STATE OF MICHIGAN
DEPARTMENT OF EDUCATION
LANSING

JENNIFER M. GRANHOLM
GOVERNOR

MICHAEL P. FLANAGAN
SUPERINTENDENT OF
PUBLIC INSTRUCTION

MEMORANDUM

TO: State Board of Education

FROM: Michael P. Flanagan, Chairman

DATE: April 23, 2007

SUBJECT: Presentation of the Draft K-7 Grade Level Content Expectations for Science Prior to Public and National Review

The national call to create more rigorous learning for high school students has become a major priority for state leaders across the country. In Michigan, this movement started with the State Board amending, then approving the State Superintendent recommendations, and culminated in April 2006, when Governor Jennifer M. Granholm signed into law a comprehensive set of high school graduation requirements called the Michigan Merit Curriculum. The Michigan Department of Education's Office of School Improvement developed High School Content Expectations (HSCE) and Course Credit Requirements for Science. The content expectations were developed to create a more rigorous learning experience for the students.

In an effort to ensure continuity and high rigorous expectations from kindergarten through twelfth grade, the Office of School Improvement has developed K-7 Grade Level Content Expectations (GLCE) in science. The work group was co-chaired by two well respected science educators: Larry Casler from Genesee Intermediate School District – Math/Science Center, and Liz Niehaus, from Niehaus and Associates Inc., who assembled a broad, diverse work group of teacher-leaders who are strong in each of the content areas for science. Their charge was to develop content expectations that clearly defined what all students should know and be able to do in kindergarten through seventh grade.

The first draft of this document is being presented to the State Board of Education before it is provided to the field for feedback. It is anticipated that both a field and national review will begin in May of 2007.

Attchment

608 WEST ALLEGAN STREET • P.O. BOX 30008 • LANSING, MICHIGAN 48909
www.michigan.gov/mde • (517) 373-3324

SCIENCE v.4.07

GRADE LEVEL CONTENT EXPECTATIONS

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KINDERGARTEN SCIENCE

GRADE LEVEL CONTENT EXPECTATIONS

K 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)

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Preparing Students for Academic Success

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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.00.1 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.00.01 Make purposeful observation of the natural world using the five senses.
S.IR.00.02 Generate questions based on observations.
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S.IR.00.07 Communicate and present findings of observations.
S.IR.00.08 Develop research strategies and skills for information gathering and problem solving.

S.IR.00.2 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.00.09 Recognize that science investigations generally work the same way in different places.
S.IR.00.10 Recognize that when science investigations are done the same way, very similar results are expected.
S.IR.00.11 Demonstrate scientific concepts through various illustrations, performances, models, exhibits and activities.

PHYSICAL SCIENCE | Motion of Objects

P.MO.00.1 An object's position can be described by locating the object relative to other objects or a background. The description of an object's motion from one observer's view may be different from that reported from a different observer's view.

P.MO.00.12 Compare an object's position to other objects around it.
P.MO.00.13 Explain how a moving object looks different when viewed from different locations.

P.MO.00.3 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.MO.00.14 Demonstrate pushes and pulls.
P.MO.00.15 Observe that objects move in the direction of the push or pull.
P.MO.00.16 Observe how pushes and pulls can change the speed or direction of moving objects.
P.MO.00.17 Predict how shape, size and weight of an object can affect motion.

P.MO.00.4 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.MO.00.18 Observe how objects fall toward the earth.

LIFE SCIENCE — Organization of Living Things

L.OL.00.1 Animals need air, water, and a source of energy (food). Plants also require air, water, and a source of energy (light to make food). Plants and animals break down food to produce building material for growth and repair.

L.OL.00.19 Describe the basic needs of organisms.
L.OL.00.20 Identify and compare living and nonliving things.

EARTH SCIENCE — Solid Earth

E.SE.00.3 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.00.21 Identify Earth materials (air, water, soil) that are used to grow food.

