

PreK-Kindergarten

Students will be able to:

- Collect, analyze, and draw conclusions from data.
- Communicate scientific ideas through writing and discussion.
- Support conclusions with reasons that are based on observation and experience.

- Identify their senses through interaction in their environment.
- Match the sense to the appropriate part of the body.
- Identify objects using individual senses.

1. Recognize that people and animals use their senses as tools. (LS 6)

- Identify characteristics of living things.
- Observe living things in and out of the classroom.
- Communicate observations of living things.

2. Students will acquire an awareness of the living things around them. (LS 1, LS 2)

- Identify the basic needs of humans, plants, and animals.
- Illustrate daily activities that satisfy the basic needs of living things (i.e., drinking, eating, shelter).
- Compare their basic needs of plants and animals.

3. Students will acquire awareness that living things have basic needs. (LS 8)

- Match baby animals to their parents.
- Compare and communicate similarities and differences between parent and offspring.

4. Recognize that animals closely resemble their parents. (LS 4)

- Relate various objects by color.
- Relate objects according to the properties of size (i.e. small, medium, large).
- Relate various objects by shape.
- Compare the weight of various objects.
- Relate various objects by texture.

5. Relate various objects using one of the following attributes (size, shape, weight, texture, color). (PS 1)

PreK-Kindergarten (Continued)

- Identify and experience movement.
 - Identify and communicate the various ways objects move.
 - Relate the objects by the way they move.
- 6. *Explore the various ways objects can move (straight-line, back-and-forth, zigzag, round-and-round, fast, and slow).* (PS 3)**
- Identify weather elements: clouds, rain, snow, sun, wind, and temperature.
 - Name and compare weather conditions using symbols.
 - Communicate using scientific language associated with weather.
- 7. *Recognize that weather changes from day to day.* (ES 3)**
- Identify the seasons.
 - Identify the attributes of the seasons.
 - Compare the seasons and communicate differences.
- 8. *Recognize that weather changes over the seasons.* (ES 3)**
- Observe and identify natural events found in a twenty-four hour cycle.
 - Distinguish repeating patterns as they occur in the day and in the night, i.e., story graphic.
 - Illustrate the changes in the natural events in the seasons of the year.
 - Discuss and communicate differences in the seasons.
- 9. *Identify some events around us that have repeating patterns, including seasons of the year, day and night.* (ES 5)**
- Observe different samples of wood and other natural resources (i.e., cotton).
 - Discuss the origin of different samples of wood and other natural resources (i.e., cotton).
 - Describe properties of different samples of wood and other natural resources (i.e., texture, color, strength, floating/sinking and odor).
 - Compare how different samples of wood are alike and different.
 - Compare how different samples of other natural resources are alike and different.
 - Change wood into a variety of products (i.e., saw dust, particle board, wood shavings, plywood, paper).
 - Discuss how cotton can be made into a variety of products.
- 10. *Identify characteristics and uses of wood and other natural resources.* (T/E 1.1, T/E 1.2)**

PreK-Kindergarten (Continued)

- Examine different kinds of man-made materials (i.e., plastic cup).
- Describe properties of different kinds of man-made materials (texture, color, strength, odor and weight).
- Compare different man-made products using the above characteristics.
- Discuss how these products are used everyday.

11. Identify and describe man-made materials and their possible uses. (T/E 1.1, T/E 1.2)

- Identify a variety of tools found in the classroom (i.e., scissors, pencils, straws, etc.).
- Demonstrate the safe use of these tools.
- Discuss the safe use of these tools in the classroom.
- Discuss how tools help us construct simple structures.

12. Use tools and materials safely while constructing simple structures (i.e., scissors, pencils, straws, etc.). (T/E 1.3)

- Identify parts of the body that are used as tools (teeth for chewing, hands/fingers for holding).
- Demonstrate the uses of their own body parts as tools.

13. Describe different parts of the body that are used as tools. (T/E 2.2)

Grade 1

Students will be able to:

- Collect, analyze, and draw conclusions from data.
 - Communicate scientific ideas through writing and discussion.
 - Support conclusions with reasons that are based on observation and experience.
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- List things an animal would need to stay alive.
 - Describe what a plant needs to live.
1. ***Recognize that animals are living things that grow and need food, air, and water.***
(LS 1)
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- Discuss what non-living means.
 - Identify and label things as living and non-living.
 - Compare and contrast living things vs. non-living things.
2. ***Classify living and nonliving things according to at least one similar characteristic.***
(LS 2)
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- Observe stages of development in the life cycle of animals (i.e. mealworms).
 - Identify the stages in the life cycle of animals.
 - Illustrate the stages of a butterfly life cycle.
3. ***Recognize that plants and animals have a life cycle.*** *(LS 3)*
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- Demonstrate how you use each of your five senses.
 - Determine what sense would be used by animals to find food, water, and shelter.
4. ***Recognize that people and animals use their senses to meet their basic needs.***
(LS 6)
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- Describe what happens to trees and other plants when the seasons change.
 - Discuss animal changes throughout the four seasons.
5. ***Recognize that animals and plants go through changes in appearance as the seasons change.*** *(LS 7)*
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- Describe the importance of air in a healthy habitat.
 - Describe the importance of water in a healthy habitat.
 - Describe the importance of nutrients in a healthy habitat.
 - Describe the importance of light in a healthy habitat.
 - Describe the importance of shelter in a healthy habitat.
6. ***Identify how a healthy environment consisting of air, water, nutrients, light and shelter sustains animals' life cycle.*** *(LS 8)*

Grade 1 (Continued)

- Compare and communicate the properties of color and shape in various solids.
- Compare and communicate the property of roll and stack in various solids.
- Compare and communicate the properties of hardness and magnetism in various solids.
- Compare and communicate the properties of buoyancy (sink and float) of various solids.

7. *Identify objects and materials as solids. (PS 2)*

- Identify the properties of liquids (color, viscosity, variable form).
- Compare and communicate the property of color in various liquids.
- Compare and communicate the properties of viscosity in various liquids.
- Compare and communicate that liquids take on the form of various shapes.

