SIXTH GRADE SCIENCE

GRADE LEVEL CONTENT EXPECTATIONS

6 SCIENCE

v.4.07

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 Scholar Work Group depended heavily on the *Science Framework for the 2009 National Assessment of Educational Progress* (National Assessment Governing Board, 2006) which had 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.

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 for the draft review, each expectation has been coded with a discipline, standard, grade-level, and expectation number. For example, **P.MO.00.09** indicates:

P - Physical Science Discipline

MO-Motion of Objects Standard

00-Kindergarten Expectation

09-Ninth Expectation in the Kindergarten Grade-Level

Discipline 1 **Science Processes**	**Discipline 2** **Physical Science**	**Discipline 3** **Life Science**	**Discipline 4** **Earth Science**
Standards			
Inquiry and Reflection (IR)	Motion of Objects (MO) Energy (EN) Properties of Matter (PM) Changes in Matter (CM)	Organization of Living Things (OL) Heredity (HE) Evolution (EV) Ecosystems (EC)	Earth Systems (ES) Solid Earth (SE) Fluid Earth (FE) Earth in Space and Time (ST)

*(**Note:** Final coding will be different than this draft document coding, and will incorporate content statements and content expectations into the coding.)*

Preparing Students for Academic Success

Within the hands of teachers, the Grade Level Content Expectations are converted into exciting and engaging learning for Michigan's students. As we use these expectations to develop units of instruction and plan instructional delivery, it is critical to keep in mind that content knowledge alone is not sufficient for academic success. Students must be able to 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. The art of teaching is what makes the content of learning become a reality.

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.

SCIENCE PROCESSES — Inquiry, Reflection, and Social Implications

S.IR.06.1 Inquiry involves generating questions, conducting investigations, and developing solutions to problems through reasoning and observation. Inquiry includes an analysis and presentation of findings that lead to future questions, research, and investigations.

S.IR.06.01 Generate scientific questions based on observations, investigations, and research.
S.IR.06.02 Design and conduct scientific investigations.
S.IR.06.03 Use tools and equipment appropriate to scientific investigations.
S.IR.06.04 Use metric measurement devices in an investigation.
S.IR.06.05 Construct charts and graphs from data and observations.
S.IR.06.06 Identify patterns in data.
S.IR.06.07 Analyze information from data tables and graphs to answer scientific questions.

S.IR.06.2 Reflecting knowledge is the application of scientific knowledge to new and different situations. Reflecting knowledge requires careful analysis of evidence that guides decision-making and the application of science throughout history.

S.IR.06.08 Evaluate the strengths and weaknesses of claims, arguments, and data.
S.IR.06.09 Describe limitations in personal and scientific knowledge.
S.IR.06.10 Identify the need for evidence in making scientific decisions.
S.IR.06.11 Evaluate scientific explanations based on current evidence and scientific principles.
S.IR.06.12 Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.
S.IR.06.13 Design solutions to problems using technology.
S.IR.06.14 Describe the effect humans and other organisms have on the balance of the natural world.
S.IR.06.15 Describe what science and technology can and cannot reasonably contribute to society.
S.IR.06.16 Describe how science and technology have advanced because of the contributions of many people throughout history and across cultures.

PHYSICAL SCIENCE — Properties of Matter

P.PM.06.1 Matter has chemical properties. The understanding of chemical properties helps to explain how new substances are formed.

P.PM.06.17 Identify examples of chemical properties of matter.
P.PM.06.18 Classify substances by their chemical properties.
P.PM.06.19 Identify acids and bases using an acid/base indicator.

P.PM.06.3 Elements are composed of a single kind of atom that are grouped into families with similar properties on the periodic table. Compounds are composed of two or more different elements. Each element and compound has a unique set of physical and chemical properties such as boiling point, density, color, conductivity, and reactivity.

P.PM.06.20 Identify the smallest component that makes up an element.
P.PM.06.21 Describe how the elements within the Periodic Table are organized into families.
P.PM.06.22 Identify that compounds are composed of two or more different elements.
P.PM.06.23 List examples of physical and chemical properties of elements and compounds (boiling point, density, color, conductivity, reactivity).

Changes in Matter

P.CM.06.1 Matter changing from state to state can be explained by using models which show that matter is composed of tiny particles in motion. When changes of state occur, the atoms and/or molecules are not changed in structure. When the changes in state occur, mass is conserved because matter is not created or destroyed.

P.CM.06.24 Describe and illustrate changes in state, in terms of the arrangement and relative motion of the atoms or molecules.
P.CM.06.25 Explain how mass is conserved as it changes from state to state in a closed system.

P.CM.06.2 Chemical changes occur when two elements and/or compounds react and produce new substances. These new substances have different physical and chemical properties than the original elements and/or compounds. During the chemical change, the number and kind of atoms in the reactants are the same as the number and kind of atoms in the products. Mass is conserved during chemical changes. The mass of the reactants is the same as the mass of the products.

P.CM.06.26 Identify evidence of chemical change through color, gas formation, solid formation, and temperature change.
P.CM.06.27 Compare and contrast the chemical properties of a new substance with the original after a chemical change.
P.CM.06.28 Describe the physical properties and chemical properties of the products and reactants in a chemical change.

