



Science Curriculum Guide

Revised 8/7/2016

Philosophy:

We believe science is discovery and investigation within God's creation. We teach science so our students gain an understanding of the world God created and learn to be stewards of the world the Lord has given us and to appreciate his creation. Therefore, through science we learn how we can improve our management of God's creation as well as marvel at God's design.

At Star of Bethlehem Lutheran School we believe there is a base of science fundamentals and principles that our students need to learn. The areas of learning include: chemistry which is the study of matter and the changes that take place with that matter. Physical science which deals with materials that are not alive and the ways in which nonliving things work. Earth science which deals with the earth and its make-up, or any of its changing aspects and Life science, which deals with living organisms and their organization, life processes, and relationships to each other and their environment. These areas of study reveal the all-powerful hand of a loving God. The Bible is not our science textbook, but our science curriculum allows children to see the wisdom and skill of our Creator.

Through hands-on-learning the students will be actively engaged in experiments, projects and presentations. These opportunities will allow them to develop skills such as observing, comparing, hypothesizing, predicting, measuring, testing and interpreting for a better understanding of the world our Lord created.

Kindergarten Science Objectives

The students will:

Earth and Space Science

K.1 Earth's Materials:

A. Recognize that water, rocks, soil, and living organisms are found on the earth's surface.

K.2 Earth's Materials:

A. Understand that air is all around us and that wind is moving air.

K.3 Weather:

A. Describe the weather changes from day to day and over the seasons.

B. Describe the weather changes and temperature from day to day.

K.4 The Sun as a Source of Light and Heat:

A. Recognize that the sun supplies heat and light to the earth and is necessary for life.

B. Identify parts of the solar system such as sun, moon, planets, and stars.

C. Discuss the properties of colors such as primary and secondary, mixing of colors, and color wheel.

K.5. Periodic Phenomena: Identify some events around us that have repeating patterns, including the seasons of the year, day and night.

Life Science

K.6 Characteristics of Living Things:

A. Recognize that animals (including humans) and plants are living things that grow, reproduce, and need food, air, and water.

K.7 Characteristics of Living Things:

A. Differentiate between living and nonliving things. Group both living and nonliving things according to the characteristics that they share.

K.8 Life Cycles:

A. Recognize that plants and animals have life cycles, and that life cycles vary for different living things.

K.9 Living Things and Their Environment:

A. Recognize that people and other animals interact with the environment through their senses of sight, hearing, touch, smell, and taste.

K.10. Living Things and Their Environment:

A. Identify the ways in which an organism's habitat provides for its basic needs (plants require air, water, nutrients, and light; animals require food, water, air, and shelter).

B. Explore the basic characteristics of the following habitats- ocean, desert, rainforest, savanna, and polar.

K.11. Human Body:

A. Recognize the purpose of bones, muscles, body organs, and nutrition and how they work together to support the human body.

Physical Sciences

K.12 Observable Properties of Objects:

A. Sort objects by observable properties such as size, shape, color, weight, and texture.

K.13 States of Matter:

A. Identify objects and materials as solid, liquid, or gas. Recognize that solids have a definite shape and that liquid and gases take the shape of their container.

K.14 Position and Motion of Objects:

A. Describe the various ways that objects can move, such as in a straight line, zigzag, back-and-forth, round-and-round, fast, and slow.

K.15 Position and Motion of Objects:

A. Recognize that under some conditions, objects can be balanced.

Technology/Engineering

K.16 Materials and Tools:

A. Identify and describe characteristics of natural materials (e.g., wood, cotton, fur, wool) and human-made materials (e.g., plastic, Styrofoam).

K.17 Materials and Tools:

A. Identify and explain some possible uses for natural materials (e.g., wood, cotton, fur, wool) and human-made materials (e.g., plastic, Styrofoam).

K.18 Materials and Tools:

A. Identify and describe the safe and proper use of tools and materials (e.g., glue, scissors, tape, ruler, paper, toothpicks, straws, spools) to construct simple structures.

K.19 Engineering Design:

A. Describe how human beings use parts of the body as tools (e.g., teeth for cutting, hands for grasping and catching), and compare their use with the ways in which animals use those parts of their bodies.

1st Grade Science Objectives

The students will:

1.1 Students describe the rights and individual responsibilities of citizenship.

- A. Understand the rule-making process in a direct democracy (everyone votes on the rules) and in a representative democracy (an elected group of people make the rules) giving examples of both systems in their classroom school, and community.
- B. Understand the elements of fair play and good sportsmanship respect for the rights and opinions of others, and respect for rules by which we live, including the meaning of the “Golden Rule.”

1.2 Students compare and contrast the absolute and relative locations of places and people and describe the physical and/or human characteristics of places. Locate on maps and globes their local community, Wisconsin, the United States, the seven continents, and the four oceans.

- A. Compare the information that can be derived from a three-dimensional model to the information that can be derived from a picture of the same location.
- B. Construct a simple map using cardinal directions and map symbols.
- C. Describe the how the location, weather, and physical environment affect the way people live including the effects on their food, clothing shelter transportation, and recreation.

1.3 Students know and understand the symbols, icons, and traditions of the United States that provide continuity and a sense of community across time.

Recite the Pledge of Allegiance and sing songs that express American ideals (e.g., “My Country ‘Tis of Thee”)

- A. Understand the significance of our national holidays and the heroism and achievements of the people associated with them.
- B. Identify American symbols, landmarks and essential documents, such as the flag, bald eagle Statue of Liberty, U.S. Constitutions, and Declaration of Independence, and now the people and events associated with them.

1.4 Students compare and contrast everyday life in different times and places around the world and recognize that some aspects of people, places, and things change over time while others stay the same.

- A. Examine the structure of schools and communities in the past.
- B. Study transportation methods of earlier days.
- C. Recognize similarities and differences of earlier generations in such areas as work (inside and outside the home), dress manners, stories, games and festivals, drawing from biographies, oral histories, and folklore. (Laura Ingalls Wilder)

1.5 Students understand basic economic concepts and the role of individual choice in a free-market society.

- A. Describe food production and consumption long ago and today, including the roles of farmers, processors, distributors, weather, and land and water resources.

2nd Grade Science Objectives

The students will:

Earth and Space Science

2.1 Earth's Materials:

- A. Recognize that water, rocks, soil, and living organisms are found on the earth's surface.
- B. Identify similarities and differences between natural rock and manmade concrete

2.2 Earth's Materials:

- A. Understand that air is a mixture of gases that is all around us
- B. Realize that air takes up space
- C. Describe wind as moving air
- D. Identify wind direction

2.3 Weather:

- A. Describe the weather changes from day to day and over the seasons. (calendar time)
- B. Keep a class weather chart indicating daily temperature, how windy it is, which direction wind is blowing (use visual clues), and kind of precipitation, if any.
- C. Identify six weather tools (thermometer, barometer, anemometer, rain gauge, wind vane, weather map)
- D. Discuss temperature and how it varies from day to day
- E. Identify four different cloud types – cirrus, cumulus, stratus and nimbus
- F. Explore various types of storms – thunderstorms, tornadoes, hurricanes and blizzards
- G. Learn characteristics of rainbows and how they are formed

2.4 Water cycle:

- A. Identify the various stages of the water cycle.
- B. Use vocabulary related to the four stages.

2.5 Periodic Phenomena:

- A. Identify some events around us that have repeating patterns, including the seasons of the year, day and night. (calendar)

2.6 The Sun as a Source of Light and Heat:

- A. Recognize that the sun supplies heat and light to the earth
- B. Know that the sun is necessary for life.

2.7 The Earth in the Solar System:

- A. Recognize that the earth is part of a system called the 'solar system'
- B. Realize that the solar system includes the sun (a star), planets, and many moons.
- C. Identify the planets in the solar system.
- D. Recognize that the earth is the third planet from the sun in our solar system.

Life Science

2.8 Living Things and Their Environment:

- A. Identify the ways in which an organism's habitat provides for its basic needs (plants require air, water, nutrients, and light; animals require food, water, air, and shelter).
- B. Explore the basic characteristics of the following habitats - Arctic Polar, Rainforest, Forest, Pond, Ocean, Desert
- C. Compare and contrast the characteristics of plant or animals from widely different environments.

Physical Sciences

2.9 Electrical energy:

- A. Work with batteries.
- B. Explore positive and negative forces.

2.10 Simple circuits:

- A. Explore simple circuit
- B. Realize that the circuit must be complete for the circuit to work.

2.11 Magnetic energy:

- A. Explore magnets
- B. Realize that opposites attract (N and S)

Technology/Engineering

2.12 Engineering Design:

- A. Identify tools and simple machines used for a specific purpose, e.g., inclined plane, wheel and axle, pulley, lever, screw, and wedge.

2.13 Engineering Design:

- A. Describe how human beings use parts of the body as tools (e.g., teeth for cutting, hands for grasping and catching)
- B. Compare human use with the ways in which animals use those parts of their bodies.

3rd Grade Objectives

The students will:

Life Science

3.1 Characteristics of Plants and Animals: Classify plants and animals according to the physical characteristics that they share.

- A. Sort plant and animal pictures based on physical characteristics.
- B. Use a dichotomous key to identify plants.
- C. Create a simple chart to classify plants and animals that are common to the school's geographical area.

