St. Philomena School

MODEL CONTENT STANDARDS
&
GRADE LEVEL EXPECTATIONS

SCIENCE

INTRODUCTION

St. Philomena School Model Content Standards for Science

The model standards presented here specify what all students should know and be able to do in science as a result of their school studies. Specific expectations are given for students completing grades K-4 and 5-8. These standards reflect high expectations and outline the essential level of science knowledge and skills needed by all citizens to participate productively in our increasingly technological society. Some suggestions are also offered for those students who elect to extend their study of science beyond that specified in these content standards, based on their particular interests, motivation, career goals and needs.

In 1992, the National Committee for Science Education Standards and Assessment (NCSESA), which directed the National Research Council's development of K-12 national science education standards, issued guiding principles for its work. This statement provides useful perspective on the purpose and eventual use of these standards:

> "In particular, the commitment of 'Science for All' implies inclusion not only of those who traditionally have received encouragement and opportunity to pursue science, of women and girls, all racial and ethnic groups, the physically and educationally challenged, and those with limited English proficiency. Further, it implies attention to various styles of learning and differing sources of motivation. Every person must be brought into and given access to the ongoing conversation of science." *NCSESA, 1992*

In that spirit, these model science standards define the level of science knowledge and proficiency that all students should gain in their school studies. The goal is to have students apply scientific information and processes to practical problems in an ethical and safe manner.

The view of the nature of science conveyed in these content standards can be summarized through this excerpted material from Science for All Americans, published by the American Association for the Advancement of Science in 1990:

> Science presumes that the things and events in the universe occur in consistent patterns that are comprehensible through careful, systemic study. Scientists believe that through the use of the intellect, and with the aid of instruments that extend the senses, people can discover patterns in all of nature. Science is a process for producing knowledge. Change in scientific knowledge is inevitable because new observations may challenge prevailing theories. In science, the testing and improving and occasional discarding of theories, whether new or old, go on all the time. However, the modification of ideas, rather than their outright rejection, is the norm in science, as powerful constructs tend to survive and grow more precise and to become widely accepted. Continuity and stability are as

characteristic of science as change is, and confidence is as prevalent as tentativeness.

The numerical order of the six science content standards does not imply any particular judgements regarding their relative importance or teaching priorities. In fact, as the document emphasizes, Standards 1, 5, and 6 – relating to scientific investigations, applications, and connections – should be addressed through teaching subject matter from the physical, life, and earth/space sciences (Standards 2, 3, and 4). Even though the six science content standards are identified separately, they represent interconnected expectations for students.

The organization of these contend standards in six categories does not imply that standards-based science must be taught in separate units or courses that carry these particular titles. The student proficiencies in science can be supported within courses organized in a variety of ways, ranging from integrated and interdisciplinary approaches, to instruction built on major scientific themes, as well as more conventional subject- or discipline-specific approaches. Regardless of how science instruction is organized, these model standards specify the core knowledge and sills that all students should acquire.

Even though these content standards represent high expectations for all students, they can be reached only if students are provided appropriate science instruction at *all* grade levels. If K-4 science content standards, for example, are designated as the responsibility of only fourth grade (or even third and fourth grade) teachers, this will place an unfair (and instructionally irresponsible) burden on both those teachers and their students. These standards are set with the expectation that science-related activities will occur at *all* grade levels – from initial explorations in kindergarten through increasingly organized and focused science instruction in higher grades.

These content standards were guided in part by related work at the national level focused on defining what all students should know and do in science. The *Benchmarks* from the American Association for the Advancement of Science's *Project 2061* and draft reports from the National Science Education Standards Project at the National Research Council have been particularly useful and influential.

Model Content Standards

Science

1. **Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.**

2. **Physical Science: students know and understand common properties, forms, and changes in matter and energy.**

3. **Life science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment.**

4. **Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space.**

5. **Students know and understand interrelationships among science, technology, and human activity and how they can affect the world.**

6. **Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines.**

STANDARD 1:

Students understand the processes of scientific investigation and design, conduct, communicate about, and evaluate such investigations.

RATIONALE:

In everyday life, we find ourselves gathering and evaluating information (data), noting and wondering about patterns and regularities, devising and testing possible explanations for how things work, and discussing ideas with others. These characteristically human activities mirror in many ways how scientists think and work. Scientific investigation (inquiry) often begins with a question or problem and usually ends with further questions to investigate. Such investigations may include long-term field studies and are not limited to direct experimentation in a lab setting. They involve the identification and control of variables. Inquiry in the science classroom helps students develop a useful base of scientific knowledge, communicated in increasingly mathematical and conceptual ways as they progress through school. In addition, scientific inquiry stimulates student interest, motivation, and creativity. Designing and conducting investigations encourages students to interpret, analyze, and evaluate what is known, how we know it, and how scientific questions are answered. The knowledge and skills related to scientific inquiry enable students to understand how science works, and are powerful ways for students to build their understanding of the scientific facts, principles, concepts, and applications that are described in the other science content standards, particularly standards two, three, and four. To comprehend the world around them, students need opportunities to pursue questions that are relevant to them and to learn how to conduct scientific investigations. Some scientific inquiries can only be investigated by the use of models since actual events are not repeatable.

GRADE K

•Ask reasonable questions based on observations about objects, organisms and events in their environment
•State simple hypothesis about cause and effect relationships in the environment
•Predict the results of an observable cause and effect relationship in the environment
•Ask "what if" questions and explore multiple possible explanations
•Organize and explore how objects, organisms and events are measured according to different characteristics
•Perform simple measurements using appropriate tools and devices
•Compare observable characteristic of common objects (size, color, texture) for similarities and differences
•Compare objects according to their measurement (larger than, heavier than)
•Offer explanations of observed events and evidence of event
•Communicate observations and comparisons through various means such as pictographs, pictures, models and words
•Describe observations with pictographs, pictures, models and words
•Describe similarities and differences of observations

GRADE 1

•Ask reasonable questions based on observation about objects, organisms, and events in their environment
•State simple hypotheses about cause and effect relationships in the environment
•Predict the result of an observable cause and effect relationship in the environment
•Ask "what if" questions and explore multiple possible explanations
•Observe and describe changes in a simple system (for example; plant terrarium, plant farm, aquarium)
•Observe and explain simple cycles (for example; seasons, day/night, geometric designs)
•Conduct simple inquiry based on his/her own questions
•Make multiple observations of events and explanations using the five senses (or as many of the five senses that are appropriate)
•Perform simple measurements using appropriate tools and devices (for example; magnifiers, thermometers, rulers)
•Manipulate a simple mechanical device and verbally communicate how it works
•Draw pictures that portray some features of a natural event that they observe (for example; fish in the aquarium, weather change)
•Record observation/data on a bar graph
•Describe the relative position of objects using two references (for example; above and next to, below and left of)
•Consider the ideas expressed by others about natural events and discuss whether these ideas can be supported by fact
•Be able to reasonably explain what they observe in an inquiry on a science topic that interests them