FIRST GRADE SCIENCE

GRADE LEVEL CONTENT EXPECTATIONS

1 SCIENCE

v.4.07

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SCIENCE PROCESSES

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SCIENCE PROCESSES — Inquiry, Reflection, and Social Implications

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S.IR.01.02 Generate questions based on observations.
S.IR.01.03 Plan and conduct simple investigations.
S.IR.01.04 Manipulate simple tools that aid observation and data collection.
S.IR.01.05 Make accurate measurements with appropriate units for the measurement tool.
S.IR.01.06 Construct simple charts and graphs from data and observations.
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S.IR.01.2 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.01.09 Recognize that science investigations generally work the same way in different places.
S.IR.01.10 Recognize that when science investigations are done the same way, very similar results are expected.
S.IR.01.11 Demonstrate scientific concepts through various illustrations, performances, models, exhibits and activities.

PHYSICAL SCIENCE — Properties of Matter

P.PM.01.1 All objects and substances have physical properties.

P.PM.01.12 Demonstrate the ability to sort objects according to observable attributes such as color, shape, size, sinking or floating.
P.PM.01.13 Use appropriate tools (rulers, balances and thermometers) to measure observable attributes.

P.PM.01.3 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.01.14 Observe water as a solid that keeps its own shape (ice).
P.PM.01.15 Observe water as a liquid that takes on the shape of various containers.

LIFE SCIENCE

Heredity

L.HE.01.1 Plants and animals share many, but not all, characteristics of their parents.

L.HE.01.16 Identify characteristics (including body coverings, ways to get air, leaf shape, flower type, and others) that are passed on from parents to young.

L.HE.01.17 Recognize offspring using parents' observable characteristics as evidence (such as dogs/puppies, cats/kittens, maple trees/saplings, beans, seedlings).

EARTH SCIENCE

Solid Earth

E.SE.01.1 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 land slides, volcanic eruptions, and earthquakes.

E.SE.01.18 Describe the major landforms of the earth's surface (mountains, plains, valleys, deserts, hills).

Fluid Earth

E.FE.01.1 Water is a natural resource and is found under the ground, on the surface of the earth, and in the sky.

E.FE.01.19 Identify water sources (wells, springs, lakes, rivers, oceans).

E.FE.01.20 Identify household uses of water (drinking, cleaning, food preparation).

E.FE.04.2 Water moves in predictable patterns.

E.FE.01.21 Describe how rain collects on the earth's surface, flows downhill into bodies of water (streams, rivers, lakes, oceans), or into the ground.

SECOND GRADE SCIENCE

GRADE LEVEL CONTENT EXPECTATIONS

2 SCIENCE

v.4.07

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

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S.IR.02.11 Demonstrate scientific concepts through various illustrations, performances, models, exhibits and activities.
S.IR.02.12 Identify technology used in everyday life.
S.IR.02.13 Describe the effect humans and other organisms have on the balance of the natural world.

PHYSICAL SCIENCE | Properties of Matter

P.PM.02.1 All objects and substances have physical properties.

P.PM.02.14 Describe objects and substances according to their properties.
P.PM.02.15 Compare weight and volume of objects.

P.PM.02.4 Some objects are composed of a single substance, while other objects are composed of more than one substance.

P.PM.02.16 Classify objects as single substances or mixtures.

LIFE SCIENCE

Organization of Living Things

L.OL.02.1 Animals need air, water, and a source of energy (food). Plants also require air water, and a source of energy (light to make food). Plants and animals break down food to produce growth and repair.

L.OL.02.17 Identify the needs of familiar plants.

L.OL.02.2 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.02.18 Describe the life cycle of familiar flowering plants including the following stages: seed, plant, flower, and fruit.

L.OL.02.3 Organisms have different structures that serve different functions in growth, survival and reproduction.

L.OL.02.19 Describe the function of the following plant parts, flower, stem, root and leaf.

L.OL.02.4 Organisms can be classified on the basis of observable characteristics.

L.OL.02.20 Classify familiar plants on the basis of observable physical characteristics including roots, leaves, stems and flowers.

Evolution

L.EV.02.1 Different kinds of organisms have characteristics that help them to live in different environments.

L.EV.02.21 Distinguish characteristics and functions of observable parts in a variety of plants that allow them to live in their environment.