8. *Identify objects and materials as liquids. (PS 2)*

- Illustrate how different objects can move.
- Explore the ways an object can be moved.
- Communicate the ways that objects can be moved.

9. *Recognize that the position and motion of an object can be changed by pushing or pulling. (PS 4)*

- Identify that varying surfaces impact the movement of objects.
- Illustrate how varying surfaces impact the movement of objects.
- Communicate how the varying surfaces impact the movement of objects.

10. *Observe the outcomes of moving objects on varying surfaces (rough, smooth, sloped, carpeted). (PS 4, PS 5)*

- Identify the properties of rocks, i.e. color, hardness, luster.
- Compare the five sizes of rocks: large pebbles, small pebbles, large gravel, small gravel, sand.
- Investigate properties of homemade and local soils using techniques: shaking, screening, and settling out in water.
- Communicate using descriptive vocabulary: crystal, dull, hard, pointy, rough, round, shiny etc.

11. *Recognize that water, rock, soil and living organisms are found on the Earth's surface. (ES 1)*

Grade 1 (Continued)

- Identify and explain the effect of moving air on everyday objects (flags, branches, hair, etc.).
- Observe the effect of air on clouds.
- Produce moving air to affect change.

12. Explain his/her understanding that there is air moving around us. (ES 2)

- Record weather conditions at home and then at school daily.
- Predict causes for the differences in weather.
- Draw conclusions for the difference in weather conditions.

13. Recognize that weather conditions vary across local areas. (ES 3)

- Identify the properties of the sun.
- Experience and record the heat of the sun in every day situations.
- Investigate and identify the ways light affects every living thing.
- Communicate their discoveries in class discussion and presentations.

14. Recognize that the sun supplies heat and light to the Earth. (ES 4)

- Observe examples of wheels being used in a machine (i.e., cars, bikes).
- Observe examples of a ramp being used in the school (doorstop, wheelchair ramp).
- Identify how and why a wheel is used as a simple machine in a school.
- Identify how and why a ramp is used as a simple machine within a school.

15. Identify two simple machines and their possible uses. (T/E 2.1)

- Illustrate the uses of their own body parts as tools (i.e., fingers, teeth).
- Observe various animals using their body as a tool (i.e., bear catching salmon).
- Identify the body part of the animal being used as a tool (bear's claw).
- Compare how the body parts are used as a tool by animals and humans.

16. Describe parts of the human body that are used as tools compared to the way animals use those body parts. (T/E 2.2)

Grade 2

Students will be able to:

- Collect, analyze, and draw conclusions from data.
- Communicate scientific ideas through writing and discussion.
- Support conclusions with reasons that are based on observation and experience.

- Observe the basic needs of plants.
- Observe the behavior of plants.
- Communicate what would happen if a plant did not receive one of its basic needs.

1. Recognize that plants are living things that grow, reproduce, and need food, air, and water. (LS 1)

- Observe the growth of seeds
- Observe plant development
- Observe the development of roots and stems
- Record and communicate observations in words and drawings

2. Identify specific stages in the life cycle of plants (LS 3)

- Explore how to balance different objects.
- Identify that weight affects the balance of objects.
- Explore how the position of the weight affects balance.
- Identify the fulcrum.
- Recognize that changing the position of the fulcrum impact balance.

3. Demonstrate that under certain conditions, objects can be balanced. (PS 5)

- Explore the properties of air (gas).
- Communicate how air (gas) occupies the space of a defined container.
- Recognize the characteristics of air (gas) in terms of compression, resistance, propulsion.

4. Identify that air is a gas. (PS 2, ES 2)

Grade 2 (Continued)

- Record weather using a class calendar and individual class journals.
- Describe and identify weather using different weather instruments.
- Collect weather data using a thermometer, anemometer, and rain gauge.
- Examine weather conditions over time and display the data using a bar graph.

5. *Describe the weather changes from day to day and over the seasons. (ES 3)*

- Discover air occupies space through free exploration.
- Recognize that air can be compressed.
- Compressed air builds up pressure that can be used to push objects.
- Design and construct air-using devices from a variety of materials.
- Compare how a variety of systems move air.

6. *Understand that air is all around us and that wind is moving air. (ES 2)*

- Identify the characteristics of four simple machines (wheel, ramp, lever, pulley).
- Observe each of the above simple machines as they are used as tools.
- Identify and communicate these simple machines within the school and identify their purpose.

7. *Identify four simple machines and their specific uses. (T/E 2.1)*

- Identify the need of various weather instruments.
- Discuss and construct a weather instrument (sun dial, windsock).

8. *Discuss the need for weather instruments and the tool that addresses these needs. (T/E 1.3)*

Grade 3

Students will be able to:

- Collect, analyze, and draw conclusions from data.
- Communicate scientific ideas through writing and discussion.
- Support conclusions with reasons that are based on observation and experience.

- List and label the major structures in plants.
- Describe the function of each of these structures.
- Communicate how these structures are responsible for food production, support, water transport, reproduction, growth, and protection.

1. Identify the structures in plants and their functions. (LS 2)

- Compare the reaction of two plants, one in the presence of the sun's energy and one in the absence of the sun's energy.
- Define photosynthesis (as the transfer of the sun's energy to the plant).

2. Describe how energy from the sun is used by plants to make food. (LS 11)

- Illustrate and label the life cycle of a butterfly.
- Construct the life cycle of a frog as they grow through metamorphosis.
- Communicate the similarities and differences of various animals' life cycles.

3. Compare how various organisms undergo changes during their lifespan (i.e., frogs, butterflies). (LS 4)

- Identify characteristics that enable animals to successfully survive in their environment (i.e., webbed feet, shape of beak, and size).
- Communicate how these characteristics help animals to survive.

4. Observe how animals respond and adapt to their environment. (LS 8, LS 9, LS 10)

- Recognize that when liquid water disappears, it turns into a gas in air.
- Recognize that water vapor can turn into liquid water when it is cooled.
- Recognize that liquid water can be changed to solid water (ice) by cooling a sample below the freezing point of water.
- Recognize that solid water (ice) can be changed to liquid water by heating a sample above its freezing temperature.