GRADE 2

•Create and refine ideas and questions about events in their environment by asking for information and trying things out (for example; identify a simple problem and test a possible solution)
•Observe patterns and make predictions based on the observation
•Develop solutions to unfamiliar problems through reasoning and inquiry that includes formulating a plan, gathering data and constructing a reasonable explanation
•Use accurate tools to observe and measure objects during an inquiry
•Measure length, temperature, and liquid volume with appropriate tools and express measurements
•Compare and sort common objects based on two or more physical attributes (for example; color and texture, size and shape)
•Conduct inquiry into a topic of their interest and run repeat trials of a related simple experiment to compare results
•Identify a sequence of events in a natural cycle (for example; water cycle, life to death)
•Distinguish between actual observations from ideas and speculation about what was observed
•Describe the process used in solving the problem or investigation
•Create communications that describe and compare things in terms of numbers, shape, texture, size, odor, sound, mass, and motion

•Restate, illustrate, or summarize what others have said
•Use a variety of media to search for information

GRADE 3

•Ask questions and state predictions (hypotheses) that can be addressed through scientific investigation
•Select and use simple devices to gather data related to an investigation (for example; length, volume, and mass measuring instruments, thermometers, watches, magnifiers, microscopes, calculators, and computers);
•Use data based on observations to construct a reasonable explanation
•Communicate about investigations and explanations
•Predict what is missing and what will come next in sequences of objects and test his/her predictions
•Seek evidence to support ideas by asking, "How does it work?" How do we know?" "Why?"
•Search for information from a variety of resources
•Explain and discuss various influences affecting observations and interpretations
•Seek evidence to support opinions, statements and conclusions

GRADE 4

•Ask questions and state predictions (hypotheses) that can be addressed through scientific investigation
•Plan, design, predict, and conduct experiments, collect data and communicate reasonable explanations
•Use the data from one investigation to generate a prediction for a new investigation
•Demonstrate alternate ways to display data
•Conduct a systematic observation over time
•Organize data into an appropriate format (for example; bar graph, pie chart, charts)
•Select and use mathematical tools to measure, count, sort, identify, describe, label and communicate information from observations (for example; whole numbers, simple fractions, geometric figures, representative charts such as pie and bar charts)
•Analyze data found in graphs, charts, and articles in order to draw and evaluate conclusions
•Develop and evaluate explanations based upon experimental evidence and the experience of others
•Check explanations against scientific knowledge, experiences, and observations of others
•Use facts to support and evaluate the fairness of conclusions
•Write instructions that others can follow
•Describe and illustrate the steps taken in solving a problem including the resources used
•Use appropriate units to add meaning to numbers
•Use geometric figures, number sequences, graphs, diagrams, sketches, number lines and maps to represent objects, events, and processes
•Select and use simple devices to gather data related to an investigation (for example, ruler, thermometers, watches, magnifying lens, microscopes, calculators, and computers

•Selecting and using simple devices to gather data related to an investigation (for example; length, volume, and mass measuring instruments, thermometers, watches, magnifiers, microscopes, calculators, and computers)
•Plan, design, predict, and conduct experiments, collect data and communicate reasonable explanations
•Use the data from one investigation to generate a prediction for a new investigation
•Conduct a systematic observation over time
•Organize data into an appropriate format (for example; bar graph, pie chart, charts)
•Select and use mathematical tools to measure, count, sort, identify, describe, label and communicate information from observations (for example; whole numbers, simple fractions, geometric figures, representative charts such as pie and bar charts)
•Analyze data found in graphs, charts, and articles in order to draw and evaluate conclusions
•Develop and evaluate explanations based upon experimental evidence and the experience of others
•Describe and illustrate the steps taken in solving a problem including the resources used
•Use appropriate units when presenting or using numerical data
•Use geometric figures, number sequences, graphs, diagrams, sketches, number lines and maps to represent objects, events, and processes
•Select and use simple devices to gather data related to an investigation
•Using data based on observations to construct a reasonable explanation
•Plan, design, predict, and conduct experiments, collect data and communicate reasonable explanations
•Use the data from one investigation to generate a prediction for a new investigation
•Conduct a systematic observation over time
•Organize data into an appropriate format (for example; bar graph, pie chart, charts)
•Select and use mathematical tools to measure, count, sort, identify, describe, label and communicate information from observations (for example; whole numbers, simple fractions, geometric figures, representative charts such as pie and bar charts)
•Analyze data found in graphs, charts, and articles in order to draw and evaluate conclusions
•Develop and evaluate explanations based upon experimental evidence and the experience of others
•Use knowledge and evidence obtained in experimentation, to support explanation
•Check explanations against scientific knowledge, experiences, and observations of others. Use facts to support and evaluate the fairness of conclusions
•Write instructions for a scientific or experimental procedure that others can follow
•Describe and illustrate the steps taken in solving a problem including the resources used
•Use appropriate units when presenting or using numerical data
•Use geometric figures, number sequences, graphs, diagrams, sketches, number lines and maps to represent objects, events, and processes
•Communicate about investigations and explanations
•Plan, design, predict, and conduct an experiment, collect data, and communicate reasonable explanations
•Use the data from one investigation to generate a prediction for a new investigation

•Organize data into an appropriate format (for example; bar graph, pie chart, charts, Venn diagram)
•Select and use mathematical tools to measure, count, sort, identify, describe, label, and communicate information from observations (for example; whole numbers, simple fractions, geometric figures, representative charts such as charts and bar charts)
•Develop and evaluate explanations based on experimental evidence and the experience of others
•Use data from an experiment to support explanations
•Check explanations against scientific knowledge, experiences, and observations of others. Write instructions that others can follow.
•Describe and illustrate the steps taken in solving a problem including the resources used
•Use geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories to represent objects, events, and processes

GRADE 5

•Predict an outcome based on a set of experimental data
•Recognize that scientific investigations sometimes generate new methods or procedures for an investigation or develop new technologies to improve the collection of data
•Differentiate between ideas based on scientific fact or understanding and those based on myths or misrepresented data
•Differentiate between a question and a hypothesis
•Develop a testable hypothesis
•Refine hypotheses from a series of investigations
•Demonstrate ability to identify and control variables
•Design a model to illustrate an investigation
•Select appropriate tools (for example; thermometers, balances, beakers) and make quantitative observations
•Organize and present data in an appropriate format (for example; charts, graphs, labeled diagrams, tables)
•Draw conclusions based on a set of experimental data
•Use metric units in measuring, calculating, and reporting results
•Communicate the results of an investigation that includes the hypothesis tested, tests conducted, or evidence examined, conclusions drawn, and explanations for any inconsistencies, limitations, and variability in recorded observations