L.EV.02.2 Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.

L.EV.02.22 Identify individual differences in organisms of the same kind.

L.EV.02.23 Explain how physical characteristics (traits) or adaptation of animals (sharp teeth or claws for catching and killing prey or color for camouflage) help them to survive in their environment.

Earth Systems

E.ES.02.1 The sun warms the land, air and water and helps plants grow.

E.ES.02.24 Identify the sun as the most important source of heat which warms the land, air, and water of the Earth.
E.ES.02.25 Demonstrate the importance of sunlight and warmth in plant growth.

E.ES.02.2 Weather changes from day to day and over the seasons.

E.ES.02.26 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.02.27 Describe and compare weather related to the four seasons in terms of temperature, cloud cover, precipitation, and wind.
E.ES.02.28 Describe severe weather events.
E.ES.02.29 Describe precautions that should be taken for human safety during severe weather conditions (thunderstorms, lightning, tornadoes, high winds, blizzards, hurricanes).

E.ES.02.3 Scientists use tools for observing, recording, and predicting weather changes.

E.ES.02.30 Identify the tools that might be used to measure temperature, precipitation, cloud cover and wind.
E.ES.02.31 Observe and collect data of weather conditions over a period of time.

Solid Earth

E.SE.02.3 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.02.32 Describe how Earth materials (air, water, soil) help support the growth of plant and animal life.

Fluid Earth

E.FE.02.1 Water exists on Earth in three states: liquid, solid, gas. It can go back and forth from one form to another.

E.FE.02.33 Describe the properties (visible, flowing, melting, dew) of water as a liquid (lakes, rivers, streams, oceans).

E.FE.02.34 Describe the properties (hard, visible, freezing, ice) of water as a solid (ice, snow, iceberg, sleet, hail).

E.FE.02.35 Describe the properties (invisible) of water as a gas (water vapor).

THIRD GRADE

SCIENCE

GRADE LEVEL CONTENT EXPECTATIONS

3 SCIENCE

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S.IR.03.17 Describe how people have contributed to science throughout history and across cultures.

PHYSICAL SCIENCE | Energy

P.EN.03.1 Heat, electricity, light, and sound are forms of energy.

P.EN.03.18 Identify forms of energy: light and sound.

P.EN.03.3 Light travels in straight lines. Shadows result from light not being able to pass through an object. When light travels at an angle from one substance to another in air and water, it changes direction.

P.EN.03.19 Demonstrate that light shines in a straight line.
P.EN.03.20 Explain how shadows are made by placing an object in a path of light.
P.EN.03.21 Explain what happens to light when it travels from one substance to another.

P.EN.03.5 Vibrating objects produce sound. The pitch of sound varies by changing the rate of vibration.

P.EN.03.22 Recognize that all sounds are the results of vibrations.
P.EN.03.23 Distinguish the effect of fast or slow vibrations as pitch.

Properties of Matter

P.PM.03.2 Objects vary to the extent they absorb and reflect light energy.

P.PM.03.24 Determine objects which absorb or reflect light.

Motion of Objects

P.MO.03.2 An object is in motion when its position is changing. The speed of an object is defined by how far it travels divided by the amount of time it took to travel that far.

P.MO.03.25 Compare and contrast the motion of objects in terms of direction.
P.MO.03.26 Explain how the speed of an object changes based on the distance it travels divided by the amount of time it took to cover the distance.

P.MO.03.3 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.MO.03.27 Describe how a push or a pull is a force.
P.MO.03.28 Compare and contrast the motion of objects in terms of direction.
P.MO.03.29 Explain how forces are needed to change the motion of an object.
P.MO.03.30 Describe that the change in motion of an object may be related to the strength of the force acting upon the moving object or to the mass of the object.
P.MO.03.31 Explain that when an object does not move in response to a force, it is because another force is being applied by the environment.

LIFE SCIENCE — Organization of Living Things

L.OL.03.1 Animals need air, water, and a source of energy (food). Plants also require air, water, and a source of energy (light) to make food. Plants and animals break down food to produce building material for growth and repair.