5. Identify the differences between solids, liquids and gases and how these states are interchangeable when heat is added or taken away. (PS 2, PS 3)

Grade 3 (Continued)

- Identify that a magnet always has two poles.
- Recognize that even if a magnet is cut in two pieces, each piece will still have two different poles.
- Recognize that poles of different polarities attract each other.
- Recognize that poles of similar polarities repel each other.

6. *Experiment with magnets and observe the poles that repel and attract each other.*
(PE 9)

- Distinguish solids that are attracted by magnets from those who are not attracted.
- Describe similarities among the solids that are attracted by magnets.
- Describe similarities among the solids that are not attracted by magnets.

7. *Discover and classify various objects that are attracted or repelled by magnets.*
(PS 10)

- Observe properties of water in a surface (i.e., transparency, movement/flow, shapelessness, surface tension).
- Observe and compare water flow on different slopes.
- Observe and compare the rate of water flow on different surfaces.
- Experience the power of water.
- Observe and compare how water flows through different earth materials.
- Identify natural forms of water interaction in real world.
- Conclude that water can change the face of the earth.

8. *Observe how the surface of the Earth changes due to the effect of water.* (ES 12)

- Observe and compare water at different temperatures.
- Observe and compare the properties of water in two states (solid and liquid).
- Observe and communicate the process through which water expands when it freezes.
- Observe and communicate the process through which water contracts when heated.
- Observe the process by which liquid water changes into water vapor (gas).
- Investigate the fact that temperature affects the rate of evaporation.
- Observe the transformation of water vapor to a liquid (condensation).
- Communicate that evaporation and condensation contributes to the movement of water through the water cycle.

9. *Demonstrate understanding of the process of the water cycle.* (ES 10)

Grade 3 (Continued)

- Investigate evidence of the change of water vapor to liquid as it relates to climate.
- Investigate evidence of evaporation as it relates to climate.

10. Demonstrate and understand that the cycling of water effects climate. (ES 11)

- Name at least five basic building tools (hammer, screw driver, tape measure, pliers, screw).
- Describe the functions of each of the above tools.
- Communicate the application of each of the above tools.

11. Identify commonly used tools and their function in building. (T/E 1.2)

- Identify different types of shelters for humans, animals and objects.
- Identify the use of shelter by humans, animals and objects.
- Determine what problems are overcome by the use of shelters.

12. Identify a problem that reflects the need for shelter, storage or convenience. (T/E 2.1)

Grade 4

Students will be able to:

- Collect, analyze, and draw conclusions from data.
- Communicate scientific ideas through writing and discussion.
- Support conclusions with reasons that are based on observation and experience.

- Identify learned animal behaviors (i. e. dogs learning tricks).
- Identify instinctive animal behaviors (i. e. turtles burying their eggs).
- Recognize that instinctive behavior is stimulated by the environment.

1. Compare and contrast how animals behave in terms of response and adaptation to their environments. (LS 8)

- Classify animals by where they live.
- Identify physical characteristics (i.e. fins, webbed feet, etc.) that support animals in their natural environment.
- Explain that to be able to survive and grow, animals require resources (food, water, light, and air).
- Analyze the physical characteristics animals have that demonstrate they have adapted to their environment.

2. Describe how animals meet some of their needs in an environment by using behaviors. (LS 6)

- Observe and identify the different particles of topsoil.
- Compare and contrast particles of sand and topsoil in terms of color, texture, and size of particles.

3. Recognize and discuss the different properties of soil, including color, texture (size of particles). (ES 5)

- Investigate water flow over earth materials.
- Observe the processes of erosion, deposition of earth materials.
- Identify the composition of deposition (minerals, organic material, sand and clay).

4. Explain and give examples of the ways in which soil is formed (the weathering of rock by water and wind and from the decomposition of plant and animal remains). (ES 4)

Grade 4 (Continued)

- Discuss causes of weathering.
 - Investigate the relationship of slope and erosion on the earth's surface.
 - Compare and contrast natural erosion to flood flow erosion.
- 5. Describe changes in the earth surface due to slow processes (erosion, weathering) and rapid processes (landslides and floods). (ES 12)**
- Interpret the functions of the essential components in an electric circuit.
 - Construct and compare simple circuits.
 - Demonstrate evidence of the flow of electricity.
 - Communicate understanding of a complete electric circuit.
 - Recognize that current passes through an electric circuit only when an electrical loop is completed.
- 6. Recognize that by using a source of power, light bulbs and wires in a circuit, light can be produced. (PS 6)**
- Identify materials that conduct electricity.
 - Identify as insulators those materials that do not conduct electricity.
 - Determine through a circuit test a material's conductivity.
- 7. Identify and classify objects and materials that are conductors or insulators of electricity. (PS 7)**
- Identify that a magnet always has two poles.
 - Recognize that even if a magnet is cut in two pieces, each piece will still have two different poles.
 - Recognize that poles of different polarities attract each other.
 - Recognize that poles of similar polarities repel each other.
- 8. Experiment with magnets and observe the poles that repel and attract each other. (PE 9)**
- Distinguish solids that are attracted by magnets from those who are not attracted.
 - Describe similarities among the solids that are attracted by magnets.
 - Describe similarities among the solids that are not attracted by magnets.
- 9. Discover and classify various objects that are attracted or repelled by magnets. (PS 10)**
- Demonstrate that electricity can create magnetism.
 - Identify components of an electromagnet.
 - Use electromagnets to differentiate magnetic and non-magnetic materials.
 - Communicate the uses of electromagnets in everyday life.
- 10. Construct an electromagnet and explain how they are used. (PS 8)**

Grade 4 (Continued)

- Identify the connection between vibration and sound.
- Observe and compare how sound travels through solids, liquids, and air.
- Define pitch as a characteristic of sound.
- Determine the relationship between the pitch of a sound and the physical properties of the sound source.

11. Recognize that sound is produced by vibrating objects, requires a medium through which to travel, and its pitch is determined by the rate of vibration. (PS 11)

- Discuss energy in sound
- Communicate that a transfer of energy is required to produce sound

12. Describe how energy can be transferred from one form to another. (PS 5)

- Identify manmade objects that accelerate water flow.
- Identify manmade objects that retard the water flow.
- List and analyze human modifications and how they affect the erosion process.

