as pitch.

\* Revised expectations marked by an asterisk.

## 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.5 Conductive and Reflective Properties- Objects vary to the extent they absorb and reflect light energy and conduct heat and electricity.**

**P.PM.03.51** Demonstrate how some materials are heated more than others by light that shines on them.

**P.PM.03.52** Explain how we need light to see objects: light from a source reflects off objects and enters our eyes.

## 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.

**L.OL.E.3 Structures and Functions- Organisms have different structures that serve different functions in growth, survival, and reproduction.**

**L.OL.03.31** Describe the function of the following plant parts: flower, stem, root, and leaf.

**L.OL.03.32** Identify and compare structures in animals used for controlling body temperature, support, movement, food-getting, and protection (for example: fur, wings, teeth, scales). \*

**L.OL.E.4 Classification- Organisms can be classified on the basis of observable characteristics.**

**L.OL.03.41** Classify plants on the basis of observable physical characteristics (roots, leaves, stems, and flowers).

**L.OL.03.42** Classify animals on the basis of observable physical characteristics (backbone, body coverings, limbs). \*

\* Revised expectations marked by an asterisk.

## Evolution

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***K-7 Standard L.EV:*** *Develop an understanding that plants and animals have observable parts and characteristics that help them survive and flourish in their environments. Understand that fossils provide evidence that life forms have changed over time and were influenced by changes in environmental conditions. Understand that life forms either change (evolve) over time or risk extinction due to environmental changes and describe how scientists identify the relatedness of various organisms based on similarities in anatomical features.*

**L.EV.E.1 Environmental Adaptation- Different kinds of organisms have characteristics that help them to live in different environments.**

**L.EV.03.11** Relate characteristics and functions of observable parts in a variety of plants that allow them to live in their environment (leaf shape, thorns, odor, color). \*

**L.EV.03.12** Relate characteristics and functions of observable body parts to the ability of animals to live in their environment (sharp teeth, claws, color, body coverings). \*

## 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.4 Natural Resources- The supply of many natural resources is limited. Humans have devised methods for extending their use of natural resources through recycling, reuse, and renewal.**

**E.ES.03.41** Identify natural resources (metals, fuels, fresh water, fertile soil, and forests). \*

**E.ES.03.42** Classify renewable (fresh water, fertile soil, forests) and non-renewable (fuels, metals) resources. \*

**E.ES.03.43** Describe ways humans are protecting, extending, and restoring resources (recycle, reuse, reduce, renewal).

**E.ES.03.44** Recognize that paper, metal, glass, and some plastics can be recycled.

\* Revised expectations marked by an asterisk.

**E.ES.E.5 Human Impact- Humans depend on their natural and constructed environment. Humans change environments in ways that are helpful or harmful for themselves and other organisms.**

**E.ES.03.51** Describe ways humans are dependent on the natural environment (forests, water, clean air, Earth materials) and constructed environments (homes, neighborhoods, shopping malls, factories, and industry).

**E.ES.03.52** Describe helpful or harmful effects of humans on the environment (garbage, habitat destruction, land management, renewable, and non-renewable resources).

## **Solid Earth**

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***K-7 Standard E.SE:** Develop an understanding of the properties of Earth materials and how those properties make materials useful. Understand gradual and rapid changes in Earth materials and features of the surface of Earth. Understand magnetic properties of Earth.*

**E.SE.E.1 Earth Materials- Earth materials that occur in nature include rocks, minerals, soils, water, and the gases of the atmosphere. Some Earth materials have properties which sustain plant and animal life.**

**E.SE.03.13** Recognize and describe different types of Earth materials (mineral, rock, clay, boulder, gravel, sand, soil, water, and air). \*

**E.SE.03.14** Recognize that rocks are made up of minerals.

**E.SE.E.2 Surface Changes- The surface of Earth changes. Some changes are due to slow processes, such as erosion and weathering; and some changes are due to rapid processes, such as landslides, volcanic eruptions, and earthquakes.**

**E.SE.03.22** Identify and describe natural causes of change in the Earth's surface (erosion, glaciers, volcanoes, landslides, and earthquakes).

**E.SE.E.3 Using Earth Materials- Some Earth materials have properties that make them useful either in their present form or designed and modified to solve human problems. They can enhance the quality of life as in the case of materials used for building or fuels used for heating and transportation.**

**E.SE.03.31** Identify Earth materials used to construct some common objects (bricks, buildings, roads, glass). \*

**E.SE.03.32** Describe how materials taken from the Earth can be used as fuels for heating and transportation.

\* Revised expectations marked by an asterisk.