L.OL.03.32 Identify the needs of familiar animals.

L.OL.03.2 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.03.33 Describe the life cycle of familiar animals including the following stages: egg, young, adult; egg, larva, pupa, adult.

L.OL.03.3 Organisms have different structures that serve different functions in growth, survival, and reproduction.

L.OL.03.34 Identify and compare structures in familiar animals used for controlling body temperature, support, movement, food-getting, and protection.

L.OL.03.4 Organisms can be classified on the basis of observable characteristics.

L.OL.03.35 Classify familiar animals on the basis of observable physical characteristics (backbone, skin, shell, limbs, scales).

E.ES.03.7 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.03.36 Identify natural resources (metals, fuels, fresh water, farmland, and forests).
E.ES.03.37 Classify renewable and non-renewable resources.
E.ES.03.38 Describe ways humans are protecting, extending, and restoring resources (recycle, reuse, reduce, renewal).
E.ES.03.39 Describe the consequences of continued urban sprawl, deforestation, strip mining, and increased volumes of garbage and waste.
E.ES.03.40 Recognize that paper, metal, glass, and some plastics can be recycled.

E.ES.03.8 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.03.41 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.03.42 Describe helpful or harmful effects of humans on the environment (garbage, habitat destruction, land management, renewable and non-renewable resources).
E.ES.03.43 Recognize that paper, metal, glass, and some plastics can be recycled.

Solid Earth

E.SE.03.1 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.03.44 Identify and describe natural causes of change in the Earth's surface (erosion and weather, gravity and glaciers, volcanoes landslides, and earthquakes).

E.SE.03.3 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.03.45 Recognize and describe different types of earth materials (mineral, rock, clay, boulder, gravel, sand, soil).
E.SE.03.46 Recognize the difference and relationship between rocks and minerals.

E.SE.03.4 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.03.47 Identify Earth materials used to construct some common objects.

E.SE.03.48 Describe how materials taken from the Earth can be used for transportation, building materials and fuels for heating and transportation.

Earth in Space and Time

E.ST.03.3 Fossils provide evidence about the plants and animals that lived long ago and the nature of the environment at that time.

E.ST.03.49 Explain how fossils are formed and preserved.

E.ST.03.50 Compare and contrast life forms found in fossils and organisms that exist today.

FOURTH GRADE SCIENCE

GRADE LEVEL CONTENT EXPECTATIONS

4

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.

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PHYSICAL SCIENCE | Properties of Matter

P.PM.04.2 Objects vary to the extent they absorb and reflect light energy and conduct heat and electricity.

P.PM.04.18 Identify objects that conduct heat and electricity.

P.PM.04.3 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.04.19 Compare and contrast the states of matter.

P.PM.04.5 Magnets can repel or attract other magnets. Magnets can also attract certain non-magnetic objects at a distance.

P.PM.04.20 Identify materials that are attracted by magnets.
P.PM.04.21 Observe that like poles of a magnet repel and unlike poles of a magnet attract.
P.PM.04.22 Demonstrate why non-magnetic objects are affected by the strength of the magnet and the distance away from the magnet.
P.PM.04.23 Demonstrate magnetic field by observing the patterns formed with iron filings using a variety of magnets.

Energy

P.EN.O4.1 Heat, electricity, light, and sound are forms of energy.

P.EN.04.24 Identify forms of energy: heat and electricity.

P.EN.04.2 Increasing the temperature of any substance requires the addition of energy.

P.EN.04.25 Demonstrate how temperature can be increased in a substance by adding energy.
P.EN.04.26 Describe heat as the energy produced when substances burn, certain kinds of materials rub against each other, and when electricity flows through wire.
P.EN.04.27 Describe how heat is produced through electricity, rubbing, and burning.

P.EN.04.6 Electrical circuits transfer electrical energy and produce magnetic fields.

P.EN.04.28 Describe how electrical energy is transferred and changed through the use of a simple circuit.
P.EN.04.29 Describe how electricity flowing through a wire creates a magnetic field.

Changes in Matter

P.CM.04.1 Matter can be changed from one state to another and then back again. This may be caused by heating and cooling.