13. Determine human modifications which accelerate and retard the erosion process. (T/E 2.1, 2.4)

Grade 5

Students will be able to:

- Collect, analyze, and draw conclusions from data.
 - Communicate scientific ideas through writing and discussion.
 - Support conclusions with reasons that are based on observation and experience.
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- Identify an ecosystem as stable or undisturbed and recognize the causes of a disturbed ecosystem as natural or human-made.
1. ***Explain how environmental changes affect the life of specific plants and animals. (LS 7)***
 - Conduct, record, and organize daily observations.
 - Observe interaction of organisms with their environment.
 - Analyze behaviors of organisms over time in ecosystems.
 - Examine how natural and man-made events can “disturb” an ecosystem.
 2. ***Communicate how organisms behave in terms of response and adaptation to their environment: instinctive and learned behavior. (LS 8)***
 - Analyze how adaptations help organisms survive.
 - Identify migration as a behavioral adaptation.
 - Investigate the ways animals live in different temperatures have adapted to their environments.
 - Observe how insects adapted to survive in their environments.
 3. ***State examples of how inherited characteristics may change over time as adaptations to changes in the environment that enable organisms to grow. (LS 6)***
 - Examine ecosystems in local area, state, etc.
 - Consider how model ecosystems can be used to learn more about the complex relationships that exist on earth.
 - Analyze an environmental problem and suggest solutions for change.
 4. ***Investigate how members of a food chain can cause changes in their environment to ensure their survival; explain how these changes may affect the ecosystem. (LS 10)***
 - Investigate through research how the Earth would not have any life on it without the Sun's energy, which reaches Earth in the form of heat and light.
 - Explain the Sun as the source of energy (green plants absorb sunlight and convert it to food which these plants then use to live and grow; in this process, the plants give off the oxygen that animals breathe and animals eat these plants for nourishment).
 5. ***Describe how plants make food using energy from the sun. (LS 11)***

Grade 5 (Continued)

- Illustrate how the producers, consumers, and decomposers are important in the energy transfer in an ecosystem.
- Explain what happens to the bodies of organisms when they die.
- Discuss how things in nature all exist in equilibrium.

6. *Communicate how energy is transferred through an ecosystem (from producers>consumers> decomposers). (LS 11)*

- Recognize that an effort (Force) is needed to lift a load.
- Recognize that work can be done when force is applied to move an object.

7. *Identify forces in a system and the application of force to do work. (PS 4)*

- Identify and classify simple machines (lever, pulley, inclined plane, wheel and axle, and wedge).
- Describe advantage and its relationship to simple machines.
- Investigate the fulcrum, effort, and load of different kinds of levers.
- Analyze the effort (Force) needed to lift a load with different kinds of pulleys.

8. *Recognize the concept of advantage as it relates to simple machines (lever, pulley, inclined plane, wheel and axle, and wedge). (T/E 1.3)*

- State what is meant by the term physical property.
- Find, compare, and discuss the hardness of a sample of rocks and minerals.
- Find, compare, and discuss the luster of a sample of rocks and minerals.
- Identify, compare, and discuss the color of a sample of rocks and minerals.
- Describe and compare shape and texture of a sample of rocks and minerals.

9. *Explain and identify through tests the physical properties of rocks and minerals (hardness, color, luster, shape, texture). (ES 2)*

- Identify and communicate properties of metamorphic rock.
- Investigate how metamorphic rock was formed.
- Identify and communicate properties of igneous rock.
- Investigate how igneous rock was formed.
- Identify and communicate properties of sedimentary rock.
- Investigate how sedimentary rock was formed.

10. *Compare and contrast the three categories of rocks (metamorphic, igneous, sedimentary) based on how they were formed. (ES 3)*

Grade 5 (Continued)

- Identify the parts in a solar system (sun, stars, planets, and moon).
- Identify the earth's location in our solar system.
- Construct and communicate a model of our solar system.

11. Recognize that the earth is part of a system called the solar system. (ES 13)

- Describe the orbit of the earth around the sun and its duration.
- Describe the rotation of the earth on its axis and its duration.
- Observe and describe the observable changing shape of the moon.
- Communicate the earth's movement in terms of day and night.

12. Recognize that the earth revolves and rotates in a timely manner and communicate its correlation to day and night. (ES 14)

- Identify the proper tool to rate minerals hardness.
- Design an instrument that can determine time of day.
- Design and create a calendar that illustrates the observable changes of the moon.

13. List and explain the use of materials and tools needed to construct a design or model to solve a specific problem. (T/E 1.2)

- State the properties of simple machines.
- Identify various simple machines.
- State the properties of complex machines.
- Identify various complex machines.
- Classify machines as simple or complex.
- Communicate how simple and complex machines extend our ability and solve problems.

14. Identify and explain the difference between simple and complex machines and the tasks they accomplish. (T/E 1.3)

Grade 6

Students will be able to:

- Collect, analyze, and draw conclusions from data.
 - Communicate scientific ideas through writing and discussion.
 - Support conclusions with reasons that are based on observation and experience.
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- Construct definition of organ and body system.
 - Explore the positions of the major organs of the body.
 - Communicate the functions of the major organs and systems of the human body.
- 1. Examine the hierarchical organization of the systems of the human body. (LS 5, LS 6)**
 - Analyze how specialized cells perform specialized functions in the human body.
 - Investigate how groups of specialized cells cooperate to form a tissue, such as a muscle.
 - Examine how tissues are grouped together to form larger functional units such as the heart and the lungs.
 - Categorize how each type of cell, tissue and organ has a distinct structure and a set of functions that serve the human body.
 - 2. Recognize that within cells, many of the basic functions of organisms are carried out. The way cells function is similar in all living organisms (specialized cells perform specialized functions: tissues, organs, functions). (LS 4, LS 5)**
 - Construct a model and communicate the functions of the digestive system.
 - Construct a model and communicate the functions of the respiratory system.
 - Construct a model and communicate the functions of the circulatory system.
 - Construct a model and communicate the functions of the muscular skeletal system.
 - Identify and analyze the functions and interactions of the major systems of the human body.
 - 3. Identify the functions and interactions of the major systems of the human body (digestive, respiratory, reproduction, circulation, excretion, protection from disease, and movement, control and coordination). (LS 6)**
 - Define and demonstrate potential energy.
 - Define and demonstrate kinetic energy.
 - Identify situations where kinetic energy is transformed into potential energy and where potential energy is transformed into kinetic energy.
 - 4. Differentiate between potential and kinetic energy. (PS 13)**

Grade 6 (Continued)

- Observe and record information about the natural cycles of the Sun and Moon.
- Observe the phases of the Moon's cycle.
- Measure and predict the passage of time during a month observing the Moon's cycle.
- Observe the Sun's shadow in the Northern Hemisphere as it move west to east—sun changing position relative to Earth during the day.