GRADE 6

•Choose measurement methods and devices according to the level of precision demanded by the problem
•Predict and outcome based on a set of experimental data
•Identify the variables in an investigation

GRADE 7

•Recognize that scientific investigations sometimes lead to new methods or procedures for conducting an investigation or new technologies to improve the collection of data
•Create a written plan to include the question to be investigated, an appropriate hypothesis, design of the experiment, identification of the variables, a developed scientific procedure to collect and record data; the design should also include a number of repeated trials, accurate measurements and record keeping and a comparison to a control
•Organize and present data in an appropriate format (for example; histograms, circle graphs, flow charts) and make inferences based on that data
•Identify and interpret patterns, trends, relationships in collected data and identify data that does not fit a pattern
•Analyze the results of an experiment, draw conclusions about the question being investigated, and defend those conclusions
•Use metric units in measuring, calculating, and reporting results
•Communicating results of their investigations in appropriate ways (for example; written reports, graphic displays, oral presentations)
•Propose and critique alternative explanations and procedures and suggest alternative explanations for the same observations
•Predict an outcome based on a set of experimental data
•Propose and execute design changes to correct what might be wrong with an experimental design
•Cite subject matter knowledge when making judgments
•Construct scale models, maps, and appropriately labeled diagrams to communicate scientific knowledge
•Form a logical argument about cause and effect relationships in conclusions
•Use mathematics to structure convincing explanations
•Use analogies to understand how things work
•Summarize the results of others' investigations to see if findings will result in new questions and more investigations
•Share findings and offer explanations for inconsistencies, limitations, and variability in recorded observations
•Acknowledge different ideas and explanations, be able to accept the skepticism of others and consider alternative explanations

GRADE 8

•Create a written plan to include the question to be investigated, an appropriate hypothesis, design of the experiment, identification of the control and variables, a developed scientific procedure to collect and record data; the design should also include a number of repeated trials, accurate measurements and record keeping and a comparison to a control
•Apply scientific ideas, concepts, and relationships to the formation of scientific questions
•Evaluate explanations by examining evidence, comparing evidence, identifying faulty reasoning, and pointing out statements that go beyond the evidence
•Predict an outcome based on a set of experimental data

•Recognize that scientific investigations sometimes generate new methods or procedures for an investigation or develop new technologies to improve the collection of data
•Construct a model to predict change (for example; motion carts, computer simulation)
•Organize and construct representation of data into appropriate formats (for example; histograms, circle graphs, flow charts) and make inferences based on that data
•Using metric units in measuring, calculating, and reporting results
•Analyze data and evaluate hypothesis
•Construct appropriate graphs from data and develop qualitative statements about the relationships between the variables
•Communicate the logical connection among hypothesis, science concepts, tests conducted, data collected, and conclusions drawn from the scientific evidence
•Ask questions and stating hypotheses, using prior scientific knowledge to help guide their development
•Select and use appropriate technologies to gather, process, and analyze data and to report information related to an investigation
•Construct and revise scientific explanations and models, using evidence, logic, and experiments that include identifying and controlling variables
•Communicate and evaluate scientific thinking that leads to particular conclusions
•Explain the difference between a scientific theory and a scientific hypothesis
•Design and complete an advanced scientific investigation – either individually or as part of a student team – that extends over several days or weeks; and continuing to practice and apply inquiry skills as they extend their understanding of science content through further study

STANDARD 2:

Physical Science: Students know and understand common properties, forms, and changes in matter and energy. *(Focus: Physics and Chemistry)*

2.1 Students know that matter has characteristic properties, which are related to its composition and structure.

RATIONALE:

Everyone has experience with matter in a variety of forms. Such experiences help build students' understanding of similarities and differences in the properties of matter. Their personal experiences help students understand common properties such as hardness, strength, color, shape, and states of matter (solid, liquid, and gaseous). Knowledge of observable properties of matter and its structure and composition is helpful in considering matter's varied uses, availability, and limitations in our world.

2.2 Students know that energy appears in different forms, and can move (be transferred) and change (be transformed).

RATIONALE:

Energy is a central concept in science because all physical interactions involve changes in energy. Students need to understand that all physical events involve transferring energy or changing one form of energy into another. When a transformation of energy takes place, some of it is likely to appear as heat. Knowledge of forms of energy, its transfer and transformation, is essential to interpreting, explaining, predicting, and influencing change in our world.

2.3 Students understand that interactions can produce changes in a system, although the total quantities of matter and energy remain unchanged.

RATIONALE:

Interactions between matter and energy account for changes observed in everyday events. Understanding how matter and energy interact extends students' knowledge of the physical world and allows them to monitor and explain a wide variety of changes and to predict future physical and chemical changes. Students gain both a practical and conceptual understanding of the laws of conservation of matter and energy.

GRADE K

•Sort common objects using specific properties such as shape, texture, color, patterns
•Identify physical properties of objects that are detected by the senses (large/small, odor, rough/smooth, heavy/light, soft/hard)
•Describe or demonstrate how matter can be mixed or put together
•Predict whether an object can sink or float

GRADE 1

•Identify the properties of magnets
•Examine, describe, and compare objects based on common physical properties (for example; ice cube melting)
•Explore forms of energy (for example; heat and moving objects, choose an object and see how it moves on different surfaces)
•Describe interactions that produce change in a system (for example; making mobiles to explain balance and stability)
•Understand that things near the earth fall to the ground unless something holds them up
•Investigate which objects will sink or float

GRADE 2

•Examine, describe and compare the properties of solids and liquids
•Make observations and gather data on quantities associated with energy, movement, and change (for example; time to melt an ice cube)
•Compare quantities associated with energy movement and change by constructing simple diagrams and charts (for example; chart of melting time)

•Know that sound is caused by vibration (for example; use a variety of items such as cymbals, hair combs, rulers to produce sounds and record the physical evidence of how things that make sound vibrate)
•Recognize light and heat as forms of energy (for example; observe and describe what happens when a rolling object travels down an incline at different heights; investigate light by using mirrors)