P.CM.04.30 Explain how matter can change from one state to another by heating and cooling.

LIFE SCIENCE

Organization of Living Things

L.OL.04.1 Animals need air, water, and a source of energy (food). Plants also require air, water, and a source of energy (light to make food). Plants and animals break down food to produce building material for growth and repair.

L.OL.04.31 Compare the needs of familiar plants and animals.

Evolution

L.EV.04.1 Different kinds of plants and animals have characteristics that help them to live in different environments.

L.EV.04.32 Illustrate characteristics and functions of observable body parts in a variety of animals that allow them to live in their environment.

L.EV.04.2 Individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.

L.EV.04.33 Explain how physical characteristics (traits) or adaptations of animals (sharp teeth or claws for catching and killing prey, or color for camouflage) help them to survive in their environments.

Ecosystems

L.EC.04.1 Organisms interact in various ways including providing food and shelter to one another. Some interactions are helpful: others are harmful to the organism and other organisms.

L.EC.04.34 Identify familiar organisms as part of a food chain or food web.

L.EC.04.2 When the environment changes, some plants and animals survive to reproduce; others die or move to new locations.

L.EC.04.35 Explain how environmental changes can produce a change in the food web.

EARTH SCIENCE — Earth in Space and Time

E.ST.04.1 Common objects in the sky have observable characteristics.

E.ST.04.36 Identify common objects in the sky, such as the sun and the moon.
E.ST.04.37 Compare and contrast the characteristics of the sun, moon and Earth, including relative distances and abilities to support life.

E.ST.04.2 Common objects in the sky have observable characteristics and predictable patterns of movement.

E.ST.04.38 Describe the Earth's revolution around the sun as it defines a year.
E.ST.04.39 Explain that the Earth's rotation creates day and night.
E.ST.04.40 Describe the motion of the moon around the Earth.
E.ST.04.41 Explain that the observable shape of the moon follows a predictable pattern from full moon to full moon which approximately defines a month.
E.ST.04.42 Describe the apparent movement of the sun and moon across the sky through day/night and the seasons.

FIFTH GRADE SCIENCE

GRADE LEVEL CONTENT EXPECTATIONS

5

SCIENCE

v.4.07

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S.IR.05.02 Design and conduct scientific investigations.
S.IR.05.03 Use tools and equipment appropriate to scientific investigations.
S.IR.05.04 Use metric measurement devices in an investigation.
S.IR.05.05 Construct charts and graphs from data and observations.
S.IR.05.06 Identify patterns in data.
S.IR.05.07 Analyze information from data tables and graphs to answer scientific questions.

S.IR.05.2 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.05.08 Evaluate the strengths and weaknesses of claims, arguments, and data.
S.IR.05.09 Describe limitations in personal and scientific knowledge.
S.IR.05.10 Identify the need for evidence in making scientific decisions.
S.IR.05.11 Demonstrate scientific concepts through various illustrations, performances, models, exhibits, and activities.
S.IR.05.12 Design solutions to problems using technology.
S.IR.05.13 Describe the effect humans and other organisms have on the balance in the natural world.
S.IR.05.14 Describe how science and technology have advanced because of the contributions of many people throughout history and across cultures.

PHYSICAL SCIENCE — Motion of Objects

P.MO.05.2 Motion can be described by a change in position relative to a point of reference. An object's motion can be described by its speed and the direction it is moving. An object's position and speed can be measured and graphed as a function of time.

P.MO.05.15 Explain the motion of an object relative to its point of reference.
P.MO.05.16 Describe the motion of an object in terms of distance, time and direction, as the object moves, in relationship to other objects.
P.MO.05.17 Illustrate how motion can be measured and represented on a graph.

P.MO.05.3 Forces have a magnitude and direction. Forces can be added. The net force on an object is the sum of all of the forces acting on the object. An object's speed and/or direction of motion changes when a non-zero net force is applied to it. A balanced force on an object does not change the objects motion (the object either remains at rest or continues to move at a constant speed in a straight line).