5. Describe lunar and solar eclipses, the observed moon phases, and tides. Relate them to the relative positions of the Earth, Moon and Sun. (ES 9)

- Define prototype.
- Communicate and implement all steps of the design process.
- Develop a prototype using the design process.

6. Construct a prototype and identify the proper materials and tools needed to solve the problem. (T/E 2.1)

- Define an assembly line.
- Explore the historical sequence in the development of assembly lines and mass production.
- Analyze how assembly lines and mass production improve efficiency and productivity in manufacturing.

7. Describe various manufacturing systems (mass production). (T/E 4.1)

- Identify the three types of bridges (Beam, Truss, Suspension).
- Evaluate the strength and stability of each bridge design.
- Determine the appropriate use of the each bridge type (i.e., safety and ease of use).

8. Identify and describe the three types of bridges. (T/E 5.2)

- Define forces of tension, compression, torsion, bending, and shear.
- Justify the above factors in bridge construction.
- Justify design and construction of bridges in terms of force used.

9. Distinguish among the forces of tension, compression, torsion, bending and shear in relationship to bridge performance. (T/E 5.3)

Grade 6 (Continued)

- Explain the meaning of transportation.
- Identify the four means of transportation (land, air, water and space).
- Determine the best utilization of the above transportation systems.

10. Describe the major systems in transportation. (T/E 6.1, 6.2)

- Define an adaptive device.
- Identify the need for adaptive and assistive devices in our lives.
- Identify the existence and function of such devices.
- Brainstorm ideas for new adaptive devices.

11. Explain examples of adaptive and assistive devices. (T/E 7.1)

Grade 7

Students will be able to:

- Collect, analyze, and draw conclusions from data.
- Communicate scientific ideas through writing and discussion.
- Support conclusions with reasons that are based on observation and experience.

- Explain the function of a cell.
- Describe and compare a variety of unicellular organisms.

1. Recognize that all organisms are composed of at least one cell. (LS 2)

- Identify the defining structures of cells (membranes, cell walls, nuclei, chloroplasts, ribosome, mitochondria, and cytoplasm).
- Identify the functions of the above structures.

2. Distinguish how cells carry out all the basic functions of life. (LS 3, LS 4)

- Examine plant cells and identify the structures.
- Examine animal cells and identify the structures.
- Compare and contrast plant and animal cells.

3. Recognize differences and similarities between plant and animal cells. (LS 3)

- Relate that motion is the act of changing position.
- State that speed is the rate of change of position of an object ($v = d/t$).
- Determine the distance and displacement of an object as it moves from a point of reference.
- Determine the speed of an object by using graphical and analytical methods.

4. Recognize that the motion of an object can be described by its position, direction of motion and speed. (PS 11)

- Describe inertia.
- Identify that the sum of the forces acting on an object at rest or an object moving at constant speed is equal to zero.

5. Recognize that an object at rest will remain at rest or an object moving at constant speed will continue to move at the same speed unless a net force is applied on it. (PS 12)

Grade 7 (Continued)

- Show how net force applied to an object produces acceleration (change in speed as a function of time).
 - Illustrate that the force of gravity accelerates objects in free fall and objects rolling on an inclined plane.
 - Investigate the relation between mass and acceleration.
- 6. Explain that the speed of an object changes when unbalanced forces act on it. (PS 13)**
- Describe the movement of planets around the Sun.
 - Research and model that every planet has a center of axis.
 - Research and model that Earth tilts from its center of axis as it moves around the Sun.
- 7. Explain how the tilt of the Earth and its revolution around the Sun result in an uneven heating of the earth, which in turn causes the seasons. (ES 11)**
- Examine a model of the structure of the universe to interpret the hierarchical structure of the universe (planets in solar systems, stars in galaxies, galaxies in the universe).
 - Compare the relative scales of the objects in the universe.
- 8. Recognize that the universe contains many billions of galaxies, and that each galaxy contains billions of stars. (ES 12)**
- Observe the pull of gravity on the free falling motion of objects.
 - Investigate that all planets, stars and galaxies have a dense center that attracts massive objects.
 - Observe that our moon revolves around our planet, our planet revolves around the sun, and the sun revolves around the center of our galaxy.
 - Relate the movement of those bodies in space to the strength of the force of gravity.
- 9. Recognize that gravity is a force that pulls all things on and near the Earth toward the center of the earth and that it plays a major role in the formation of the planets, stars, and solar system in determining their motion. (ES 8)**

Grade 7 (Continued)

- Read and appreciate a map as a useful reference tool in order to establish locations in terms of frame of reference.
- Recognize and interpret representations of features and the relative sizes and distances between major landforms on various maps.

10. Recognize, interpret, and be able to create models of the Earth's common physical features in various mapping representations including contour maps. (ES 1)

- Predict phases of the moon through systematic record keeping of the observations of the Moon.
- Predict relative positions of the Sun, Earth, and Moon when examining representations of Moon phases.
- Evaluate the role force gravity plays in the solar system.
- Relate the connection of gravitational force between the Sun, the Moon, and Earth's tides.

11. Describe lunar and solar eclipses, the observed moon phases, and tides as they relate to the relative positions of the Earth, Moon, and Sun. (ES 9)

- Identify similarities and differences between the Earth and other objects in the solar system.
- Analyze lunar composition and physical characteristics of lunar rocks.
- Communicate several theories of the origin of the Moon and support theories with evidence.