GRADE 3

•Examine, describe, classify, and compare tangible objects in terms of common physical properties (for example; state of matter, size, shape, texture, flexibility, color);
•Measure common physical properties of objects (for example; length, mass, volume, temperature)
•Recognize that energy (for example; light, heat, motion, sound, and mechanical) can affect common objects
•Make observations and gather data on quantities associated with energy, movement and change
•Compare quantities associated with energy movement and change by constructing simple diagrams
•Observe and describe parts of system (for example; water in a closed jar, water in an open jar, a plant terrarium)
•Describe an observed change (for example; a melting ice cube, crystal growth, burning candle, physical breakage) in terms of starting conditions, type of change, and ending conditions, using words, diagrams, or graphs
•Predict what changes and what remains unchanged when matter experiences an external influence (for example; a push or pull, addition or removal of heat, division of clay into pieces, melting an ice cube, changing a ball of clay to a flattened shape)
•Investigate that heat can be produces in many ways (i.e. burning, rubbing, mixing substances)
•Identify and consider a variety of methods that produce heat by friction (for example; rubbing hands together, shaking sand)
•Identify characteristics of conductive and insulative materials
•Predict which materials will reflect, which will absorb, and which will transmit light (for example; glass, paper, clear plastic)

GRADE 4

•Examine, describe, classify, and compare tangible objects in terms of common physical properties (for example; state of matter, size, shape, texture, flexibility, color)
•Understand that materials can exist in different forms (solids, liquids, gasses) and can be changed from one form to another by heating or cooling
•Investigate the properties of light as it travels in a straight line until it strikes an object; reflected by a mirror, refracted by a lens, or absorbed by an object
•Apply knowledge of simple circuits to create a new circuit that involves more components (using batteries, wires, light or a buzzer, demonstrate the requirements for a complete circuit)

•Understand that matter changes in both physical and chemical ways
•Recognizing that energy (for example; light, heat, motion, sound, mechanical) can affect common objects and is involved in common events
•Making observations and gathering data on quantities associated with energy, movement, and change (for example; distances for a bean-launcher, time for a melting ice cube)
•Comparing quantities associated with energy movement and change by constructing simple diagrams or charts (for example; graph of launch distances, chart of melting time)
•Observing and describing parts of system (for example; water in a closed jar, water in an open jar, a plant terrarium)
•Describing an observed change (for example; a melting ice cube, crystal growth, burning candle, physical breakage) in terms of starting conditions, type of change, and ending conditions, using words, diagrams, or graphs
•Predicting what changes and what remains unchanged when matter experiences an external influence (for example; a push or pull, addition or removal of heat, division of clay into pieces, melting an ice cube, changing a ball of clay to a flattened shape)

GRADE 5

•Examine, describe, compare, measure, and classify objects based on common physical and chemical properties (for example; states of matter, mass, volume, electrical charge, temperature, density, boiling points, pH, magnetism, solubility)
•Separate mixtures of substances based on their properties (for example; solubility, boiling points, magnetic properties, densities)
•Classify and describe matter in terms of elements, compounds, mixtures, atoms, and molecules (for example; copper is an element, water is a compound, air is a mixture)
•Develop simple models to explain observed properties of matter (for example; using a particle model to account for the solubility of a substance)
•Measure quantities associated with energy forms (for example; temperature, mass, speed, distance, electrical charge, current, voltage)
•Describe qualitative and quantitative relationships, using data and observations and graphs, associated with energy transfer or energy transformation (for example; speed of object vs. height of ramp; length of string vs. pitch of sound; electric current vs. volume of gas produced in electrolysis, with length of time kept constant)
•Identify and classify factors that cause change within a system (for example; force, light, heat)
•Identify and predict what will change and what will remain unchanged when matter experiences an external force or energy change (for example; boiling a liquid; comparing the force, distance, and work involved in simple machines)
•Observe and gather data to support the concept of conservation of mass within a closed system (for example; precipitation reaction, forming mixtures, gas production)
•Describe, measure (for example; temperature, mass, volume, melting point of a substance) and calculate quantities before and after a chemical or physical change within a system (for example; temperature change, mass change, specific heat)

•Describe, measure (for example; time distance, mass, force), and calculate quantities that characterize moving objects and their interactions within a system (for example; force, velocity, acceleration, potential energy, kinetic energy)

GRADE 6

•Know that materials made by chemically combining two or more substances may have properties that differ from the original properties (for example; vinegar and baking soda)
•Recognize that there are 92 known elements in nature many of which combine to form compounds
•Describe the difference between the students' own weight and mass
•Construct models of several kinds of atoms and describe their general properties (nucleus, proton, neutron, electron)
•Use laboratory investigations to demonstrate the formation of new compounds
•Investigate changes in the state of water and use the particle model to explain these changes
•Know that energy can be carried from one place to another by heat flow or by waves including water waves, light and sound, or by moving objects

GRADE 7

Standard 2 is not addressed in Grade 7

GRADE 8

•Calculate the average speed of a toy or an animal moving in a straight or curved path by making appropriate measurements (motion of an object can be described by its position, direction of motion, and speed)
•Measure the various net forces acting on an object and their effects (explain in terms of forces involved, why a satellite orbits the Earth)
•Give examples of heat transfer
•Determine the potential and kinetic energy of a cart as it moves up and down an inclined lane
•Interpret and explain the relationship among kinetic energy, potential energy, and mechanical advantage (for example; demonstrate the types of energy, changes in motion, and mechanical advantage involved in shooting an arrow)
•Interpret graphs of position versus time and speed versus time for motion in a single direction
•Know that force has both direction and magnitude and when an object is subject to two or more forces at once, the effect is the cumulative effect of all the forces
•Know that when forces on an object are balanced, the motion of the object does not change; when the forces are unbalanced the object will change its motion (for example; speed up, slow down, change direction)
•Demonstrate that simple machines can be used to change the direction or size of a force (for example; measure the effectiveness of a lever in moving objects with different masses)

•Describe how energy is involved in chemical, physical and nuclear changes
•Give an example of an object moving in a circular path and find and compare its speed, period, frequency, acceleration, and centripetal force with other masses and report these findings
•Collect and graph data and explain that acceleration is a change in velocity or direction of travel
•Calculate and report the acceleration and motion of several different objects when released from the same position
•Demonstrate that for every action there is an equal and opposite reaction (for example; identifying places on a roller coaster ride where one feels lighter or heavier)
•Observe and measure the effect of friction on moving objects
•Know that the laws of conservation of energy and momentum provide a way to predict and describe the movement of objects
•Examine, describe, compare, measure, and classify objects based on common physical and chemical properties (for example; states of matter, mass, volume, electrical charge, temperature, density, boiling points, pH, magnetism, solubility)
•Separate mixtures of substances based on their properties (for example; solubility, boiling points, magnetic properties, densities)
•Classify and describe matter in terms of elements, compounds, mixtures, atoms, and molecules (for example; copper is an element, water is a compound, air is a mixture)
•Recognize that substances are often placed in categories or groups if they react in similar ways (for example; periodic table)
•Use word equations to describe a chemical change
•Separate mixtures based on their physical including solubility in water, particle size, density and magnetism
•Know that in chemical reactions, the number of atoms stays the same no matter how they are arranged so their total mass stays the same (conservation of matter)
•Determine whether a solution is acidic, basic, or neutral
•Use bonding diagrams (ionic, covalent) to predict the outcome of a chemical reaction

STANDARD 3:

Life Science: Students know and understand the characteristics and structure of living things, the processes of life, and how living things interact with each other and their environment. (Focus: Biology – Anatomy, Physiology, Botany, Zoology, Ecology)

3.1 Students know and understand the characteristics of living things, the diversity of life, and how living things interact with each other and with their environment.