3.2 Plant Structures and Functions: Identify the structures in plants (leaves, roots, flowers, stem, bark, wood) that are responsible for food production, support, water transport, reproduction, growth, and protection.

- A. Observe plant/pollinator interaction and seed dispersal methods.
- B. Study maple trees and go maple sugaring. Identify the structures in the maple tree and their functions.
- C. Collect plants. Make a detailed drawing of a plant. Identify and label its major structures (i.e., leaves, flowers, stems, roots, seeds). Describe functions of each structure.

3.3 Plant Structures and Functions: Recognize that plants and animals go through predictable life cycles that include birth, growth, development, reproduction, and death.

- A. Grow plants from seeds. Document the complete life cycle of plants. Describe emergence of structures and the functions of these structures. Record changes in height over time. Graph the data.
- B. Design and construct a habitat for a small animal (e.g. Frog) that has adequate space and contains the necessities for survival. The habitat should allow for observation of the animal as it goes through the stages of its life cycle.

3.4 Plant Structures and Functions: Describe the major stages that characterize the life cycle of the frog and butterfly as they go through metamorphosis.

- A. Using either live organisms or pictures/models, observe the changes in form that occurs during the life cycle of a frog.

3.5 Plant Structures and Functions: Differentiate between observed characteristics of plants and animals that are fully inherited (e.g., color of flower, shape of leaves, color of eyes, number of appendages) and characteristics that are affected by the climate or environment (e.g., browning of leaves due to too much sun, language spoken).

- A. Make frequency tables of the number of students with certain inherited physical traits, e.g., eye color hair color, earlobe free or attached.

3.6 Adaptations of Living Things: Give examples of how inherited characteristics may change over time as adaptations to changes in the environment that enable organisms to survive, e.g., shape of beak or feet, placement of eyes on head, length of neck, shape of teeth, color.

- A. Compare and contrast the physical characteristics of plants or animals from widely different environments (e.g., desert vs. Tropical plants, aquatic vs. terrestrial animals). Explore how each is adapted to its environment.
- B. Discuss how engineers design things by using their knowledge of the ways that animals move (e.g., birds and wings influence airplane design, tails and fins of aquatic animals influence boat design)

3.7 Adaptations of Living Things: Give examples of how changes in the environment (drought, cold) have caused some plants and animals to die or move to new locations (migration).

- A. Investigate how invasive species out-compete native plants (e.g., phragmites and purple loosestrife). Discuss how some native plants die as a result.

3.8 Adaptations of Living Things: Describe how organisms meet some of their needs in an environment by using behaviors (patterns of activities) in response to information (stimuli) received from the environment. Recognize that some animal behaviors are instinctive (e.g., turtles burying their eggs), and others are learned (e.g., humans building fires for warmth, chimpanzees learning how to use tools).

- A. Discuss how newly born sea turtles find their way to the ocean.
- B. Discuss how pets are trained to learn new tricks.
- C. Discuss how migrating birds navigate.
- D. Discuss the actions that coastal species take to adjust to the changing levels of the tide.
- E. Observe an earthworm placed on top of soil in a container that is exposed to light. Discuss how its ability to sense light helps it survive (by burrowing) and how its structure allows it to burrow through soil.

3.9 Adaptations of Living Things: Recognize plant behaviors, such as the way seedlings' stems grow toward light and their roots grow downward in response to gravity. Recognize that many plants and animals can survive harsh environments because of seasonal behaviors, e.g., in winter, some trees shed leaves, some animals hibernate, and other animals migrate.

- A. Set a germinating bean in a glass filled with water next to an asymmetric source of light. Allow the root and stem to grow a few inches. Rotate the bean so that the roots are now touching the water at an angle and the stem is away from the light source. Observe how the root system and stem respond to this change by changing their direction of growth.
- B. Identify the differences between producers, consumers, and decomposers and how they are important to each other.
- C. Identify the need for herbivores, omnivores, and producers
- D. Identify the relationship between predator and prey.

3.10 Adaptations of Living Things: Give examples of how organisms can cause changes in their environment to ensure survival. Explain how some of these changes may affect the ecosystem.

- A. Discuss the importance of wetlands to human survival.
- B. Investigate how an invasive species changes an ecosystem.
- C. Research local projects where humans are changing the environment to

ensure a species' survival.

- D. Brainstorm and sketch items in the home that do help or could help humans survive (e.g., heater for warmth, stove to cook).

3.11 Energy and Living Things: Describe how energy derived from the sun is used by plants to produce sugars (photosynthesis) and is transferred within a food chain from producers (plants) to consumers to decomposers.

- A. Make a food chain. Begin with the sun as the source of energy and end with decomposers. Create links that show the relationships of plants and animals in the chain. Show the direction of the flow of energy. Discuss results if various links in the chain are broken.
- B. Design and build a compost bin. Use a thermometer to measure the temperature rise during composing. Discuss where heat (energy) comes from (decomposers metabolizing energy stored by producers and consumers)

3.12 Human Body: Identify the major parts and functions of the skeletal system, muscular system, nervous system, respiratory system, circulatory system, and digestive system.

- A. Recognizing how all the system work together.
- B. Explaining how to keep these systems healthy

Physical Sciences

3.13 Properties of Objects and Materials: Differentiate between properties of objects (e.g., size, shape, weight) and properties of materials (e.g., color, texture, hardness).

- A. Gather a variety of solid objects. Collect data on properties of these objects, such as origin (human-made or natural), weight (heavy, medium, light), length, odor, color, hardness, and flexibility.
- B. Given a variety of objects made of different materials, ask questions and make predictions about the hardness, flexibility, and strength of each. Test to see if the predictions were correct.

3.14 States of Matter: Compare and contrast solids, liquids, and gases based on the basic properties of each of these states of matter.

- A. Design several stations, each of which demonstrates a state of matter (e.g., water table, balloon and fan table, sand and block table).
- B. Design one container for each state of matter, taking into account which material properties are important (e.g., size, shape, flexibility)
- C. Explain how atoms and molecules work together to form solids, liquids, and gases.

3.15 States of Matter: Describe how water can be changed from one state to another by adding or taking away heat.

- A. Do simple investigations to observe evaporation, condensation, freezing, and melting. Confirm that water expands upon freezing.
- B. Using given insulating materials, try to keep an ice cube from melting.
- C. Do simple investigation to observe results of expanding and contracting molecules.

D. Demonstrate the difference between physical and chemical change

3.16 Forms of Energy: Identify the basic forms of energy (light, sound, heat, chemical , mechanical, electrical, magnetic, and solar). Recognize that energy is the ability to cause motion or create change.

- A. Play music through a speaker with and without a grill cover. Discuss the difference in sound.
- B. Design and construct a candle wheel that demonstrates how heat can cause a propeller to spin.
- C. Demonstrate the difference between potential and kinetic energy.

3.17 Forms of Energy: Give examples of how energy can be transferred (converted) from one form to another.

- A. Rub two pieces of wood together (mechanical energy) and observe the change in temperature of the wood.
- B. Design and build a simple roller coaster for a marble or toy car to demonstrate how energy changes form one form to another.

3.18 Sound Energy: Recognize that sound is produced by vibrating objects and requires a medium through which to travel. Relate the rate of vibration to the pitch of the sound.

- A. Use tuning forks to demonstrate the relationship between vibration and sound.
- B. Design and construct a simple telephone (prototype) using a variety of materials (e.g., paper cups, string, tin cans, wire). Determine which prototype works best and why.
- C. Describe the differences between pitch and volume.
- D. Recognize that pitch is determined by the frequency of the vibration; volume is determined by the amplitude of the vibrations.
- E. Change the length, tension, tension, or thickness of a string to affect the frequency of vibration and, therefore, the pitch of the sound produced.
- F. Describe how the human ear has a membrane that vibrates when sound reaches it; the ear and the brain translate these vibrations into the sensation of sound.
- G. Do simple demonstration of how sound is produced by the human vocal cords as air moves through the tightened cords.
- H. Design an instrument that is able to show pitch and volume change and explain with proper vocabulary how they were able to demonstrate these changes.

3.19 Light Energy: Recognize that light travels in a straight line until it strikes an object or travels from one medium to another, and that light can be reflected, refracted, and absorbed.

- A. Use a flashlight, mirrors, and water to demonstrate reflection and refraction.
- B. Design and build a prototype to inhibit solar heating of a car (e.g., windshield reflector, window tinting).

3.20 Heat Energy: Recognize that is thermal energy.

- A. Know freezing and boiling point of water.
- B. Explain the definition and give an example of conduction, radiation, and convection.
- C. Do simple experiments with insulators and conductors.

Technology/Engineering

3.21 Engineering Design: Describe different ways in which a problem can be represented, e.g., sketches, diagrams, graphic organizers, and lists. (roller coaster 3.17)

- A. Identify relevant design features (e.g., size, shape, weight) for building a prototype of a solution to a given problem.

3.22 Engineering Design: Compare natural systems with mechanical systems that are designed to serve similar purposes, e.g., a bird's wings as compared to an airplane's wings.

4th grade Objectives

The students will:

Earth and Space Science

4.1 Minerals

- A. Give a simple explanation of what a mineral is
- B. Identify the physical properties of minerals (hardness, color, luster, cleavage, and streak),
- C. Explain how minerals can be tested for these different physical properties.