L.OL.06.6 All animals, including humans, are consumers that meet their energy by eating other organisms or their products. Consumers break down the structures of the organisms they eat to make the materials they need to grow and function. Decomposers, including bacteria and fungi, use dead organisms or their products to meet their energy needs.

L.OL.06.29 Classify organisms (producers, consumers, and decomposers) based on their source of energy for growth and development.

L.OL.06.30 Distinguish between the ways in which consumers and decomposers obtain energy.

Ecosystems

L.EC.06.1 Organisms of one species form a population. Populations of different organisms interact and form communities. Living communities and nonliving factors that interact with them form ecosystems.

L.EC.06.31 List examples of populations, communities, and ecosystems.

L.EC.06.2 Two types of organisms may interact with one another in several ways: They may be in a producer/consumer, predator/prey, or parasite/host relationship. Some organisms may scavenge or decompose another. Relationships may be competitive or mutually beneficial. Some species have become so adapted to each other that neither could survive without the other.

L.EC.06.32 Describe common ecological relationships between and among species and their environment (competition, territory, carrying capacity, population, dependence, and other biotic factors).

L.EC.06.33 Describe the role of decomposers in the transfer of energy in an ecosystem.

L.EC.06.34 Explain how two organisms can be mutually beneficial and how that can lead to interdependency.

L.EC.06.3 The number of organisms and populations an ecosystem can support depends on the biotic (living) resources available and abiotic (nonliving) factors, such as quality of light and water, range of temperatures and soil composition.

L.EC.06.35 Identify the factors in an ecosystem that influence changes in population size.
L.EC.06.36 Identify the living (biotic) and nonliving (abiotic) components of an ecosystem.
L.EC.06.37 Describe how living and non-living factors cycle in an ecosystem (water, carbon, oxygen, and nitrogen).

L.EC.06.4 All organisms (including humans) cause changes in the environment where they live. Some of the changes are harmful to the organism or other organisms, whereas others are helpful.

L.EC.06.38 Predict how changes in one population might affect other populations based upon their relationships in a food web.
L.EC.06.39 Describe how human beings are part of Earth's ecosystem and that human activities can purposefully or accidentally alter the balance in ecosystems.

EARTH SCIENCE — Earth Systems

E.ES.06.1 The sun is the major source of Earth's energy for phenomena on Earth's surface.

E.ES.06.40 Describe how the sun produces light and heat for Earth in terms of supporting life.
E.ES.06.41 Demonstrate, using a model or drawing, the relationship between the sun's warming of the Earth and the water cycle as it applies to the atmosphere (evaporation, water vapor, warm air rises, cooling, condensation, clouds).
E.ES.06.42 Describe the relationship between the sun's warming of the Earth's atmosphere and convection within the atmosphere and oceans.
E.ES.06.43 Describe how the sun's warming of the Earth produces winds and ocean currents.

E.ES.06.5 Global patterns of atmospheric and oceanic movement influence weather and climate.

E.ES.06.44 Compare and contrast the difference and relationship between climate and weather.

E.ES.06.45 Describe how different weather occurs due to the constant motion of the atmosphere from the sun's energy reaching Earth's surface.

E.ES.06.46 Explain how the temperature of the oceans affect the different climates on Earth because water in the oceans holds a large amount of heat.

E.ES.06.47 Describe relative humidity in terms of the moisture content of the air and the moisture capacity of the air, and how these depend on the temperature.

E.ES.06.48 Describe conditions associated with frontal boundaries (cold, warm, stationary, and occluded) and the movement of major air masses and the jet stream across North America using a weather map.

E.ES.06.6 Water circulates through the earth's four spheres in what is known as the "water cycle."

E.ES.06.49 Explain the water cycle and describe how evaporation, transpiration, condensation, cloud formation, precipitation, infiltration, surface runoff, ground water, and absorption occur within the cycle.

E.ES.06.50 Analyze the flow of water between the components of a watershed, including surface features (lakes, streams, rivers, wetlands) and groundwater.

E.ES.06.51 Demonstrate how water dissolves minerals and gases in the atmosphere in the process of the water cycle and carries them to oceans.

E.ES.06.7 Human activities have changed the Earth's land, oceans and atmosphere resulting in the reduction of the number and variety of wild plants and animals sometimes causing extinction of species.

E.ES.06.52 Explain how human activities (surface mining, construction and urban development, farming, dams, landfills, and restoring natural areas) change the surface of the Earth.

E.ES.06.53 Describe the effects of deforestation and how it affects the growth and survival of other plants and animals.

E.ES.06.54 Describe the origins of pollution in the atmosphere, geosphere, and hydrosphere, (car exhaust, industrial emissions, acid rain, and natural sources), and how pollution impacts habitats, climatic change, and endangerment of species.

E.ES.06.55 Describe how an overpopulated environment will become degraded due to the increased use of resources, which may lead to a reduction in the number and variety of plants and animals, and possible extinction of species.

Fluid Earth

E.FE.07.1 The atmosphere is a mixture of nitrogen, oxygen and trace gases that include water vapor. The atmosphere has different physical and chemical composition at different elevations.

E.FE.06.56 Describe the composition and layers of the atmosphere. (air, molecules, gas, water vapor, dust particles, ozone).

E.FE.06.57 Explain the behavior of water in the atmosphere.