RATIONALE:

As a result of their study of a variety of organisms and where they live, students gain a better understanding of their world. Students have a natural curiosity about life and the

great diversity of organisms. Their curiosity leads to the study of organisms and how the organisms interact with the world. Through the study of similarities and differences of organisms, students learn the importance of classification as a tool used by scientists. In their future as citizens, students will need to think about and make decisions about the diversity and extinction of organisms in their communities and the world.

3.2 Students know and understand interrelationships of matter and energy in living systems.

RATIONALE:

From experience, students know that they must eat food to live. As a result of their study of energy movement (transfer) and change (transformation) in living organisms, students understand that the Sun is the primary and ultimate source of energy for living organisms. They learn why a constant input of matter and energy is critical for life. Photosynthetic organisms are critical to all organisms and need to be maintained. If one or more components are altered in an ecosystem, all other components are affected. Through studying the interrelationships of organisms, students learn that they can have a critical impact on other organisms.

3.3 Students know and understand how the human body functions, factors that influence its structures and functions, and how these structures and functions compare with those of other organisms.

RATIONALE:

Students are interested in learning about their bodies and how they relate biologically to other forms of life. The study of structure and function, body organization, growth and development, and maintenance of other organisms enhances students' understanding of human development, health, and disease. Knowledge of these areas can assist students in making informed choices regarding nutrition, exercise, and other factors that influence how their body functions.

3.4 Students know and understand how organisms change over time in terms of biological evolution and genetics.

RATIONALE:

Students study the scientific concept of biological evolution – the changes in populations of organisms through time – in order to understand diversity and relatedness within the living world. Inquiries into evolution explain the ways in which natural processes produce life's diversity. These studies help students understand that evolution is the major unifying concept in the biological sciences and that it explains a wide variety of observations that can be made about the living world. In particular, students see that the study of evolution initiates questions about biodiversity, adaptation, genetics, mutations, the geological record, and the observed unity at molecular and whole-organism levels.

This content standard does not define any student expectations related to the origin of life.

GRADE K

•Identify and describe living and non-living things
•Use pictures to describe the growth of a plant
•Describe some plants and animals that live in different places (polar bear) and how they are different

GRADE 1

•Distinguishing living from nonliving things
•Describe the changes that take place as a previously living thing decays in the environment (for example; plants, fruit with skin and without skin over time)
•Explore life cycles of selected organisms (for example; cat, mealworm, bees)
•Discuss how living and nonliving things change over time (for example; insects)
•Discuss how each plant or animal has different structures that serve different functions in growth and survival
•Know that plants and animals have predictable life cycles

GRADE 2

•Identify parts of plants and animals (for example; stem, root, seed, flower, leaf, bud, bulb)
•Recognize that green plants need energy from sunlight and various raw materials to live
•Identify variables that affect plant growth (for example; water and light)
•Recognize and compare the structural characteristics of plants and animals (for example; plants and animals that live in the ocean with those that live on land)
•Describe metamorphosis of insect (for example; butterfly, beetle)
•Recognize how environmental changes influence the life and death of plants and animals
•Discuss how the behavior of animals and plants is dependent upon their environment
•Identify and discuss the similarities and differences between parents and their offspring

GRADE 3

•Distinguish living from nonliving things
•Classify a variety of organisms according to selected characteristics (for example; backbone vs. no backbone)
•Describe the basic needs (for example; food, water, air, shelter, space) of an organism
•Give examples of how organisms interact with each other and with nonliving parts of their habitat
•Recognize that green plants need energy from sunlight and various raw materials to live, and animals consume plants and other organisms to live
•Recognizing the interrelationships of organisms by tracing the flow of matter and energy in a food chain

•Describe human body systems (for example; digestive, respiratory, circulatory, skeletal, muscular)
•Describe the basic food requirements for humans as summarized in the nutrition pyramid
•Describe life cycles of selected organisms (for example; frog, chicken, butterfly, radish, bean plant)
•Identify characteristics that are common to all individuals of a species (for example, offspring resemble their parents)
•Recognize that there are differences in appearance among individuals of the same population or group
•Identify characteristics of plants and animals that allow them to live in specific environments
•Describe examples of extinct organisms based on fossil evidence (for example; dinosaurs)
•Describe how plants and animals have life cycles (birth, growth, reproduction and death)
•Recognize that all organisms cause and respond to changes in their environment
•Identify characteristics of plants and animals that allow them to live in specific environments

GRADE 4

•Distinguish living from nonliving things
•Classify a variety of organisms according to selected characteristics (for example; backbone vs. no backbone)
•Describe the basic needs (for example; food, water, air, shelter, space) of an organism
•Give examples of how organisms interact with each other and with nonliving parts of their habitat
•Recognize that green plants need energy from sunlight and various raw materials to live, and animals consume plants and other organisms to live
•Recognize the interrelationships of organisms by tracing the flow of matter and energy in a food chain
•Describe and recognize human body systems (for example; digestive, respiratory, circulatory, skeletal, muscular)
•Describe the basic food requirements for humans as summarized in the nutrition pyramid
•Describe life cycles of selected organisms (for example; frog, chicken, butterfly, radish, bean plant)
•Identify characteristics that are common to all individuals of a species (for example; offspring resemble their parents)
•Recognize that there are differences in appearance among individuals of the same population or group
•Identify characteristics of plants and animals that allow them to live in specific life zones in New England environments
•Describe examples of extinct organisms based on fossil evidence (for example; dinosaurs)

•Recognize that some characteristics of organisms are inherited while others are environmentally influenced
•Conduct investigations to gather data, information, and ideas related to the energy and nutrients organisms need from their environment in order to survive
•Explore a simple, natural system (for example; classroom aquarium or outdoor habitat and generate questions about transfer of energy and use of nutrients)
•Know that all organisms need energy and matter to live and grow