P.MO.05.18 Describe how constant motion is the result of balanced forces.
P.MO.05.19 Describe how changes in the motion of objects are caused by unbalanced forces.
P.MO.05.20 Relate the size of change in motion to the strength of unbalanced forces and the mass of the object.

P.MO.07.4 Some forces between objects act when the objects are in direct contact (touching), such as friction and air resistance, or when they are not in direct contact (not touching), such as magnetic force, electrical force, and gravitational force.

P.MO.05.21 Explain how contact forces change an object's motion.
P.MO.05.22 Explain how non-contact forces change an object's motion.

LIFE SCIENCE — Organization of Living Things

L.OL.05.4 Multicellular organisms may have specialized systems that perform functions that serve the needs of the organism.

L.OL.05.23 Identify the general purpose of selected animal systems (digestive, circulatory, respiratory, skeletal, muscular, nervous, excretory, and reproductive).
L.OL.05.24 Explain how animal systems (digestive, circulatory, respiratory, skeletal, muscular, nervous, excretory, and reproductive) work together to perform selected activities.

Evolution

L.EV.05.1 Species with certain traits are more likely than others to survive and have offspring in particular environments. When an environment changes, the advantage or disadvantage of the species' characteristics can change. Extinction of a species occurs when the environment changes and the characteristics of a species are insufficient to allow survival.

L.EV.05.25 Describe the attributes of organisms that help them survive.
L.EV.05.26 Describe how fossils provide evidence about the nature of ancient (extinct) and modern life forms.
L.EV.05.27 Explain how behavioral characteristics (adaptation, instinct, learning, habit) of animals help them to survive in their environment.

L.EV.05.2 Similarities among organisms are found in anatomical features, which can be used to infer the degree of relatedness among organisms. In classifying organisms, biologists consider details of internal and external structures to be more important than behavior or general appearance.

L.EV.05.28 Relate degree of similarity in anatomical features to the classification of contemporary organisms.
L.EV.05.29 Describe how scientific theory traces evolutionary relationships among present and past life forms.

EARTH SCIENCE

Solid Earth

E.SE.05.2 Rocks and rock formations bear evidence of the minerals, materials, temperature/pressure conditions, and forces that created them.

E.SE.05.30 Explain the rock cycle as it relates to the three rock types (igneous, sedimentary and metamorphic).
E.SE.05.31 Compare and contrast the formation of the different rock types, and demonstrate the similarities and differences using a model.
E.SE.05.32 Classify rock samples as igneous (granite, basalt, obsidian, pumice), metamorphic (marble, slate, quartzite), and sedimentary (sandstone, limestone, shale, conglomerate).
E.SE.05.33 Identify common rock forming minerals (quartz, feldspar, mica, halite, hematite, hornblende).

E.SE.05.3 Soils consist of weathered rocks and decomposed organic materials from dead plants, animals, and bacteria. Soils are often found in layers with each having a different chemical composition and texture.

E.SE.05.34 Explain how physical and chemical weathering leads to erosion and the formation of soils and sediments.
E.SE.05.35 Describe how soil is a mixture, made up of weather eroded rocks, humus, formed through decomposition of once living things.
E.SE.05.36 Compare different soil samples based on particle size and texture.

E.SE.05.5 Earth's lithospheric plates constantly move, resulting in major geological events, such as earthquakes, volcanic eruptions, and mountain building.

E.SE.05.37 Explain plate tectonic movement and how the lithospheric plates move centimeters each year.
E.SE.05.38 Demonstrate how major geological events (earthquakes, volcanic eruptions, mountain building) result from these plate motions.
E.SE.05.39 Describe evidence that supports the theory of Pangaea.
E.SE.05.40 Describe the three types of plate boundaries (convergent, divergent, transform) and geographic features associated with them (continental rifts and mid-ocean ridges, volcanic and island arcs, deep sea trenches).
E.SE.05.41 Describe Earth's layers as a lithosphere (crust and upper mantle), convecting mantle, and dense metallic core.

E.SE.05.6 Earth as a whole has a magnetic field that is detectable at the surface with a compass.