4.2 Rocks and Their Properties:

- A. Identify the three categories of rocks (metamorphic, igneous, and sedimentary) based on how they are formed
- B. Explain the natural and physical processes that create these rocks.
- C. Describe the rock cycle.
- D. Sort rock specimens according to their properties

4.3 The Earth: Basics

- A. Identify the Earth's layers

4.4 The Earth: Rapid Changes to the Earth's Surface

- A. Understand the Earth's surface is constantly changing and that some changes take place very quickly.
- B. Define earthquake and identify causes of earthquakes.
- C. Explore volcanoes including causes and three different types of volcanoes.
- D. Define landslide and explore causes of them.

4.5 The Earth: Slow changes to the Earth's surface

- A. Model erosion caused by a glacier carrying sediments.
- B. Identify weathering as the breaking down of rocks at the Earth's surface by natural processes.
- C. Identify erosion as the process in which weathered rock is picked up and carried away.
- D. Identify deposition as the dropping of sediments by water, wind and ice.

4.6 Soil

- A. Explain and give examples of the ways in which soil is formed
- B. Recognize and discuss the different properties of soil - color, texture (size of particles), the ability to retain water, and the ability to support the growth of plants.
- C. Observe and describe soil samples.
- D. Recognize soil's importance to living things.

4.7 Managing Earth's Resources

- A. Model water purification
- B. Distinguish between renewable and nonrenewable resources
- C. Identify fossil fuel resources and their uses.
- D. Compare the biodegradability of common trash materials.
- E. Identify human activities that can affect resources.
- F. Understand how Earth's resources can be conserved.

4.8 Weather: What is Air?

- A. Discover that air takes up space and has weight.

- B. Identify the main gases in air.
 - C. Describe the four layers of Earth's atmosphere
 - D. Explain the greenhouse effect
- 4.9 Weather: What Causes Weather
- A. Explain how air temperature, moisture, wind speed and direction, and precipitation make up the weather in a particular place and time.
 - B. Distinguish among the various forms of precipitation (rain, snow, sleet, and hail), making connections to the weather in a particular place and time.
 - C. Understand the causes of wind and how air masses and fronts move.
 - D. Describe how global patterns such as the jet stream and water currents influence local weather in measurable terms such as temperature, wind direction and speed, and precipitation.
 - E. Collect and analyze weather data.
- 4.10 Weather: Climate
- A. Differentiate between weather and climate.
 - B. Model how bodies of water and mountains affect climate.
 - C. Identify three climate zones.
 - D. Describe how latitude and altitude affect climate.
 - E. Understand that climate changes over time.
- 4.11 Weather: The Water Cycle
- A. Model the water cycle and describe the changes that occur.
 - B. Identify three stages of water.
 - C. Describe the water cycle.
 - D. Describe different kinds of clouds.
 - E. Give examples of how the cycling of water, both in and out of the atmosphere, has an effect on climate.
- 4.12 The Solar System:
- A. Recognize that the earth is part of a system called the 'solar system'
 - B. Identify parts of the solar system including the sun (a star), planets, and many moons.
- 4.13 The Solar System: The Sun
- A. Model how the sun heats the Earth's surface
 - B. Understand the role of Sun's energy on Earth.
 - C. Discuss the role of the Sun's gravity in the solar system.
- 4.14 The Solar System: The Planets
- A. Create a scale model of the outer planets
 - B. Describe and compare the nine planets
 - C. Learn the size, distance from the Sun, and surface composition of the outer planets.
 - D. Recognize that the earth is the third planet from the sun in our solar system.
- 4.15 The Solar System: The Earth
- A. Recognize that the earth revolves around (orbits) the sun in a year's time
 - B. Recognize that the earth rotates on its axis once approximately every 24 hours.
 - C. Make connections between the rotation of the earth and day/night, and the apparent movement of the sun, moon, and stars across the sky.
 - D. Understand the causes of Earth's seasons.
- 4.16 The Solar System: The Earth's Moon

- A. Model how sunlight falls on the Moon as it orbits the Earth.
- B. Describe the changes that occur in the observable shape of the moon over the course of a month.

Physical Science

4.17 Static Electricity

- A. Create and observe electric changes in matter
- B. Identify positive and negative charges.
- C. Know that like charges repel and unlike charges attract.
- D. Observe that charges can jump from one material to another.

4.18 Electrical Energy

- A. Recognize that electricity in circuits requires a complete loop through which an electrical current can pass
- B. Understand that electricity can produce light, heat, and sound.
- C. Identify and classify objects and materials that conduct electricity and objects and materials that are insulators of electricity.
- D. Wire simple electric circuits.
- E. Predict, observe, describe and record results of experiments with electricity.
- F. Communicate results and ideas through writing, drawing and discussion.

4.19 Magnetic Energy:

- A. Recognize that magnets have poles that repel and attract each other.
- B. Describe magnetic fields and the behavior of magnets.
- C. Identify and classify objects and materials that a magnet will attract and objects and materials that a magnet will not attract.
- D. Observe that the Earth has a magnetic field.

4.20 Electromagnets:

- A. Explain how electromagnets can be made
- B. Give examples of how electromagnets can be used.
- C. Construct and observe an electromagnet

Technology/Engineering

4.21 Materials and Tools:

- A. Identify materials used to accomplish a design task based on a specific property, i.e., weight, strength, hardness, and flexibility.
- B. Identify and explain the appropriate materials and tools (e.g., hammer, screwdriver, pliers, tape measure, screws, nails, and other mechanical fasteners) to construct a given prototype safely.

4.22 Materials and Tools: Simple Machines

- A. Identify and explain the difference between each of the six simple machines – wheel and axle, wedge, inclined plane, pulley, screw and lever.
- B. Construct and experiment with each of the six simple machines.
- C. Identify the difference between simple and complex machines, e.g., hand can opener that includes multiple gears, wheel, wedge gear, and lever.

4.23 Engineering Design: (working with Shawn to brainstorm ideas on how this can best be done with fourth graders)

A. Describe different ways in which a problem can be represented, e.g., sketches, diagrams, graphic organizers, and lists.

B. Identify relevant design features (e.g., size, shape, weight) for building a prototype of a solution to a given problem.

5th Grade Objectives

Science Inquiry

5.1 Through Science Inquiry, the students will:

- A. Formulate a relevant question through observations that can be tested by an investigation.
- B. Formulate predictions in the realm of science based on observed cause and effect relationships.
- C. Locate information (e.g., book, article, website) related to an investigation.

5.2 Designing and conducting controlled investigations.

- A. Demonstrate safe behavior and appropriate procedures (e.g., use and care of technology, materials, and organisms) in all science inquiry.
- B. Plan a simple investigation that identifies the variables to be controlled.
- C. Conduct simple investigations (e.g., related to forces and motion, Earth processes) based on student developed questions in life, physical, and Earth and space sciences.
- D. Measure using appropriate tools (e.g., ruler, scale, balance) and units of measure (i.e., metric, U.S. customary).
- E. Record data in an organized and appropriate format (e.g., t-chart, table, list, written log).

5.3 Analyze and interpret data to explain correlations and results; formulate new questions.

- A. Analyze data obtained in a scientific investigation to identify trends and form conclusions.
- B. Analyze whether the data is consistent with the proposed explanation that motivated the investigation.
- C. Evaluate the reasonableness of the outcome of an investigation.
- D. Develop new investigations and predictions based on questions that arise from the findings of an investigation.
- E. Identify possible relationships between variables in simple investigations (e.g., time and distance; incline and mass of object).

5.4 Communicate results of investigations.

- A. Communicate verbally or in writing the results of an inquiry.
- B. Choose an appropriate graphic representation for collected data: bar graph, line graph, Venn diagram, model.
- C. Communicate with other groups or individuals to compare the results of a common investigation.

History and Nature of Science/Personal and Social Perspectives

The students will:

- 5.5 Identify individual, cultural, and technological contributions to scientific knowledge.
- A. Identify how diverse people and/or cultures, past and present, have made important contributions to scientific innovations (e.g., Percy Lavon Julian [scientist], Niels Bohr [scientist], and Edwin Hubble [scientist]).
- 5.6 Understand how science is a process for generating knowledge.
- A. Provide examples that support the premise that science is an ongoing process that changes in response to new information and discoveries (e.g., space exploration, medical advances).
 - B. Explain the cycle by which new scientific knowledge generates new scientific inquiry.
 - C. Describe how scientific knowledge is subject to modification and/or change as new information/technology challenges prevailing theories.
 - D. Compare collaborative approaches that scientists use for investigations (e.g., teams, individual with peer review).
 - E. Describe qualities of the scientists' habits of mind (e.g., openness, skepticism, integrity, tolerance).
- 5.7 Describe the interactions between human populations, natural hazards, and the environment.
- A. Explain the impacts of natural hazards on habitats (e.g., global warming, floods, asteroid or large meteor impacts).
 - B. Propose a solution, resource, or product that addresses a specific human, animal, or habitat need.
 - C. Evaluate the possible strengths and weaknesses of a proposed solution to a specific problem relevant to human, animal, or habitat needs.
- 5.8 Develop viable solutions to a need or problem.
- A. Describe the relationship between science and technology.
 - B. Explain how scientific knowledge, skills, and technological capabilities are integral to a variety of careers.
 - C. Design and construct a technological solution to a common problem or need using common materials.

