KINDERGARTEN SCIENCE

GRADE LEVEL CONTENT EXPECTATIONS

K 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.

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

Kindergarten presents the initial opportunity for young learners to become engaged in the study of science through their natural curiosity in subject matter that is of high interest. The Grade Level Content Expectations for science at this level are centered on areas where the young learners have begun to form ideas and try to make sense of the world around them. Many of the building blocks of scientific understanding begin to emerge prior to school. Kindergarten students will be guided in the process of scientific inquiry through purposeful observations, raising questions, as well as making sense of their observations, investigations, meaning-making practices, and demonstrating their understanding through various activities. The curriculum builds cumulatively and in developmentally informed ways from students' early knowledge toward scientifically accepted concepts. Included in the inquiry curriculum is the use of the appropriate senses in purposeful observations. It is intended for the five senses to be taught within the content of science, giving the students the opportunity to learn and use their senses for purposeful observation, stressing the very limited use of the sense of taste in the study of science. The use of senses during observations continues to be present in the inquiry expectations for grades first through fourth.

Physical Science: Force and Motion

Prior to entering kindergarten, many students have developed an understanding of the motion of objects. For example, the young learner has discovered that solid objects cannot move through each other, changes in motion and position of objects are the result of a force outside them, and that objects tend to endure over space and time. They learn even though the ball has rolled out of sight, it still exists behind the wall, under the couch, or behind someone's back. They can also make inferences about reasonable causes of motion of inanimate objects. Pre-kindergarteners have their own concept of force that they use to explain what happens in the motion of objects. They think of forces as active pushes and pulls that are needed to explain an object's motion.

The kindergarten content expectations for physical science are meant to build on and use the early learners' ability to correctly sense some of the behaviors of simple mechanical objects and the motion of objects. The central idea is for the young learner to be able to attach appropriate language that describes motion, compares motion, and begin to develop an understanding of forces and their relationship to changes in motion. Finally the students are introduced to the concept that objects fall toward the Earth and that the force that pulls objects toward Earth affects the motion of all objects.

Life Science: Organization of Living Things

The young learner enters kindergarten with a natural wonder and curiosity of the order of living and non-living things. They are curious about the function of the different body parts of living things. They have a basic understanding that living things need food and that food is somehow changed in a manner that allows the living organism to grow and survive. They do not yet have a generalized understanding of how both plants and animals obtain their food or the process of digestion. At this level students are also beginning to categorize living and non-living things. They will sort plants and animals from toys or artifacts even though they have similarities in their appearance.

The kindergarten content expectations for life science build a greater understanding of the basic needs of all living things and classifying living and nonliving things. Through direct classroom experiences of living things and their habitats, students begin to think beyond movement as the defining characteristic of life and recognize characteristics of living things with eating, breathing, and reproducing.

Earth Science: Solid Earth

Early learners are naturally curious about the objects in their environment – soil, rocks, water, sand, rain, snow, and so on. Kindergarteners enter school with an idea that the Earth is made up of soil, rocks, pebbles, sand, water, and living things. They should be encouraged to closely observe materials found on Earth and begin to describe their properties.

The essential learning in Earth science for the kindergarten student is to be able to identify different Earth materials and recognize the Earth materials necessary to grow plants, linking the common thread of understanding in life science and Earth science.

Young students have difficulty understanding the concept that the Earth is round. Their own observations tell them that the Earth is essentially flat. When told that the Earth is round they may interpret that to mean that it is a flat disc or saucer. The introduction of globes as models of the Earth is essential in their beginning to understand the shape of objects in the sky such as the Earth, moon, and sun.

Kindergarten 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 (1)

Discipline 2: Physical Science (P)

Standard: Force and Motion (FM)
Position (2)
Gravity (1)
Force (4)

Discipline 3: Life Science (L)

Standard: Organization of Living Things (OL)
Life Requirements (2)

Discipline 4: Earth Science (E)

Standard: Solid Earth (SE)
Earth Materials (1)

SCIENCE PROCESSES

Inquiry Process

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.00.11 Make purposeful observation of the natural world using the appropriate senses.
S.IP.00.12 Generate questions based on observations.
S.IP.00.13 Plan and conduct simple investigations.
S.IP.00.14 Manipulate simple tools (for example: hand lens, pencils, balances, non-standard objects for measurement) that aid observation and data collection.
S.IP.00.15 Make accurate measurements with appropriate (non-standard) units for the measurement tool.
S.IP.00.16 Construct simple charts from data and observations.

Inquiry Analysis and Communication

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.00.12 Share ideas about science through purposeful conversation.
S.IA.00.13 Communicate and present findings of observations.
S.IA.00.14 Develop strategies for information gathering (ask an expert, use a book, make observations, conduct simple investigations, and watch a video).

Reflection and Social Implications

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.00.11 Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.

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.1 Position- A position of an object can be described by locating the object relative to other objects or a background. *

P.FM.00.11 Describe the position of an object (for example: above, below, in front of, behind, on) in relation to other objects around it. *

P.FM.00.12 Describe the direction of a moving object (for example: away from or closer to) from different observers' views. *

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.00.21 Observe how objects fall toward 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.00.31 Demonstrate pushes and pulls on objects that can move. *

P.FM.00.32 Observe that objects initially at rest will move in the direction of the push or pull.

P.FM.00.33 Observe how pushes and pulls can change the speed or direction of moving objects.

P.FM.00.34 Observe how shape (for example: cone, cylinder, sphere) and mass of an object can affect motion. *

* Revised expectations marked by an asterisk.

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.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.00.11 Identify that living things have basic needs.
L.OL.00.12 Identify and compare living and nonliving things.

EARTH SCIENCE — Solid Earth

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.00.11 Identify Earth materials that occur in nature (sand, rocks, soil, water). *
E.SE.00.12 Describe how Earth materials contribute to the growth of plant and animal life. *

* Revised expectations marked by an asterisk.