GRADE 5

•Construct models that illustrate food chains and food webs
•Recognize that the human body is organized into systems
•Understand that the human body systems depend on each other
•Explore the process of photosynthesis
•Explore the process of cellular respiration
•Describe the basic food requirements for humans and classify food into basic groups
•Demonstrate an understanding that all living things are made up of one or more cells and that complex multi-cellular living things have tissues, organs, and organ systems
•Explain how adaptations affect species survival
•Explain interactions and interdependence of nonliving and living components within ecosystems with first order consumers, second order consumers, biotic factors, and abiotic factors

GRADE 6

•Know that energy entering ecosystems as sunlight is transferred by producers into chemical energy through photosynthesis and then from organism to organism in food webs
•Identify the difference between plant and animal cells
•Identify parts of a cell explaining the structure and function of a cell
•Describe the role of chromosomes and genes in heredity (for example; a typical cell of any organism contains genetic instructions that specify its traits; these traits may be modified by environmental influences)

GRADE 7

•Construct and use classification systems based on the structure of organisms
•Describe the importance of plant and animal adaptations, including local examples
•Create and interpret food chains and food webs
•Explain the interaction and interdependence of nonliving and living components within ecosystems
•Describe how an environment's ability to provide food, water, space, and essential nutrients determines carrying capacity

•Describe the basic processes of photosynthesis and respiration and their importance to life (for example; set up a terrarium or aquarium and make changes such as blocking out light)
•Compare and contrast food webs within and between different ecosystems (for example; grasslands, tundra, marine) and predicting the consequences of disrupting one of the organisms in a food web
•Explain the recycling of materials by determining a pathway of a substance that is important for life (for example; trace water through an ecosystem)
•Describe the role of organisms in the decomposition and recycling of dead organisms (for example; bacteria's role in the decomposition and recycling of matter from a dead animal)
•Describe the observable components and functions of a cell (for example; cell membrane, nucleus, cytoplasm, chloroplasts; movement of molecules into and out of cells)
•Compare and contrast the basic structures and functions of different types of cells (for example; single-celled organisms in pond water, Elodea, onion cell, human cheek cell); describing the growth and development of several organisms (for example; embryonic development of a vertebrate)
•Describe the structures and functions of human body systems
•Describe and give examples of non-communicable diseases and communicable diseases (for example; heart disease and chicken pox cancer, AIDES)
•Describe the purpose of body cell division and sex cell division
•Describe the role of chromosomes and genes in heredity (for example; genes control traits, while chromosomes are made up of many genes)
•Describe evidence that reveals changes or constancy in groups of organisms over geologic time
•Compare and contrast the purpose and process of cell division (mitosis) with the production of sex cells (meiosis)
•Give examples to show how some traits can be inherited while others are due to the interaction of genes and the environment (for example; skin cancer triggered by over-exposure to sunlight or contact with chemical carcinogens)
•Describe how DNA serves as the vehicle for genetic continuity and the source of genetic diversity upon which natural selection can act

GRADE 8
Standard 3 is not addressed in Grade 8

STANDARD 4:

Earth and Space Science: Students know and understand the processes and interactions of Earth's systems and the structure and dynamics of Earth and other objects in space. (Focus: Geology, Meteorology, Astronomy, Oceanography)

4.1 Students know and understand the composition of Earth, its history, and the natural processes that shape it.

RATIONALE:

By studying Earth, its composition, history, and the processes that shape it, students gain a better understanding of the planet on which they live. Landforms, resources, and natural events such as earthquakes, flooding, and volcanic eruptions affect the location of population centers. Life throughout geologic time has been, and continues to be, affected by changes that occur at a varying rate on Earth's surface. Knowledge of the structure and composition of the Earth provides a basis for making informed decisions. Understanding geologic events, such as earthquakes and volcanic eruptions, allows students to make responsible choices, evaluate the consequences, and predict the impact of future occurrences.

4.2 Students know and understand the general characteristics of the atmosphere and fundamental processes of weather.

RATIONALE:

Our Earth's atmosphere is vital to life. The Sun and atmosphere affect every aspect of our lives, including work productivity, food supply, energy use, transportation, recreation, environmental quality, and human health and safety. Weather-related choices we make range from selecting appropriate clothing to more complex situations, including preparing for and responding to hazardous weather. Preparedness and response to weather conditions require knowledge of how energy transfer influences atmospheric changes. The more we know about weather, the greater the chances that we will make informed decisions concerning its impact.

4.3 Students know major sources of water, its uses, importance, and cyclic patterns of movement through the environment.

RATIONALE:

The world's water is vital to life. Both subtle and wholesale changes in Earth's water can have profound effects on human existence. In order to preserve both the quality and quantity of water for daily living, wise management of water resources is crucial. As the population and economies of the world grow, water becomes an even more important political and economic issue. Knowing the properties of water, its influences on weather, and its availability is necessary for understanding of how they affect weather, climate and life. It is important to understand the circulation of water because the amount of water on Earth is finite.

4.4 Students know the structure of the solar system, composition and interactions of objects in the universe, and how space is explored.

RATIONALE:

Observing the sky has always fascinated human cultures and civilizations. These observations resulted in the development of ways to measure time and predict natural phenomena. All bodies in space, including Earth, are influenced by forces acting throughout the solar system and the universe. Studying the universe enhances our understanding of Earth's origins, its place in the universe, and its future. Much of what we know about Earth's atmosphere and our solar system is due to space exploration. Modern society benefits from many of the technological advances developed for space exploration, including robotics, telecommunications, satellites, and miniaturized components used in computers and other electronic devices. Knowledge of the universe and past space exploration enables people to make informed decisions about the future of space exploration.