Life Science

The students will:

- 5.9 Understand the relationships between structures and functions of organisms.
- A. Identify the functions and parts of the skeletal system: protection – rib cage and cranium, support – vertebrae, movement – pelvis, femur, hip
 - B. Identify the following types of muscles: cardiac – heart, smooth – stomach, skeletal – biceps.
 - C. Identify the functions and parts of the nervous system: control center – brain, relay mechanism – spinal cord, transport messages – nerves
 - D. Distinguish between voluntary and involuntary responses.
- 5.10 Support an argument that plants get the materials they need for growth chiefly from air and water.
- A. Understand the organizational flow of matter and energy in organisms.

- B. Understand that matter is transported into, out of, and within systems.
- 5.11 Describe the movement of matter among plants, animals, decomposers, and the environment.
 - A. Understand the interdependent relationships in ecosystems.
 - B. Identify the cycles of matter and energy transfer in ecosystems.

Earth and Space Science

The students will:

- 5.12 Understand the processes acting on the Earth and their interaction with the Earth systems.
 - A. Describe how the Moon's appearance changes during a four-week lunar cycle.
 - B. Describe how Earth's rotation results in day and night at any particular location.
 - C. Distinguish between revolution and rotation.
 - D. Describe the role of gravity as an attractive force between celestial objects.
- 5.13 Understand the relationships of the Earth and other objects in the solar system.
 - A. Identify the known planets of the solar system.
 - B. Describe the distinguishing characteristics of the known planets in the solar system.
 - C. Describe various objects in the sky (e.g., asteroids, comets, stars, meteors/shooting stars).
 - D. Describe the change in position and motion of the following objects in the sky over time: • real motion – Moon, planets • apparent motion (due to the motion of the Earth) – Sun, Moon, and stars.
 - E. Explain the apparent motion of the Sun and stars. PO 6. Describe efforts to explore space (e.g., Apollo missions, space shuttles, Hubble space telescope, space probes).

Physical Science

The Students will:

- 5.14 Understand physical and chemical properties of matter.
 - A. Identify that matter is made of smaller units called: molecules (e.g., H₂O, CO₂), atoms (e.g., H, N, and Na).
 - B. Distinguish between mixtures and compounds.
 - C. Describe changes of matter:
 - 1 Physical – cutting wood, ripping paper, freezing water
 - 2 Chemical – burning of wood, rusting of iron, milk turning sour.
- 5.15 Measure and graph quantities to provide evidence that regardless of the type of changes that occur when heating, cooling, or mixing substances, the total weight of matter is conserved.
 - A. Understand that the amount (weight) of matter is conserved when it changes form, even in transitions in which it seems to vanish.

- B. Understand that no matter what reaction or change in the property that occurs, the total weight of the substance does not change.
- C. Use the standard units to measure and describe physical quantities such as weight, time, temperature, and volume.

5.16 Make observations and measurements to identify materials based on their properties.

- A. Make observations and measurements to produce data to serve as the basis for evidence for an explanation of phenomenon.
- B. Use a variety of measurement to identify materials.

5.17. Conduct an investigation to determine whether the mixing of two or more substances results in new substances.

- A. Conduct an investigation collaboratively to produce data to serve as the basis for evidence, using fair tests in which variables are controlled and the number of trials considered.
- B. Understand that when two or more different substances are mixed, a new substance with different properties may be formed.

5.18 Understand the relationship between force and motion.

- A. Describe the following forces: gravity and friction.
- B. Describe the various effects forces can have on an object (e.g., cause motion, halt motion, change direction of motion, and cause deformation).
- C. Examine forces and motion through investigations using simple machines (e.g., wedge, plane, wheel and axle, pulley, and lever).
- D. Demonstrate effects of variables on an object's motion (e.g., incline angle, friction, and applied forces).

6th Grade Objectives

Science Inquiry

Science Inquiry provides opportunities to demonstrate how science is constant, historic, probabilistic, and replicable. Although there are no fixed steps that all scientists follow, scientific investigations usually involve collections of relevant evidence, the use of logical reasoning, the application of imagination to devise hypotheses, and explanations to make sense of collected evidence. Student engagement in scientific investigation provides background for understanding the nature of scientific inquiry. In addition, the science process skills necessary for inquiry are acquired through active experience. The process skills support development of reasoning and problem-solving ability and are the core of scientific methodologies.

Life Science

The students will:

6.1 Learn to classify organism according to their unique characteristics.

- A. Understand that scientists classify living things
- B. Recognize common characteristics of bacteria, fungi, and protists
- C. Understand that bacteria, fungi, and protists are diverse groups with unique characteristics

6.2 Understand the structures, processes and behaviors of plants that enable them to survive and reproduce.

- A. Understand that scientists classify plants into different groups.
- B. Identify key characteristics that plants have in common
- C. Recognize that different plant species have adaptations that help them survive in their surroundings
- D. Summarize the basic structures and functions of flowering plants required for survival, reproduction and defense.
- E. Explain the significance of the processes of photosynthesis, respiration, and transpiration to the survival of green plants and other organisms.

6.3 Understand the structures, processes and behaviors of animals that enable them to survive and reproduce.

- A. Recognize the common characteristics of invertebrates and vertebrates and the features that distinguish them.
- B. Understand that invertebrates and vertebrates can be grouped into categories.
- C. Identify major groups of invertebrates and vertebrates.

6.4 Understand the Cell and its structure and Function.

- A. Identify and describe the function and structure of cells and cell parts.
- B. Recognize that cells are the building blocks of all living things.
- C. Understand how cells acquire and use energy.
- D. Understand the role of cell division in the growth of organisms.
- E. Describe the functions of cells, tissues, organs, and organ systems.
- F. Recognize that the basic functions of organisms are carried out by or within cells and are similar in all organisms.
- G. Identify the organization of structure and function of cell, tissues, organs, organ systems, and whole organisms.

6.5 Understand that God gave all organisms the ability to Reproduce and Grow in many different ways.

- A. Recognize that all organisms reproduce.
- B. Define asexual and sexual reproduction.
- C. Describe how traits are transmitted through asexual reproduction.
- D. Describe mitosis.
- E. Understand that traits are passed on from parent to offspring.

6.6 Understand how traits and genes are passed from parent to offspring.

- A. Describe the steps in meiosis
- B. Understand the roles of DNA, genes, and chromosomes in inheritance of traits
- C. Describe Mendel's experiments on heredity
- D. Explain the difference between dominant and recessive genes and describe how they affect inherited traits

6.7 Understand the flow of energy through ecosystems and the responses of populations to the biotic and abiotic factors in their environment.

- A. Summarize how energy derived from the sun is used by plants to produce sugars (photosynthesis) and is transferred within food chains and food webs (terrestrial and aquatic) from producers to consumers to decomposers.
- B. Explain how plants respond to external stimuli (including dormancy and forms of tropism) to enhance survival in an environment.
- C. Summarize how the abiotic factors (such as temperature, water, sunlight, and soil quality) of biomes (freshwater, marine, forest, grasslands, desert, Tundra) affect the ability of organisms to grow, survive and/or create their own food through photosynthesis.

Earth Science

The students will:

6.8 Understand the earth/moon/sun system, and the properties, structures and predictable motions of celestial bodies in the Universe.

- A. Explain how the relative motion and relative position of the sun, Earth and moon affect the seasons, tides, phases of the moon, and eclipses.
- B. Explain why Earth sustains life while other planets do not based on their properties (including types of surface, atmosphere and gravitational force) and location to the Sun.
- C. Summarize space exploration and the understandings gained from them.

6.9 Understand the structure of the earth and how interactions of constructive and destructive forces have resulted in changes in the surface of the Earth over time and the effects of the lithosphere on humans.

- A. Summarize the structure of the earth, including the layers, the mantle and core based on the relative position, composition and density.
- B. Explain how crustal plates and ocean basins are formed, move and interact using earthquakes, heat flow and volcanoes to reflect forces within the earth.
- C. Explain how the formation of soil is related to the parent rock type and the environment in which it develops.
- D. Describe the distinguishing properties that can be used to classify minerals (i.e., texture, smell, luster, hardness, crystal shape, streak, reaction to magnets and acids)
- E. Describe the methods used to identify the distinguishing properties of minerals
- F. Explain how the formation of sedimentary rocks depends on weathering and erosion
- G. Make inferences about the formation of igneous and metamorphic rocks from their physical properties (e.g., crystal size indicates rate of cooling, air pockets or glassy texture indicate volcanic activity)
- H. Classify rocks as sedimentary, igneous, or metamorphic
- I. Explain and diagram the external and internal processes of the rock cycle (e.g., weathering and erosion, sedimentation, compaction, heating, re-crystallization, resurfacing due to forces that drive plate motion)
- J. Explain that the amount of matter remains constant while being recycled through the rock cycle
- K. Conclude that the good health of humans requires: monitoring the lithosphere, maintaining soil quality and stewardship.
- L. Distinguish between renewable (e.g., geothermal, hydroelectric) and nonrenewable (e.g., fossil fuel) energy sources

6.10 Understand that all things are made up of matter and matter is made up of an orderly arrangement of atoms.

- A. Identify the basic particles that make up an atom.
- B. Recognize that the number of protons determines the element but that a given element can have isotopes (different number of neutrons).
- C. Understand that elements in the periodic table are arranged by atomic number and properties.
- D. Identify the symbols of elements.
- E. Compare and contrast the properties of a compound with the properties of its constituent parts.
- F. Recognize elements and compounds as pure substances
- G. Identify compounds as substances made up of two or more elements chemically combined

6.11 Use system models to identify and analyze the flow, cycles, and conservation of matter and energy.

- A. Identify and describe the importance of the independent variable, dependent variables, control of constants, and multiple trials to the design of a valid experiment
- B. Determine the appropriate tools and techniques to collect data
- C. Use quantitative and qualitative data as support for reasonable explanations (conclusions)
- D. Learn to communicate the procedures and results of investigations and explanations through: Measurement labs, oral presentations, drawings and maps, and data tables.
- E. Allow for the recording and analysis of data relevant to the experiment, such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities), graphs (bar, single line, pictograph), equations and writings.