12. Compare and contrast properties and conditions of objects in the solar system (i.e. Sun, planets, and moon) to those on Earth (i.e. gravitational force, distance from the sun, speed, movement, temperature, and atmospheric conditions). (ES 10)

- Interpret mechanical and electronic devices to gather data for analysis (i.e., dot cars, spring scales).
- Use multimedia simulation to investigate force and motion.

13. Describe the use of tools to extend ones ability to gather data and draw conclusions. (T/E 1)

- Examine the need for appropriate tools for planetary exploration.
- Identify mapping tools (i.e., imaging technologies and its essential contribution to understanding).
- Communicate and apply specific tool to solve exploratory issues.

14. Investigate the tools needed to extend the senses in order to aid in planetary exploration. (T/E 2.1)

Grade 7 (Continued)

- Discuss the need for visual representation of design solutions.
- Communicate and relate the appropriateness of such tools, i.e., sketches, orthographic projections, multi-view drawings.
- Construct such tools to aid in presentation.

15. Demonstrate methods of representing solutions to design problems. (T/E 2.2)

Grade 8

Students will be able to:

- Collect, analyze, and draw conclusions from data.
 - Communicate scientific ideas through writing and discussion.
 - Support conclusions with reasons that are based on observation and experience.
-
- Describe and document similar characteristics or traits among family members.
 - Compare and contrast data results as evidence of passing of traits.
 - Predict traits that different pairings of students could pass to offspring.
- 1. *Demonstrate knowledge of heredity being the passage of traits from parents to offspring. (LS 7)***
 - Describe the chromosomes as part of a cell located in the nucleus.
 - Describe that genes are the basic units of heredity carried by chromosomes.
 - Describe a gene as being composed of alleles and give an example.
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- 2. *Recognize that hereditary information is contained in genes located in the chromosomes of each cell. (LS 8)***
 - Discuss the types of reproduction (asexual and sexual).
 - Explain sexual reproduction in organisms (involving two parents).
 - Explain asexual reproduction (involving one parent).
 - Classify organisms by method of reproduction (sexual or asexual).
-
- 3. *Compare and contrast sexual and asexual reproduction and realize their differences. (LS 9)***
 - Illustrate how traits assist organisms in adapting to their environment.
 - Describe how populations can change over time in response to environmental factors.
 - Describe how adaptations can affect the genetic makeup of a population over time.
 - Describe natural selection as an evolutionary process by which the individuals best adapted to their environment tend to survive and pass their traits to subsequent generations.
-
- 4. *Describe the scientific evidence that supports the theory of evolution. (LS 11)***

Grade 8 (Continued)

- List the biotic factors in an ecosystem.
 - List the abiotic factors in an ecosystem.
 - Identify the components of a food chain for a given ecosystem.
 - Identify the components of a food web for a given ecosystem.
 - Describe how energy moves from one trophic level to another in an ecosystem.
5. ***Recognize the transfer of energy is the fundamental element in an ecosystem.*** (LS 14)
- Discuss how a plant gets food.
 - Explain what is needed by a plant to make food (water, sunlight, carbon dioxide, chlorophyll).
 - Explain that the food is made in a specific organelle (chloroplast) where sugar is produced.
6. ***Explain the complete process of photosynthesis.*** (LS 16)
- Identify natural catastrophic events (i.e., earthquakes, volcano, flood, hurricane, etc.) and their effect on ecosystems.
 - Explain the consequences of human interference on an ecosystem (i.e. Mono Lake).
7. ***Explain the factors that alter ecosystems (humans, catastrophic).*** (LS 17)
- Communicate the effect of sample size on melting point.
 - Communicate the effect of sample size on the boiling point.
 - Justify the evidence that sample size is not a factor of the above.
8. ***Describe that a substance has a specific melting and boiling point.*** (PS 9)
- Communicate the appearance of substances during the heating and cooling process.
 - Explain that applying heat to a substance may result in change.
 - Observe that when some substances are heated, they may form new substances with different observable properties.
9. ***Distinguish between physical and chemical changes and design a model demonstrating these differences.*** (PS 10)
- Describe temperature change associated with ice in water in its different states.
 - Describe the effect of surface temperature on the movement of air.
10. ***Show that heat is a form of energy and moves from a warmer object to a cooler object until equilibrium is reached.*** (PS 14)

Grade 8 (Continued)

- List the five elements of a universal system model (goal, inputs, processes, outputs, and feedback).
- Identify the function of the five elements of the universal system model.
- Identify the five elements of the universal system model as they apply to a machine (washing machine, bicycle, computer).

11. Identify the five elements of a universal system model as it applies to everyday life. (T/E 2.6)

- Identify the differences between raw materials and finished goods.
- Explain the basic processes in a manufacturing system.
- Describe the parts of a manufacturing organization.
- Communicate the process of manufacturing.

12. Describe and explain manufacturing systems. (T/E 4.1, 4.3, 4.4)

- Relate through example the concept of bioengineering technology.
- Discuss the need of bioengineering technology (i.e., adaptive or assistive devices).
- State what is meant by bioengineered products.

13. Identify bioengineering technologies. (T/E 7.1, 7.2)

- Discuss and label the composition of the earth in terms of layers.
- Discuss how scientists study the structure of the Earth's interior.
- Relate the motion of earthquake waves as they assist scientists in formulating hypotheses about the Earth's interior.

14. Describe layers of the Earth. (ES 2)

- Describe the rates at which equal volumes of soil and water heat and cool.
- Analyze the relationship of heating and cooling rates of soil and water.
- Explain the degree of change of the sun's energy when it reaches the Earth.

15. Explain heat transfer through the Earth's system. (ES 4)

- Investigate the effect on the air above the surface as it relates to surface temperature.
- Describe the effect of surface temperature on the movement of the air above the surface.

16. Demonstrate the effect the sun has on atmospheric movement. (ES 4)

Grade 8 (Continued)

- Investigate the movement of lithosphere plates (collide, separate, and slide past one another).
- Describe the results of plate movement and landforms (i.e., mid-ocean ridges, mountains, trenches).
- Analyze the location of the lithosphere plates in relationship to the occurrences of catastrophic events.