E.SE.05.42 Describe the Earth as a magnet and compare Earth's magnetic properties to that of a natural or man-made magnet.
E.SE.05.43 Explain how a compass works using Earth's magnetic field.
E.SE.05.44 Explain how people have used compasses to aid in navigation on land and sea.

Earth in Space and Time

E.ST.05.3 Fossils provide important evidence of how life and environmental conditions have changed in a given location.

E.ST.05.45 Explain how rocks and fossils are used to identify extinct plants and animals.

E.ST.05.46 Explain how rocks and fossils are used to understand the age and geological history of the earth (timelines and relative dating, rock layers).

E.ST.05.4 Earth processes seen today (erosion, mountain building, and glacier movement) make possible the measurement of geologic time through methods such as observing rock sequences and using fossils to correlate the sequences at various locations.

E.ST.05.47 Explain how waves, wind, water, glacier movement, and ice, shape and reshape the Earth's land surface by eroding rock and sand in some areas, and depositing them in other areas.

E.ST.05.48 Describe how the history of the Earth is influenced by occasional natural occurrences, such as the impact of an asteroid or comet.

E.ST.05.49 Describe how fossils provide important evidence of how life and environmental conditions have changed.

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.

MICHIGAN Department of Education
Office of School Improvement

www.michigan.gov/mde

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.

SEVENTH GRADE SCIENCE

GRADE LEVEL CONTENT EXPECTATIONS

7 SCIENCE

v.4.07

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

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S.IR.07.05 Construct charts and graphs from data and observations.
S.IR.07.06 Identify patterns in data.
S.IR.07.07 Analyze information from data tables and graphs to answer scientific questions.
S.IR.07.08 Communicate and defend findings of observations and investigations using evidence.
S.IR.07.09 Compare and contrast sets of data from multiple trials of a scientific investigation to draw conclusions.
S.IR.07.10 Use multiple sources of information to evaluate strengths and weaknesses of claims, arguments, or data.

S.IR.07.2 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.07.11 Evaluate the strengths and weaknesses of claims, arguments, and data.
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S.IR.07.17 Describe the effect humans and other organisms have on the balance of the natural world.
S.IR.07.18 Describe what science and technology can and cannot reasonably contribute to society.
S.IR.07.19 Describe how science and technology have advanced because of the contributions of many people throughout history and across cultures.

P.EN.07.1 Objects and substances in motion have kinetic energy. Objects and substances may have potential energy due to their relative positions in a system. Gravitational, elastic, and chemical energy are all forms of potential energy.

P.EN.07.20 Demonstrate the evidence for kinetic energy in everyday experiences.
P.EN.07.21 Demonstrate the evidence for potential energy in everyday experiences.
P.EN.07.22 Illustrate how potential energy is transformed into kinetic energy in everyday experiences.

P.EN.07.2 Energy is transferred from a source to a receiver by radiation, conduction, and convection. When energy is transferred from a source to a receiver, the quantity of energy before the transfer is equal to the quantity of energy after the transfer.

P.EN.07.23 Explain how different forms of energy can transfer chemical potential energy through a process called photosynthesis.
P.EN.07.24 Explain why energy can be transferred while no energy is lost or gained in the transfer.

P.EN.07.4 Nuclear reactions take place in the sun producing heat and light. Only a tiny fraction of the light energy from the sun reaches Earth, providing energy to heat the Earth, and providing energy that results in winds, ocean currents, and storms. Light is also the primary source of energy for living things. In plants, light from the sun is transferred and stored as chemical potential energy through a process called photosynthesis.

P.EN.07.25 Identify that nuclear reactions take place in the sun, producing heat and light.
P.EN.07.26 Explain how the light energy from the sun is transformed to heat energy on earth.
P.EN.07.27 Explain how heat energy causes winds in the atmosphere and currents in the oceans.
P.EN.07.28 Describe how light energy is converted into a form of energy that can be used by living things.

P.EN.07.5 Waves transfer energy when they interact with matter. Examples of waves include sound waves, seismic waves, waves on water, and light waves.

P.EN.07.29 Identify examples of waves.
P.EN.07.30 Describe how waves are produced by vibrations in matter.
P.EN.07.31 Predict the action of waves as they interact with matter.