Physical Science

The students will:

6.12 Understand the properties of waves and the wavelike property of energy in earthquakes, electricity, light and sound waves.

- A. Compare the properties of waves to the wavelike property of energy in earthquakes, light and sound.
- B. Explain the relationship among visible light, the electromagnetic spectrum, and sight.

- C. Explain the relationship among the rate of vibration, the medium through which vibrations travel, sound and hearing.

6.13 Understand that all things are made up of matter and matter is made up of an orderly arrangement of atoms.

- A. Identify the basic particles that make up an atom.
- B. Recognize that the number of protons determines the element but that a given element can have isotopes (different number of neutrons).
- C. Understand that elements in the periodic table are arranged by atomic number and properties.
- D. Identify the symbols of elements.
- E. Compare and contrast the properties of a compound with the properties of its constituent parts.
- F. Recognize elements and compounds as pure substances
- G. Identify compounds as substances made up of two or more elements chemically combined

6.14 Understand the structure, classifications and physical properties of matter.

- A. Recognize that all matter is made up of atoms and atoms of the same element are all alike, but are different from the atoms of other elements.
- B. Explain the effect of heat on the motion of atoms through a description of what happens to particles during a change in phase.
- C. Compare the physical properties of pure substances that are independent of the amount of matter present including density, melting point, boiling point, and solubility to properties that are dependent on the amount of matter present to include volume, mass and weight.
- D. Recognize that the substances making up a mixture retain their original properties
- E. Recognize that solutions are mixtures on the molecular level
- F. Identify factors that affect the rate of dissolving

6.15 Understand the physical and chemical changes of matter.

- A. Recognize that in general, matter expands when it's heated.
- B. Identify physical change as change in size, shape, or state.
- C. Understand that a change of state involves thermal energy.
- D. Identify chemical change as a process that forms one or more new substances.
- E. Recognize that making and breaking chemical bonds involves energy.
- F. Describe the common examples of chemical change such as iron rusting, and wood burning.

PLTW: Magic of Electrons

The students will:

6.16 Understand characteristics of energy transfer and interactions of matter and energy.

- A. Illustrate the transfer of heat energy from warmer objects to cooler ones using examples of conduction, radiation and convection and the effects that may result.
- B. Explain the effects of electromagnetic waves on various materials to include absorption, scattering, and change in temperature.
- C. Explain the suitability of materials for use in technological design based on a response to heat (to include conduction, expansion, and contraction) and electrical energy (conductors and insulators).

6.17 Understand the characteristics and energy of electricity.

- A. Understand that opposite charges attract and like charges repel each other.
- B. Identify an electric current as electric charges in motion.
- C. Recognize that conducting bodies create resistance to electric current.
- D. Compare and contrast AC and DC electricity.
- E. Describe the difference between electrical conductors and insulators.

6.18 Understand how electricity and magnetism are related.

- A. Describe how electric current can create a magnetic field.
- B. Understand that electromagnets can be used to create generators and motors.
- C. Identify parts of an AC generator.
- D. Understand that magnets are used in a variety of common electric devices.

6.19 Understand how electricity is used in motors and machines.

- A. Use the knowledge gained on electricity and magnetism to build and experiment with different motors and machines.
- B. Apply knowledge of machines to come up with a simple use for your own invention.

Technology and Engineering

The students will:

6.20 Demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology.

- A. Apply existing knowledge to generate new ideas, products, or processes.
- B. Create original works as a means of personal or group expression.
- C. Use models and simulations to explore complex systems and issues.
- D. Identify trends and forecast possibilities.

6.21 Demonstrate research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

- A. Plan strategies to guide inquiry.
- B. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media.
- C. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks.
- D. Process data and report results.

6.22 Demonstrate critical thinking, problem solving, and decision making.

- A. Use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources.
- B. Identify and define authentic problems and significant questions for investigation.
- C. Plan and manage activities to develop a solution or complete a project.
- D. Collect and analyze data to identify solutions and/or make informed decisions.
- E. Use multiple processes and diverse perspectives to explore alternative solutions.

7th Grade Objectives

Science Inquiry

7.1 Through Science Inquiry, the students will:

- A. Formulate testable questions and hypotheses
- B. Identify and describe the importance of the independent variable, dependent variables, control of constants, and multiple trials to the design of a valid experiment
- C. Design and conduct a valid experiment
- D. Evaluate the design of an experiment and make suggestions for reasonable improvements or extensions of an experiment

7.2 Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations.

- A. Make qualitative observations using the five senses
- B. Determine the appropriate tools and techniques to collect data
- C. Use a variety of tools and equipment to gather data (e.g., microscopes, thermometers, analog and digital meters, computers, spring scales, balances, metric rulers, graduated cylinders, stopwatches)
- D. Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, force (weight) to the nearest Newton, temperature to the nearest degree Celsius, time to the nearest second
- E. Compare amounts/measurements
- F. Judge whether measurements and computation of quantities are reasonable
- G. Calculate the range and average/mean of a set of data

7.3 Scientific inquiry includes evaluation of explanations (laws/principles, theories/models) in light of evidence (data) and scientific principles (understandings)

- A. Use quantitative and qualitative data as support for reasonable explanations (conclusions)
- B. Use data as support for observed patterns and relationships, and to make predictions to be tested
- C. Determine the possible effects of errors in observations, measurements, and calculations on the formulation of explanations (conclusions) could cause possible effects
- D. Evaluate the reasonableness of an explanation (conclusion)
- E. Analyze whether evidence (data) and scientific principles support proposed explanations (hypotheses, laws, theories)

7.4 The nature of science relies upon communication of results and justification of explanations.

- A. Communicate the procedures and results of investigations and explanations through:

1. oral presentations
2. drawings and maps
3. data tables (allowing for the recording and analysis of data relevant to the experiment, such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities)
4. graphs (bar, single line, pictograph)
5. equations and writings

Life Science

The students will:

7.5 Describe how energy has a source, can be transferred, and can be transformed into various forms but is conserved between and within systems.

- A. Explain forms of energy and how they have a source, a means of transfer (work and heat), and a receiver.
- B. Recognize that chemical energy is stored in chemical compounds (e.g., energy stored in and released from food molecules, batteries, nitrogen explosives, fireworks, organic fuels).

7.6 Explain how electromagnetic energy from the Sun (solar radiation) is a major source of energy on Earth.

- A. Identify that the Sun is the source of almost all energy used to produce the food for living organisms.

7.7 Energy can be transferred within a system as the total amount of energy remains the constant (i.e., Law of Conservation of Energy.)

- A. Identify the evidence of different energy transformations (e.g., explosion of light, heat, and sound, temperature change, electrical charge) that may occur as chemical energy is released during a chemical reaction

7.7 Discover that organisms have basic needs for survival and common characteristics that all living things share

- A. Identify the common life processes necessary to the survival of organisms include (i.e.) growth, reproduction, life span, response to stimuli, energy use, exchange of gases, use of water, and elimination of waste
- B. Identify that most plants and animals require food and oxygen (needed to release the energy from that food).

7.8 Cells are the fundamental units of structure and function of all living things.

- A. Recognize that all organisms are composed of cells, the fundamental units of life, which carry on all life processes.

7.9 Plants and animals have different structures that serve similar functions necessary for the survival of the organism.

- A. Identify and contrast the structures of plants and animals that serve similar functions (e.g., taking water and oxygen, support, response to stimuli, obtaining energy, circulation, digestion, excretion, reproduction).

7.10 Explain biological classifications are based on how organisms are related.

- A. Identify examples of unicellular (e.g., bacteria, some protists, fungi) and multi-cellular organisms (e.g., some fungi, plants, animals)
- B. Identify that most of the organisms on Earth are unicellular (e.g., bacteria, protists) and other organisms, including humans, are multi-cellular
- C. Identify and describe the function of the following plant and animal cell structures: cell membrane, nucleus, cell wall, chloroplast, cytoplasm, mitochondria, lysosome, vacuole, Golgi bodies, endoplasmic reticulum, and ribosomes.

7.11 Distinguish life processes that living organisms carry out in order to survive.

- A. Describe how a cell contains a set of structures called organelles that interact to carry out life processes through physical and chemical means.
- B. Compare and contrast plant and animal cell structures
- C. Describe how the cell membrane helps regulate the transfer of materials in and out of the cell
- D. Identify the function of the chloroplast during photosynthesis

7.12 Be able to show how photosynthesis and cellular respiration are complementary processes necessary to the survival of most organisms on Earth.