GRADE K

•Identify that the Earth is a planet with many living and nonliving things
•Describe how activities and clothing must be changed to agree with the weather
•Name the four seasons and some characteristics of each
•Know that rain and snow furnish water for rivers
•Identify that water is important to all living things on Earth
•Know that the sun can only been seen in the daytime whereas the moon can be seen mostly at night but sometimes during the day

GRADE 1

•Know the Earth's materials are part of the Earth's surface
•Know that fossils are evidence of plants and animals that lived on the Earth long ago
•Explore some processes that change the Earth's surface (for example; erosion, weathering)
•Draw pictures of the four seasons
•Identify changes in weather and know that weather changes with the seasons in different regions of the United States
•Know that water is needed to support the growth of plants in our food supply
•Know that sun provides light

GRADE 2

•Compare the ingredients in different soils
•Describe how plants cycle water through their parts (for example; soil, roots, stem, leaves, and atmosphere)
•Know that the sun's movements can be observed and described
•Know that the sun provides heat
•Identify patterns and changes in the sun, moon, and stars

GRADE 3

•Describe different types and uses of Earth materials (for example; rocks, soil, minerals)
•Recognize that fossils are evidence of past life
•Identify major features of Earth's surface (for example; mountains, rivers, plains, hill, oceans, plateaus)
•Describe natural processes that change Earth's surface (for example; weathering, erosion, mountain building, volcanic activity)
•Recognize that humans are affected by natural events (for example; earthquakes, volcanoes, floods)
•Recognize that the Sun is a principal source of Earth's heat and light
•Recognize how our daily activities are affected by the weather (for example; types of clothing, travel plans, recreational activity)
•Describe existing weather conditions by collecting and recording weather data (for example; temperature, precipitation, amount of cloud cover)
•Identify major sources of water (for example; oceans, glaciers, river, groundwater, atmosphere)
•Identify and describing the states (solid, liquid, gaseous) in which water can be found on Earth
•Recognize the importance and uses of water (for example; drinking, washing, irrigating)
•Describe what can be readily observed by the unaided eye in the daytime and nighttime sky (for example; the Sun, Moon, planets, stars, constellations)
•Describe the motion of Earth in relation to the Sun, including the concepts of day, night, and year
•Recognize the characteristics of seasons
•Identify basic components of the solar system (for example; Sun, planets, moons)
•Describe a space exploration event such as a manned or unmanned space mission
•Explore that soils differ in their capacity to retain water
•Recognize that the sun is the principle source of Earth's heat and light and is a major factor in weather systems
•Draw a picture of how water cycles in nature
•Know that every 24 hours the Earth makes a full rotation on its axis which cause day and night
•Describe the motion of Earth in relation to the sun
•Identify the basic components of the solar system
•Know the Earth is one of nine planets that orbit the sun and that as Earth orbits the sun, different patterns of stars can be seen in different seasons
•Recognize the importance of water and its uses
•Identify and describe the states (solid liquid, gas) in which water can be found

GRADE 4

•Describe different types and uses of Earth materials (for example; rocks, soil, minerals)
•Recognize that fossils are evidence of past life
•Identify major features of Earth's surface (for example; mountains, rivers, plains, hill, oceans, plateaus)

•Describe natural processes that change Earth's surface (for example; weathering, erosion, mountain building, volcanic activity)
•Recognize that humans are affected by natural events (for example; earthquakes, volcanoes, floods)
•Recognize that the Sun is a principal source of Earth's heat and light
•Recognize how our daily activities are affected by the weather (for example; types of clothing, travel plans, recreational activity)
•Describe existing weather conditions by collecting and recording weather data (for example; temperature, precipitation, amount of cloud cover)
•Identify major sources of water (for example; oceans, glaciers, river, groundwater, atmosphere)
•Identify and describing the states (solid, liquid, gaseous) in which water can be found on Earth
•Recognize the importance and uses of water (for example; drinking, washing, irrigating)
•Describe what can be readily observed by the unaided eye in the daytime and nighttime sky (for example; the Sun, Moon, planets, stars, constellations)
•Describe the motion of Earth in relation to the Sun, including the concepts of day, night, and year
•Recognize the characteristics of seasons
•Identify basic components of the solar system (for example; Sun, planets, moons)
•Describe a space exploration event such as a manned or unmanned space mission
•Distinguish between weather and climate
•Know that clouds have properties, locations, and movements that can be observed and described
•Know that weather can be described in measurable quantities, temperature, wind direction, and precipitation
•Identify the water cycle (for example; evaporation, condensation, transpiration, etc.)
•Compare weather patterns in different locations in the United States and discuss how these patterns influence plant growth and human activity in those states
•Know that energy from the sun heats the Earth unevenly, causing air movements resulting in changing weather patterns
•Use weather maps and forecasts to predict local weather and that predication depends on many changing variables
•Conduct investigations to determine the effect of temperature or wind on evaporation and condensation

GRADE 5

•Compare Earth to other natural planets (for example, size, distance from the sun and from each other, temperature, length of day)
•Explore objects associated with the universe(for example, comets, galaxies, asteroids)
•Compare and contrast the physical features of Earth (for example; land forms)
•Evaluate how revolution, rotation, and tilt of the Earth influences the amount of sunlight that reaches that reaches the surface

•Know that the rotation of Earth on its axis every 24 hours causes the day and night and makes the sun, moon, planets, and stars appear to move across the sky from east to west each day
•Explain lunar and solar eclipses and moon phases
•Know that the solar system forms part of the Milky Way Galaxy which is one of the many galaxies that compromise the universe
•Know that the nine planets, their respective moons, comets, many asteroids and meteorites orbit the sun which is the gravitational center of the solar system
•Know that the path of a planet around the sun is due to the gravitational attraction between the sun and the planet
•Know that the sun, an average star, is the central and largest body in the solar system and is comprised primarily of hydrogen and helium

GRADE 6
Standard 4 is not addressed in Grade 6

GRADE 7
•Model natural processes that shape Earth's surface (for example; weathering, erosion, mountain building, volcanic activity)
•Explain the distribution and causes of natural events (for example; earthquakes, volcanoes, landslides)
•Describe the basic components, composition, size, and theories of origin of the solar system
•Compare Earth to other planets (for example; size, composition, relative distance from the Sun)

GRADE 8
Standard 4 is not addressed in Grade 8

STANDARD 5:

Students know and understand interrelationships among science, technology, and human activity and how they can affect the world.

RATIONALE:

Our world is shaped in many ways by scientific advances, technology (involving applications of science), and human activity. Science and technology provide useful connections between the natural world and the designed world. Since the invention of stone tools, technological applications have provided, and will continue to provide, humans the ability to modify their environment. Because scientific advances and

technology affect all of Earth's living and non-living systems, it is vital that students understand the interrelationships of science, technology, and human activity.