Organization of Living Things

L.OL.07.2 Following fertilization, cell division produces a small cluster of cells that then differentiate by appearance and function to form the basic tissue of an embryo.

L.OL.07.32 Describe growth and development in terms of increase of cell number, cell size, and/or cell products.
L.OL.07.33 Examine how through cell division, cells can become specialized for specific functions.

L.OL.07.3 Cells carry out the many functions needed to sustain life. They grow and divide thereby producing more cells. Food is used to provide energy for the work that cells do and as a source of molecular building blocks from which needed materials are assembled.

L.OL.07.34 Describe how organisms sustain life by obtaining, transporting, transforming and eliminating matter.
L.OL.07.35 Describe how organisms transform and release energy.
L.OL.07.36 Describe the effects of limiting food to developing cells.

L.OL.07.5 Plants are producers; they use the energy from light to make sugar molecules from the atoms of carbon dioxide and water. Plants use these sugars along with minerals from the soil to form fats, proteins, and carbohydrates. These products can be used immediately, incorporated into the plant's cells as the plant grows, or stored for later use.

L.OL.07.37 Describe the importance of carbon dioxide in the process of food production.
L.OL.07.38 Describe evidence that plants make and use food.
L.OL.07.39 Predict what would happen to plants growing in high carbon dioxide atmospheres.

Heredity

L.HE.07.1 Reproduction is a characteristic of all living systems; because no individual organism lives forever, reproduction is essential to the continuation of every species. Some organisms reproduce asexually. Other organisms reproduce sexually.

L.HE.07.40 Compare how characteristics of living things are passed on through generations, both asexually and sexually.
L.HE.07.41 Compare and contrast the advantages and disadvantages of sexual vs. asexual reproduction.

L.HE.07.2 The characteristics of organisms are influenced by heredity and environment. For some characteristics, inheritance is more important; for other characteristics, interactions with the environment are more important.

L.HE.07.42 Explain that the traits of an individual are influenced by both the environment and the genetics of the individual.

L.HE.07.43 Distinguish between acquired and inherited traits.

EARTH SCIENCE

Earth Systems

E.ES.07.4 Seasons result from annual variations in the intensity of sunlight and length of day due to the tilt of the Earth's rotation axis relative to the plane of its yearly orbit around the sun.

E.ES.07.44 Describe the tilt of the Earth's rotation axis in relationship to the Earth's yearly orbit around the sun, and how different parts of the globe are oriented towards the sun at different times of the year.

E.ES.07.45 Explain how the Earth's solstices are days when the sun is in the farthest northern and southern declinations.

E.ES.07.46 Explain the Earth's equinox as the two yearly occurrences when the sun crosses the celestial equator.

Earth in Space and Time

E.ST.07.1 The sun is the central and largest body in our solar system. Earth is the third planet from the sun in a system that includes other planets and their moons, as well as smaller objects, such as asteroids and comets.

E.ST.07.47 Describe the position of the Earth within our solar system.

E.ST.07.48 Design a model that describes the relationship of the planets and other objects (comets and asteroids) to the sun.

E.ST.07.49 Compare and contrast the planets in terms of varying sizes, compositions, and surface features.

E.ST.07.2 Gravity is the force that keeps most objects in the solar system in regular and predictable motion.

E.ST.07.50 Describe the motion of planets and moons in terms of rotation on axis and orbits due to gravity.

E.ST.07.51 Explain moon phases as they relate to the position of the moon in its orbit around the Earth, resulting in the amount of observable reflected light.

E.ST.07.52 Recognize that nighttime objects (stars, constellations, Milky Way) and the sun appear to move because the Earth rotates on its axis and orbits the sun.

E.ST.07.53 Recognize that it is the Earth's revolution around the sun that defines a year and the seasons.

E.ST.07.54 Explain lunar and solar eclipses based on the relative positions of the Earth, moon, and sun, and the orbit of the moon.

E.ST.07.55 Explain the oceans' tides as they relate to the gravitational pull and orbit of the moon.