- A. Describe how plants use energy from the Sun to produce food and oxygen through the process of photosynthesis
- B. Identify the reactants (water and carbon dioxide) and products (energy-rich sugar molecules and oxygen) that takes place in the presence of light and chlorophyll during the chemical change of photosynthesis
- C. Describe how oxygen is needed by all cells of most organisms for the release of energy from nutrient (sugar) molecules during cellular respiration (MAP does NOT assess the term cellular respiration)
- D. Describe the importance of the transport and exchange of oxygen and carbon dioxide to the survival of the organism.

7.13 Complex multi-cellular organisms have systems that interact to carry out life processes through physical and chemical means

- A. Identify and give examples of each level of organization (cell, tissue, organ, organ system) in multi-cellular organisms (plants, animals)
- B. Illustrate and explain the path water and nutrients take as they move through the transport system of a plant
- C. Explain the interactions between the circulatory and digestive systems as nutrients are processed by the digestive system, passed into the blood stream, and transported in and out of the cell
- D. Compare and contrast the processes of mechanical and chemical digestion, and their role in providing materials necessary for survival of the cell and organism
- E. Identify the importance of the transport and exchange of nutrient and waste molecules to the survival of the cell and organism
- F. Explain the interactions between the circulatory and respiratory systems in exchanging oxygen and carbon dioxide between cells and the atmosphere (when oxygen enter the body, passes into the blood stream, and is transported into the cell; carbon dioxide is transported out of the cell, passes into the blood stream, and exits the body)
- G. Explain the interactions between the nervous and muscular systems when an organism responds to a stimulus.

7.14 Cellular activities and responses can maintain stability internally while external conditions are changing (homeostasis)

- A. Predict the response the body may take to maintain internal balance during an environmental change (e.g., shivering when cold, slowing metabolism when food supply decreases or when dehydrated, and adrenaline rush when frightened).

7.15 Life processes can be disrupted by disease (intrinsic failures of the organ systems or by infection due to other organisms).

- A. Explain the cause and effect of diseases (e.g., AIDS, cancer, diabetes, hypertension) on the human body
- B. Relate some common diseases (i.e., cold, influenza, strep throat, dysentery, fungal infections) to the organisms that cause them (bacteria, viruses, protists, fungi)
- C. Differentiate between infectious and noninfectious diseases
- D. Explain the role of antibiotics and vaccines in the treatment and prevention of diseases

7.16 Describe the genetic basis for the transfer of biological characteristics from one generation to the next through the reproductive processes.

- A. Discover that reproduction can occur asexually or sexually.
- B. Compare and contrast the processes of asexual and sexual reproduction, including the type and number of cells involved (one body cell in asexual, two

sex cells in sexual), and the number of gene sets (body cell has two sets, sex cells have one set each) passed from parent(s) to offspring

- C. Identify examples of asexual reproduction (i.e., plants budding, binary fission of single cell organisms)
- D. Compare and contrast the reproductive mechanisms of classes of vertebrates (i.e., internal vs. external fertilization)
- E. Explain how flowering plants reproduce sexually using stamen and pistil.

7.17 Chromosomes are components of cells that occur in pairs and carry hereditary information from one cell to daughter cells and from parent to offspring during reproduction.

- A. Describe when asexual reproduction occurs, the same genetic information found in the parent cell is copied and passed on to each new daughter cell (Assess only the concept— not the term of mitosis)
- B. Describe when sexual reproduction occurs, genetic material from both parents is passed on and combined to form the genetic code for the new organism (Assess only the concept— not the term of meiosis).

7.18 Show that there is heritable variation within every species of organism.

- A. Recognize and describe when asexual reproduction occurs, the daughter cell is identical to the parent cell (assuming no change in the parent genes)
- B. Recognize and describe when sexual reproduction occurs, the offspring is not identical to either parent due to the combining of the different genetic codes contained in each sex cell.

7.19 Identify patterns of an organism's interdependency with one another and its environment.

- A. Recognize that all populations living together within a community interact with one another and with their environment in order to survive and maintain a balanced ecosystem.
- B. Identify biotic factors (populations of organisms) and abiotic factors (e.g., quantity of light and water, range of temperatures, soil composition) that make up an ecosystem.

7.20 Discover that living organisms have the capacity to produce populations of infinite size, but environments and resources are finite.

- A. Identify populations within a community that are in competition with one another for resources
- B. Identify the factors that affect the number and types of organisms an ecosystem can support are food availability, abiotic factors such as quantity of light and water, temperature and temperature range, soil composition, disease, competitions from other organisms, and predation
- C. Predict the possible effects of changes in the number and types of organisms in an ecosystem on the populations of other organisms within that ecosystem.

7.21 Recognize that the diversity of a species within an ecosystem is affected by changes in the environment, which can be caused by other organisms or outside processes.

- A. Describe beneficial and harmful activities of organisms, including humans (e.g., deforestation, overpopulation, water and air pollution, global warming, restoration of natural environments, river bank/coastal stabilization, recycling, channelization, reintroduction of species, depletion of resources, non-native species) and explain how these activities affect organisms within an ecosystem
- B. Predict the impact (beneficial or harmful) of a natural environmental change (e.g., forest fire, flood, volcanic eruption, avalanche) on the organisms in an ecosystem
- C. Describe possible solutions to potentially harmful environmental changes within an ecosystem
- D. Explain the beneficial or detrimental impact that some organisms (i.e., viruses, bacteria, protists, fungi) may have on other organisms (e.g., diseases, antibiotics, breakdown of waste, fermentation)

7.22 Describe how matter and energy flows through an ecosystem.

- A. Explain that as energy flows through the ecosystem, all organisms capture a portion of that energy and transform it to a form they can use.
- B. Diagram and describe the transfer of energy in an aquatic food web and a land food web with reference to producers, consumers, decomposers, scavengers, and predator/prey relationships.
- C. Classify populations of unicellular and multicellular organisms as producers, consumers, and decomposers by the role they serve in the ecosystem.

7.23 Understand that matter is recycled through an ecosystem.

- A. Illustrate the oxygen/carbon dioxide cycles (including the processes of photosynthesis and cellular respiration)
- B. Describe the process involved in the recycling of matter in the oxygen/carbon dioxide cycles.
- C. Recognize that fossils are evidence that some types of organisms (e.g., dinosaurs, trilobites, mammoths, giant tree ferns) that once lived in the past, and have since become extinct, have similarities with and differences from organisms living today
- D. Relate examples of adaptations (specialized structures or behaviors) within a species to its ability to survive in a specific environment (e.g., hollow bones/flight, hollow hair/insulation, dense root structure/compact soil, seeds/food, protection for plant embryo vs. spores, fins/movement in water)
- E. Predict how certain adaptations, such as behavior, body structure, or coloration, may offer a survival advantage to an organism in a particular environment

Project Lead the Way

7.24 In design and modeling the students will:

- A. Demonstrate an ability to identify, formulate, and solve engineering problems.
- B. Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- C. Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.
- D. Demonstrate an ability to apply knowledge of mathematics, science, and engineering.
- E. Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- F. Pursue the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- G. Demonstrate an understanding of professional and ethical responsibility.
- H. Demonstrate an ability to function on multidisciplinary teams.
- I. Demonstrate an ability to communicate effectively.
- J. Gain knowledge of contemporary issues.
- K. Recognize the need for, and develop an ability to engage in life-long learning.

7.25 In engineering, the students will:

- A. Understand that an engineering notebook is used to record original ideas or designs and to document the design process related to an invention or innovation.
- B. Understand that a portfolio is an organized collection of best works.
- C. Understand that science is the study of the natural world, while technology is the study of how humans develop new products to meet needs and wants.
- D. Understand that teams of people can accomplish more than one individual working alone.
- E. Understand that technological change is seen through inventions, innovations, and the evolution of technological artifacts, processes, and systems.
- F. Understand that technology can have positive and negative social, cultural, economic, political, and environmental consequences.
- G. Understand that engineers, designers, and engineering technologists are needed in high demand for the development of future technology to meet societal needs and wants.
- H. Describe the relationship between science, technology, engineering, and math.
- I. Identify the differences between invention and innovation.
- J. Describe impacts that technology has had on society.

7.26 In the design process, the students will:

- A. Understand that many different design processes are used to guide people in developing solutions to problems.
- B. Understand that the design brief is a tool for defining the problem; it is an agreement between the engineer and client.
- C. Understand that engineers use design briefs to explain the problem, identify solution expectations, and establish project constraints.
- D. Understand that design teams use brainstorming techniques to generate large numbers of ideas in a short amount of time, striving for quantity, not quality.
- E. Understand that a decision matrix is a tool used to compare solution ideas to the criteria so that you can select the best solution.
- F. Describe the design process and how it is used to aid in problem solving.
- G. Describe the elements of design.
- H. Recognize design criteria and constraints.
- I. Describe the purpose and importance of working in a team.