17. Identify the Earth's plates, their location, and the effects of their movement. (ES 5)

- Explain the theory of continental drift and its relationship to Pangaea.
- Compare fossils found in different areas of the world.
- Analyze fossil evidence as it relates to Continental Drift.

18. Describe the evidence of geological evolution. (ES 7)

- Identify causes of seasonal erosion and weathering of the earth's surface.
- Explain the natural process of deposition of sediments as it relates to storms, floods and catastrophic events.

19. Describe the elements responsible for the changes of the earth's surface. (ES 6)

Biology

Students will be able to:

- Perform experiments using the scientific method (question, hypothesis, materials, procedure, data, analysis, and conclusion) that collects numerical and/or observational data. For example, osmosis lab and cellular respiration.
- Hypothesize what the experimental outcome will be.
- Create charts and graphs using student data.
- Discuss and analyze data.
- Write a laboratory report using the scientific method, supporting hypothesis correct or incorrect.

1. Collect, analyze, and draw conclusions from data.

- Observe organisms from all kingdoms.
- Categorize organisms based on shared characteristics.
- Utilize a dichotomous key to classify organisms.
- Create a simple dichotomous key.

2. Describe how the taxonomic system classifies living things into domains (eubacteria, archaeobacteria, and eukaryotes) and kingdoms (animals, plants, fungi, etc.). (5.3)

- Identify and give examples of producers, consumers, decomposers.
- Construct a food web showing the sun, producers, primary and secondary consumers.
- Examine different types of symbioses: mutualism, parasitism, and commensalisms.
- Show examples of each type of symbiosis (ex: lichen and tapeworm).
- Explain how pollinators are vital to some plant species survival.

3. Explain how interrelationships and interdependencies among organism generate stable ecosystems. (6.2, 6.5)

- Explain how food chains, food webs, and energy pyramids are used as models.
- Identify biotic and abiotic parts of an ecosystem.
- Define ecological succession.

4. Explain how biotic and abiotic factors affect an ecosystem. (6.1)

Biology (Continued)

- List topics that relate to cells.
 - Observe and diagram different cells (plant, animal, protist) under a microscope.
 - Explain the structure and function of organelles found in a eukaryotic cell.
 - Explain the role of cell membranes as a highly selective barrier (diffusion, osmosis, and active transport).
 - Compare and contrast eukaryotic cells and prokaryotic cells.
 - Compare and contrast a plant cell and an animal cell.
 - Construct a three-dimensional eukaryotic cell, labeling all organelles.
5. ***Explain that all living things are made of cells.*** (2.2, 2.3, 2.5)
- Observe and explain the structure and function of organic molecules.
 - List the atoms that are found in organic molecules (carbon, hydrogen, oxygen, nitrogen, and sulfur).
 - Create a model of the atomic structure of each.
 - Distinguish the building blocks of organic molecules (sugars, triglycerides, amino acids, and nucleotides).
6. ***Describe the four major categories of organic molecules (carbohydrates, lipids, proteins, and nucleic acids).*** (1.3)
- Explain the processes of photosynthesis and cellular respiration.
 - Observe the structure and function of chloroplasts and mitochondria.
 - Explain how ATP is made and used.
 - Explain the relationship between photosynthesis and cellular respiration.
 - Predict what would happen if one of these processes were to end on Earth.
7. ***Explain how photosynthesis and cellular respiration are vital to maintaining life.*** (2.1, 2.6, 2.7, 2.8, 2.9)
- Observe the structure of DNA.
 - Create a three-dimensional model of DNA.
 - Identify the parts of a nucleotide: sugar-phosphate backbone, nitrogenous bases, and hydrogen bonding.
 - Construct a new strand of DNA using a template and match the complementary base pairs together (adenine with thymine, guanine and cytosine).
8. ***Explain the structure and function of DNA and how it relates to the continuity of life.*** (3.1)

Biology (Continued)

- List the steps involved in protein synthesis.
- Explain the process of protein synthesis (translation and transcription).
- Explain the role of RNA.
- Compare and contrast RNA and DNA.
- Explain what a codon is.
- Examine the Universal Genetic Code chart to sequence the amino acids found in proteins.

9. Explain that genes are a set of encoded instructions in the DNA molecule that specify the sequence of amino acids in proteins. (3.2, 3.3)

- Explain what a chromosome is.
- Match sister chromatids using a karyotyping activity.
- Explain how a gene mutation is an alteration in DNA nucleotide sequence of an allele.
- Identify and communicate various genetic mutations (ex: sickle-cell anemia, downs syndrome, etc.).
- Explain how mutations contribute to the evolutionary process.

10. Explain how mutations and new gene combinations may have a positive, negative, or no effect on an organism. (5.2)

- Explain the purpose of cell division.
- Explain the process of mitosis.
- Arrange pictures of cells in various stages of mitosis in order.
- Compare body cells versus gametes.
- Explain the role of meiosis in the production of gametes.
- Identify the two stages of meiosis.
- Explain the significance of the process of crossing-over to produce genetic variation.
- Describe the process of fertilization.
- Compare and contrast the processes of mitosis and meiosis.

11. Describe and compare the processes of mitosis and meiosis, their roles in the cell cycle, and fertilization. (2.10, 3.8)

- Define genetics.
- Explain Mendel's laws of genetics.
- Explain how genes can be hidden, i.e., dominant and recessive genes.
- Discuss the differences between genotype and phenotype.

Biology (Continued)

- Predict the offspring of parents of both monohybrid and dihybrid crosses using Punnett squares.
- Calculate the phenotypic and genotypic ratios of offspring.

12. Explain that all living things inherit traits from their parents. (3.4, 3.5, 3.6, 3.7)

- Compare and contrast how students' appearances compare to their relatives.
- Examine how a variation in phenotype will increase an organism's chance of survival (ex: moths during the Industrial Revolution, chameleons).
- Predict what would happen if there were no genetic variation.
- Explain the process of meiosis and its relationship to genetic variation.