GRADE K

•Describe the differences between natural objects and objects made by people
•Recognize some resources that come from the Earth and sun (soil from Earth, light from sun)
•Use tools and simple construction materials

GRADE 1

•Recognize how people use observation and prediction in their jobs
•Identify daily activities/devices used in everyday life that involve the use of technology
•Identify types of people that use science and technology in their jobs

GRADE 2

•Use a variety of material (for example; wood, plastic, fabric, clay) to make simple products and identify what can be recycled and what can not
•Identify careers that use science and technology
•Identify the use of technologies in their everyday life

GRADE 3

•Recognize the diversity of resources provided by the Earth and Sun (for example; soil, fuels, minerals, medicines, food)
•Invent a device that addresses an everyday problem (or task), and communicating the problem (or task), design, and solution
•Describe resource-related activities in which they could participate that can benefit their communities (for example; recycling, water conservation)
•Identify careers that use science and technology
•Know that people have always invented new ways to solve problems and get work done; these new inventions affect all aspects of life

GRADE 4

•Recognize the diversity of resources provided by the Earth and Sun (for example; soil, fuels, minerals, medicines, food)
•Invent a device that addresses an everyday problem (or task), and communicating the problem (or task), design, and solution
•Describe resource-related activities in which they could participate that can benefit their communities (for example; recycling, water conservation)
•Identify careers that use science and technology
•List some major inventions in the 19th century and compare them to the major inventions of the 20th century
•Identify some causes for recent increases in technological advances

•Describe and define the invention process (for example; brainstorm, analyze, combine, and create)

GRADE 5

•Compare present day technologies to those of the past (for example; refrigerator to ice box, horse drawn carriage to automobile) and discuss the impact these differences have on the quality of life
•Recognize that technologies consume and generate energy
•Recognize that conservation is a method of preventing depletion of energy

GRADE 6

Standard 5 is not addressed in Grade 6

GRADE 7

•Describe how people use science and technology in their profession
•Describe ways in which innovations address human biological, physical, and psychological needs

GRADE 8

•Investigate and describe the extent of human used of renewable and non-renewable resources (for example; forests, fossil fuels)
•Describe how people use science and technology in their professions

STANDARD 6:

Students understand that science involves a particular way of knowing and understand common connections among scientific disciplines.

RATIONALE:

Human societies have long asked questions about, observed and collected data on, and offered explanations for natural phenomena. Scientific evidence and knowledge are distinguished from other ways of knowing and other bodies of knowledge in terms of the criteria that must be met. These criteria include the use of empirical standards and rules of evidence, a logical structure, rational thought, questioning, and openness to criticism. Scientific disciplines differ from one another in what is studied, techniques used, and outcomes sought. They share a common purpose – to explain and predict events and phenomena – and offer strategies to solve defined problems. Scientific knowledge is dynamic. Although some scientific theories have withstood the test of time and are still used, other knowledge claims have been altered by new scientific evidence. Change, continuity, and stability are characteristic features of science.

Although acquiring scientific knowledge of laws, concepts, and theories is central to learning science, it does not necessarily lead to an understanding of how science itself works. Students need to understand that science works by weaving different aspects of science together so that they reinforce one another. To bring coherence to seemingly diverse sets of ideas or facts involving natural phenomena, scientific themes such as change, systems, models and organization are highly useful. Themes can encompass and connect large quantities of basic data and evidence in science and can be used to integrate science with other disciplines.

GRADE K

•Know that in order to learn, it is important to observe the same things often and compare them
•Know that when experiments are repeated under the same conditions, similar results are usually obtained
•Know that in doing science it is often helpful to work with a team and to share findings with others

GRADE 1

•Know that in order to learn, it is important to observe the same things often and compare them
•Know that when experiments are repeated under the same conditions, similar results are usually obtained
•Know that in doing science it is often helpful to work with a team and share findings with other

GRADE 2

•Know that in order to learn, it is important to observe the same things often and compare them
•Know that when experiments are repeated under the same conditions, similar results are usually obtained
•Know that in doing science it is often helpful to work with a team and to share findings with others

GRADE 3

•Recognize that when a science experiment is repeated with the same conditions, the experiment generally works the same way
•Compare knowledge gained from direct experience to knowledge gained indirectly (for example; collecting data about student heights in their class and comparing the results to similar data collected in another class or school)
•Identify observable patterns and changes in their lives and predicting future events based on those patterns (for example; seasonal weather patterns)

•Describe and comparing the components and interrelationships of a simple system (for example; tracing the continuous flow of water through an aquarium, filter, and pump)
•Compare a model with what it represents (for example; comparing a map of the school to the actual school; a model of the Earth to the Earth itself)
•Know that it is important to keep accurate records and descriptions to provide information and clues on causes of discrepancies in repeated experiments
•Know that a model of something is different than the real thing

GRADE 4

•Recognize that when a science experiment is repeated with the same conditions, the experiment generally works the same way
•Compare knowledge gained from direct experience to knowledge gained indirectly (for example, collecting data about student heights in their class and comparing the results to similar data collected in another class or school)
•Identify observable patterns and changes in their lives and predicting future events based on those patterns (for example; seasonal weather patterns)
•Describe and compare the components and interrelationships of a simple system (for example; tracing the continuous flow of water through an aquarium, filter, and pump)
•Compare a model with what it represents (for example; comparing a map of the school to the actual school; a model of the Earth to the Earth itself)

GRADE 5

•Know that scientific knowledge is subject to modification as new information is obtained
•Challenge prevailing theories and new theories that lead to looking at old observations in a new way
•Know that the study of the events that led scientists to discoveries can provide information about the inquiry process and its effects
•Know that a change in one or more variables may alter the outcome of an investigation
•Recognize the scientific contributions that are made by individuals of diverse backgrounds, interests, talents, and motivations
•Recognize that patterns exist within and across systems

GRADE 6

•Know that scientific knowledge is subject to modification as new information is obtained
•Challenge prevailing theories and new theories lead to looking at old observations in a new way
•Know that the study of the events that led scientists to discoveries can provide information about the inquiry process and its effects
•Know that a change in one or more variables may alter the outcome of an investigation
•Recognize the scientific contributions that are made by individuals of diverse backgrounds, interests, talents, and motivation

•Recognize that patterns exist within across systems

GRADE 7

•Explain why a controlled experiment must have comparable results when repeated
•Give examples of how scientific knowledge changes as new knowledge is acquired and previous ideas are modified (for example; through space exploration)
•Describe contributions to the advancement of science made by people indifferent cultures and at different times in history
•Identify, compare, and predict variables and conditions related to change (for example; climate, population, motion)
•Identify and illustrate natural cycles within systems (for example; water, planetary motion, geological changes, climate)
•Use a model to predict change (for example; computer simulation, video sequence, stream table)

GRADE 8

•Explain why a controlled experiment must have comparable results when repeated
•Give examples of how scientific knowledge changes as new knowledge is acquired and previous ideas are modified (for example; through space exploration)
•Describe contributions to the advancement of science made by people indifferent cultures and at different times in history
•Identify, compare, and predict variables and conditions related to change (for example; climate, population, motion)
•Identify and illustrate natural cycles within systems (for example; water, planetary motion, geological changes, climate)
•Use a model to predict change (for example; computer simulation, video sequence, stream table)