7.27 In measurement the students will:

- A. Understand that in the United States, we use both standard and metric systems of measurement.
- B. Understand that being able to measure accurately is important at school and at home, at work and when pursuing hobbies.
- C. Understand that precision measuring tools are needed for accuracy, but tools must be used correctly to ensure accurate measurements are taken.
- D. Understand that quality workmanship and accurate measurements with precise instruments are necessary to successfully solve problems.
- E. Select the appropriate value from a conversion chart to convert between standard and metric units.

7.28 In sketching and dimensioning techniques, the students will:

- A. Understand that the ability to create a rapid, accurate sketch is an important skill to communicate ideas.
- B. Understand that orthographic drawings of an object are used to provide information that a perspective drawing may not be able to show.
- C. Understand that engineers apply dimensions to drawings to communicate size and location information.
- D. Recognize thumbnail, isometric, and orthographic sketches.
- E. Recognize one and two point perspective drawings.

7.29 In designing for production the students will:

- A. Understand that simple geometric shapes are combined and joined to create a representation of an object.

- B. Understand that simple engineers use computer-aided design (CAD) modeling systems to quickly generate and annotate working drawings.
- C. Understand that simple three-dimensional computer modeling uses descriptive geometry, geometric relationships, and dimensions to communicate an idea or solution to a technological problem.
- D. Understand that simple as individual objects are assembled together, their degrees of freedom are systematically removed.
- E. Understand that simple engineers use a design process to create solutions to existing problems.
- F. Understand that simple teamwork requires constant communication to achieve the goal at hand.
- G. Understand that simple the fabrication of a prototype is the opportunity for the designer to see the product as a three-dimensional object. K1 – Describe the coordinate system and how geometric shapes work together to create objects.
- H. Identify the difference between a prototype, a model, and a mock-up.
- I. Describe why teams of people are used to solve problems.

Please reference the 7th Grade Star Speaking and Listening Curriculum Guide for specific objectives in the area of speaking and listening being met in the 7th grade science curriculum.

8th Grade Objectives

Science Inquiry

8.1 Through Science Inquiry, the students will:

- A. Formulate testable questions and hypotheses
- B. Design and conduct a valid experiment
- C. Evaluate the design of an experiment and make suggestions for reasonable improvements or extensions of an experiment

8.2 Scientific inquiry relies upon gathering evidence from qualitative and quantitative observations.

- A. Make qualitative observations using the five senses
- B. Determine the appropriate tools and techniques to collect data
- C. Use a variety of tools and equipment to gather data (e.g., microscopes, thermometers, analog and digital meters, computers, spring scales, balances, metric rulers, graduated cylinders, stopwatches)
- D. Measure length to the nearest millimeter, mass to the nearest gram, volume to the nearest milliliter, force (weight) to the nearest Newton, temperature to the nearest degree Celsius, time to the nearest second
- E. Compare amounts/measurements
- F. Judge whether measurements and computation of quantities are reasonable
- G. Calculate the range and average/mean of a set of data

8.3 Evidence is used to formulate explanations.

- A. Use quantitative and qualitative data as support for reasonable explanations (conclusions)
- B. Use data as support for observed patterns and relationships, and to make predictions to be tested. Scientific inquiry includes evaluation of explanations (hypotheses, laws, theories) in light of scientific principles (understandings).
- C. Evaluate the reasonableness of an explanation (conclusion)
- D. Analyze whether evidence (data) and scientific principles support proposed explanations (hypotheses, laws, theories)
- E. Communicate the procedures and results of investigations and explanations through: $\frac{3}{4}$ oral presentations $\frac{3}{4}$ drawings and maps $\frac{3}{4}$ data tables (allowing for the recording and analysis of data relevant to the experiment, such as independent and dependent variables, multiple trials, beginning and ending times or temperatures, derived quantities) $\frac{3}{4}$ graphs (bar, single line, pictograph) $\frac{3}{4}$ equations and writings.
- F. The nature of science relies upon communication of results and justification of explanations.

Earth Science

The students will:

8.4 Understand that the Earth's crust is composed of various materials, including soil, minerals, and rocks, with characteristic properties.

- A. Know that Earth's Systems (geosphere, atmosphere, and hydrosphere) have common components and unique structures. Earth's Systems (geosphere, atmosphere, and hydrosphere) interact with one another as they undergo change by common processes.
- B. Describe the components of soil and other factors that influence soil texture, fertility, and resistance to erosion (e.g., plant roots and debris, bacteria, fungi, worms, rodents)
- C. Differentiate between minerals and rocks (which are composed of different kinds of minerals)
- D. Describe the distinguishing properties that can be used to classify minerals (i.e., texture, smell, luster, hardness, crystal shape, streak, reaction to magnets and acids)
- E. Describe the methods used to identify the distinguishing properties of minerals
- F. Classify rocks as sedimentary, igneous, or metamorphic

8.5 The Earth's materials and surface features are changed through a variety of external processes.

- A. Make inferences about the formation of sedimentary rocks from their physical properties (e.g., layering and the presence of fossils indicate sedimentation)
- B. Explain how the formation of sedimentary rocks depends on weathering and erosion
- C. Describe how weathering agents and erosional processes (i.e., force of water as it freezes or flows, expansion/contraction due to temperature, force of wind, force of plant roots, action of gravity, chemical decomposition) slowly cause surface changes that create and/or change landforms
- D. Describe how the Earth's surface and surface materials can change abruptly through the activity of floods, rock/mudslides, or volcanoes

8.6 There are internal processes and sources of energy within the geosphere that cause changes in Earth's crustal plates.

- A. Identify events (earthquakes, volcanic eruptions) and the landforms created by them on the Earth's surface that occur at different plate boundaries
- B. Explain convection currents are the result of uneven heating inside the mantle resulting in the melting of rock materials, convection of magma, eruption/flow of magma, and movement of crustal plates

- C. Explain how rock layers are affected by the folding, breaking, and uplifting of rock layers due to plate motion
- D. Describe how the movement of crustal plates can cause earthquakes and volcanic eruptions that can result in mountain building and trench formation

8.7 Continual changes in the Earth's materials and surface that result from internal and external processes is described by the rock cycle.

- A. Explain how heating and cooling in the mantle layer leads to the formation of metamorphic rocks and some igneous rocks
- B. Make inferences about the formation of igneous and metamorphic rocks from their physical properties (e.g., crystal size indicates rate of cooling, air pockets or glassy texture indicate volcanic activity)
- C. Explain and diagram the external and internal processes of the rock cycle (e.g., weathering and erosion, sedimentation, compaction, heating, re-crystallization, resurfacing due to forces that drive plate motion)

8.8 Changes in the Earth over time can be inferred through rock and fossil evidence.

- A. Explain the types of fossils and the processes by which they are formed (i.e., replacement, mold and cast, preservation, trace)
- B. Use fossil evidence to make inferences about changes on Earth and in its environment (i.e., FHSD Academics SAL 3 Grade 8 Earth Science BOE approved 6-5-2008 superposition of rock layers, similarities between fossils in different geographical locations, fossils of seashells indicate the area was once underwater)
- C. Describe the methods used to estimate geologic time and the age of the Earth (e.g., techniques used to date rocks and rock layers, presence of fossils)
- D. Use rock and fossil evidence to make inferences about the age, history, and changing life forms and environment of the Earth (i.e., changes in successive layers of sedimentary rock and the fossils contained within them, similarities between fossils in different geographic locations, similarities between fossils and organisms present today, fossils of organisms indicating changes in climate, fossils of extinct organisms).

8.9 Human activity is dependent upon and affects Earth's resources and systems.

- A. Relate the comparative amounts of fresh water and salt water on the Earth to the availability of water as a resource for living organisms and human activity
- B. Describe the effect of human activities (e.g., landfills, use of fertilizers and herbicides, farming, septic systems) on the quality of water
- C. Analyze the ways humans affect the erosion and deposition of soil and rock materials (e.g., clearing of land, planting vegetation, paving land, construction of new buildings, building or removal of dams)

- D. Distinguish between renewable (e.g., geothermal, hydroelectric) and nonrenewable (e.g., fossil fuel) energy sources
- E. Provide examples of how the availability of fresh water for humans and other living organisms is dependent upon the water cycle.

8.10 Understand changes in properties and states of matter provide evidence of the atomic theory of matter. Energy has a source, can be transferred, and can be transformed into various forms but is conserved between and within systems.

- A. Learn that the hydrosphere is composed of water (a material with unique properties), gases, and other materials.
- B. The atmosphere (air) is composed of a mixture of gases, including water vapor, and minute particles.
- C. Describe the composition of the Earth's atmosphere (i.e., mixture of gases, water and minute particles) and how it circulates as air masses
- D. Describe the role atmosphere (e.g., clouds, ozone) plays in precipitation, reflecting and filtering light from the Sun, and trapping heat energy emitted from the Earth's surface
- E. Know climate is a description of average weather conditions in a given area over time.

8.11 Changes in the form of water as it moves through Earth's systems are described as the water cycle.

- A. Explain and trace the possible paths of water through the hydrosphere, geosphere, and atmosphere (i.e., the water cycle: evaporation, condensation, precipitation, surface run-off/ groundwater flow)
- B. Explain how thermal energy is transferred throughout the water cycle by the processes of convection, conduction, and radiation

8.12 Constantly changing properties of the atmosphere occur in patterns which are described as weather.

- A. Explain how the differences in surface temperature, due to the different heating and cooling rates of water and soil, affect the temperature and movement of the air above
- B. Identify factors that affect weather patterns in a particular region (e.g., proximity to large bodies of water, latitude, altitude, prevailing wind currents, amount of solar radiation, location with respect to mountain ranges)

8.13 Physical changes in the state of matter that result from thermal changes can be explained by The Kinetic Theory of Matter.

- A. Describe the relationship between the change in the volume of water and changes in temperature as it relates to the properties of water (i.e., water expands and becomes less dense when frozen)

- B. Describe the relationship between temperature and the movement of atmospheric gases (i.e., warm air rises due to expansion of the volume of gas, cool air sinks due to contraction of the volume of gas)

8.14 Mass is conserved during any physical or chemical change. Explain that the amount of matter remains constant while being recycled through the water cycle

- A. Explain that the amount of matter remains constant while being recycled through the water cycle
- B. Explain that the amount of matter remains constant while being recycled through the water cycle
- C. Recognize and describe how energy from the Sun is transferred to Earth in a range of wavelengths and energy levels, including visible light, infrared radiation, and ultraviolet radiation
- D. Identify solar radiation as the primary source of energy for weather phenomena.

8.15 The universe has observable properties and structure.

- A. Classify celestial bodies in the solar system into categories: Sun, moon, planets, and other small bodies (i.e., asteroids, comets, meteors), based on physical properties
- B. Compare and contrast the size, composition, atmosphere, and surface of the planets (inner vs. outer) in our solar system and Earth's moon
- C. Identify the relative proximity of common celestial bodies (i.e., Sun, moon, planets, smaller celestial bodies such as comets and meteors, other stars) in the sky to the Earth. Describe how the Earth's placement in the solar system is favorable to sustain life (i.e., distance from the Sun, temperature, atmosphere)
- D. Compare and contrast the characteristics of Earth that support life with the characteristics of other planets that are considered favorable or unfavorable to life (e.g., atmospheric gases, extremely high/low temperatures)
- E. Compare the distance light travels from the Sun to Earth to the distance light travels from other stars to Earth using light years

8.16 Regular and predictable motions of objects in the universe can be described and explained as the result of gravitational forces. Forces affect motion.

- A. Relate the apparent east-to-west changes in the positions of the Sun, other stars, and planets in the sky over the course of a day to Earth's counterclockwise rotation about its axis
- B. Describe the pattern that can be observed in the changes in number of hours of visible sunlight, and the time and location of sunrise and sunset, throughout the year

8.17 The apparent position of the moon, as seen from Earth, and its actual position relative to Earth change in observable patterns.

- A. Observe the change in time and location of moon rise, moon set, and the moon's appearance relative to time of day and month over several months, and note the pattern in this change
- B. Relate the apparent change in the moon's position in the sky as it appears to move east-to west over the course of a day to Earth's counterclockwise rotation about its axis
- C. Describe how the appearance of the moon that can be seen from Earth changes approximately every 28 days in an observable pattern (moon phases)

8.18 The regular and predictable motions of a planet and moon relative to the Sun explain natural phenomena on a planet, such as day, month, year, shadows, moon phases, eclipses, tides, and seasons.

- A. Illustrate and explain a day as the time it takes a planet to make a full rotation about its axis
- B. Diagram the path (orbital ellipse) the Earth travels as it revolves around the Sun
- C. Illustrate and explain a year as the time it takes a planet to revolve around the Sun
- D. Explain the relationships between a planet's length of year (period of revolution) and its position in the solar system
- E. Describe how the moon's relative position changes as it revolves around the Earth
- F. Relate the axial tilt and orbital position of the Earth as it revolves around the Sun to the intensity of sunlight falling on different parts of the Earth during different seasons

8.19 Gravity is a force of attraction between objects in the solar system that governs their motion.

- A. Describe how the Earth's gravity pulls any object on or near the Earth toward it (including natural and artificial satellites) •
- B. Describe how the planets' gravitational pull keeps satellites and moons in orbit around them.
- C. Describe how the Sun's gravitational pull holds the Earth and other planets in their orbits

8.20 Every object exerts a gravitational force on every other object.

- A. Compare the amount of gravitational force acting between objects (which is dependent upon their masses and the distance between them)

Science Technology

The students will:

8.21 Know the nature of technology can advance, and is advanced by, science as it seeks to apply scientific knowledge in ways that meet human needs. Science and technology affect, and are affected by society

- A. Design objects that are used to do things better or more easily and to do some things that could not otherwise be done at all.
- B. Explain how technological improvements, such as those developed for use in space exploration, the military, or medicine, have led to the invention of new products that may improve lives here on Earth (e.g., new materials, freeze-dried foods, infrared goggles, Velcro, satellite imagery, robotics, lasers)

8.22 Advances in technology often result in improved data collection and an increase in scientific information.

- A. Identify the link between technological developments and the scientific discoveries made possible through their development (e.g., Hubble telescope and stellar evolution, composition and structure of the universe; the electron microscope and cell organelles; sonar and the composition of the Earth; manned and unmanned space missions and space exploration; Doppler radar and weather conditions; MRI and CAT-scans and brain activity)

8.23 Technological solutions to problems often have drawbacks as well as benefits.

- A. Describe how technological solutions to problems (e.g., storm water runoff, fiber optics, windmills, efficient car design, electronic trains without conductors, sonar, robotics, Hubble telescope) can have both benefits and drawbacks (e.g., design constraints, unintended consequences, risks) (Assess Locally)

8.24 People of different gender and ethnicity have contributed to detract from scientific discoveries and the invention of technological innovations.

- A. Describe how the contributions of scientists and inventors, representing different cultures, races, and gender, have contributed to science, technology and human activity (e.g., George Washington Carver, Thomas Edison, Thomas Jefferson, Isaac Newton, Marie Curie, Galileo, Albert Einstein, Mae Jemison, Edwin Hubble, Charles Darwin, Jonas Salk, Louis Pasteur, Jane Goodall, Tom Akers, John Wesley Powell, Rachel Carson) (Assess Locally)

8.25 Scientific theories are developed based on the body of knowledge that exists at any particular time and must be rigorously questioned and tested for validity. Social, political, economic, ethical and environmental factors strongly influence, and are influenced by, the direction of progress of science and technology.

- A. Describe ways in which science and society influence one another (e.g., scientific knowledge and the procedures used by scientists influence the way many individuals in society think about themselves, others, and the environment;

societal challenges often inspire questions for scientific research; social priorities often influence research priorities through the availability of funding for research)

- B. Identify and evaluate the physical, social, economic, and/or environmental problems that may be overcome using science and technology (e.g., the need for alternative fuels, human travel in space, AIDS)

Project Lead the Way

8.26 In automation and robotics, the students will:

- A. Demonstrate an ability to identify, formulate, and solve engineering problems.
- B. Demonstrate an ability to design a system, component, or process to meet desired needs within realistic constraints such as economic, environmental, social, political, ethical, health and safety, manufacturability, and sustainability.
- C. Demonstrate an ability to design and conduct experiments, as well as to analyze and interpret data.
- D. Demonstrate an ability to apply knowledge of mathematics, science, and engineering.
- E. Demonstrate an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
- F. Pursue the broad education necessary to understand the impact of engineering solutions in a global, economic, environmental, and societal context.
- G. Demonstrate an understanding of professional and ethical responsibility.
- H. Demonstrate an ability to function on multidisciplinary teams.
- I. Demonstrate an ability to communicate effectively.
- J. Gain knowledge of contemporary issues.
- K. Recognize the need for, and develop an ability to engage in life-long learning.
- L. Describe the purpose of automation and robotics and its effect on society.
- M. Summarize ways that robots are used in today's world and the impact of their use on society.
- N. Describe positive and negative effects of automation and robotics on humans in terms of safety and economics.
- O. Provide examples of STEM careers and the need for these professionals in our society.

8.27 In engineering, the students will:

- A. Assemble an engineering notebook and a portfolio.
- B. Describe engineering.

8.28 In the design process, the students will:

- A. Describe the design process and how it is used to aid in problem solving.
- B. Use the design process to solve a technical problem.
- C. Describe the purpose and importance of working in a team.
- D. Explain a design brief and apply the concept when using the design process.
- E. Describe the elements of design and apply this concept to the design process.
- F. Use a decision matrix to select the best solution to a design problem.

8.29 In mechanical systems, the students will:

- A. Use ratios to solve mechanical advantage problems.
- B. Use numerical and algebraic expressions and equations to solve real-life problems, such as gear ratios.
- C. Use the characteristics of a specific mechanism to evaluate its purpose and applications.
- D. Apply knowledge of mechanisms to solve a unique problem for speed, torque, force, or type of motion.

8.30 In automated systems, the students will:

- A. Know the seven technological resources and how they are integrated into an open and closed loop system.
- B. Describe the purpose of pseudo code and comments within a computer program.
- C. Know how to use ratio reasoning to solve mechanical advantage problems.
- D. Design, build, wire, and program both open and closed loop systems.
- E. Use motors and sensors appropriately to solve robotic problems.
- F. Troubleshoot a malfunctioning system using a methodical approach.
- G. Explain the roles and responsibilities of mechanical, electrical, and computer engineers

Please reference the 8th grade Star Speaking and Listening Curriculum Guide for specific objectives in the area of speaking and listening being met in the 8th grade science curriculum.