13. Explain the variation of organisms within a species and that the great diversity of species increases the chance that some life will survive in the face of large environmental changes. (5.2)

- Compare and contrast homologous structures (ex: a bird wing vs. a bat wing).
- Explain Darwin's Theory of Natural Selection.
- Describe how fossils are formed.
- Discuss the importance of the geologic time scale.
- Describe how evidence from anatomy, embryology and biochemistry supports the theory of evolution.

14. Explain that the Earth's present-day life forms evolved from earlier distinctly different species. (5.1, 5.2)

Chemistry

Students will be able to:

- Collect, analyze, and draw conclusions from data.
 - Communicate scientific ideas through writing and discussion.
 - Support conclusions with reasons that are based on observation and experience.
-
- Define physical properties.
 - Identify several common physical properties of substances.
 - Describe a physical change.
 - Describe what happens during a chemical change.
 - Identify evidence that a chemical change has taken place.
 - Observe reactants in a chemical reaction.
 - Observe product in a chemical reaction.
 - Compare and contrast the reactants and products in a chemical reaction in terms of the law of conservation of mass.
- 1. Distinguish between physical and chemical properties and changes, identifying and explaining some physical ones (i.e. density, melting point and boiling point). (1.1)**

 - Differentiate among the four states of matter.
 - Distinguish between homogeneous and heterogeneous samples of matter.
 - Describe two ways that components of mixtures can be separated.
 - Observe and explain the difference between an element and a compound.
 - Examine the difference between a substance and a mixture.
 - 2. Describe the four states of matter and identify that matter as either a mixture or a pure substance. (1.2, 1.3)**

 - Explain Dalton's atomic theory.
 - Identify the special instruments necessary to observe individual atoms.
 - Identify the three types of subatomic particles.
 - Describe the structure of atoms according to the Rutherford atomic model.
 - Explain how isotopes of a given element are different from each other.
 - Determine the number of neutrons in an atom.
 - Determine the atomic mass of an element.
 - 3. Explain how the major components of the nuclear atom (protons, neutrons, and electrons) interact using Dalton's atomic theory. (2.1, 2.2, 2.3, 2.7, 2.10)**

Chemistry (Continued)

- State what is meant by radioactivity.
 - State what is meant by radiation.
 - Describe the three main types of nuclear radiation.
 - Determine the type of decay that will occur in an isotope based on its stability.
 - Define half-life
 - Calculate problems that involve half-life.
 - Observe simulations of the transformation of a radioactive isotope over time and relate it to radioactive decay and half-lives.
 - Describe what happens in a nuclear chain reaction.
 - Describe the process of neutron moderation.
 - Describe the process of neutron absorption.
4. ***Distinguish fission from fusion in a nuclear reaction and explain how unstable nuclei release energy by emitting radiation during the process of radioactive decay. (2.8, 2.9, 2.10, 2.11)***
- Compare and contrast Rutherford's and Bohr's models of the atom.
 - Using a quantum mechanical model, describe the energies and positions of electrons.
 - Describe how to write the electron configuration for an atom.
 - Identify three broad classes of elements.
 - Describe the information in a periodic table.
 - Explain how elements are organized in a periodic table.
 - Classify elements based on electron configuration.
5. ***Identify a variety of features of an element, such as its atomic number, mass, electron configuration, family, period, valence electrons, and reactivity with other elements in the table as well as metallic and non-metallic properties using the element's position on the periodic table. (3.1, 3.2, 3.3)***
- Describe trends among the elements for atomic size.
 - Explain how ions form.
 - Describe periodic trends for first ionization energy.
 - Describe periodic trends for ionic size.
 - Describe periodic trends for electronegativity.
6. ***Identify trends on the periodic table including ionization energy, electronegativity, electron affinity, and relative size of atoms and ions. (3.4)***
- Determine the number of valence electrons in an atom of a representative element.
 - Explain how the octet rule applies to atoms of both metallic and nonmetallic elements.
 - Describe how cations form.

Chemistry (Continued)

- Describe how anions form.
- Explain the electrical charge of an ionic compound.
- Describe properties of ionic compounds.
- Describe the information a molecular formula provides.
- Describe how electrons are shared to form covalent bonds and identify exceptions to the octet rule.
- Demonstrate how electron dot structures represent shared electrons.
- Describe how atoms form double or triple covalent bonds.
- Distinguish between a covalent bond and a coordinate covalent bond.

7. Demonstrate and explain how electron dot structures for simple molecules illustrate how atoms combine through ionic and covalent bonding to form compounds. (4.1, 4.2)

- Identify the charges of monatomic ions.
- Describe a polyatomic ion.
- Identify both monatomic ions and polyatomic ions.
- Write the formulas of common polyatomic ions.
- Compare the two common endings for the names of most polyatomic ions.
- Apply the rules for naming and writing formulas for binary ionic compounds.
- Apply the rules for naming and writing formulas for compounds with polyatomic ions.
- Apply the rules for naming and writing formulas for binary molecular compounds.
- Apply the rules for naming acids.
- Apply the rules for writing formulas of acids.
- Apply the rules for naming bases.

8. Name and write chemical formulas for simple ionic and molecular compounds (including those that contain common polyatomic ions) based on the number of valence electrons. (4.6, 4.7)

- Design methods of measuring the amount of something.
- Define Avogadro's number as it relates to a mole of a substance.
- Distinguish between the atomic mass of an element and its molar mass.
- Describe how the mass of a mole of a compound is calculated.
- Explain the relationship between the mass of a substance and moles.
- Explain the relationship between the number of particles in a substance and moles.
- Explain the relationship between the volume of a gas, at STP, and moles.

9. Understand and utilize the mole concept in terms of number of particles, mass, and gaseous volume to determine molar mass. (5.3, 5.4, 6.1)

Chemistry (Continued)

- Describe how to write word equations.
- Describe how to write skeleton equations.
- Describe the steps for writing a balanced chemical equation.
- Classify reactions according to the five general types.
- Predict the products of the five general types of reactions.
- Define the products of an acid-base reaction.

10. Identify and balance composition, decomposition, single replacement, double replacement, and neutralization reactions. (5.1, 5.2, 8.2)

- Explain why gases are easier to compress than solids or liquids are.
- Observe and explain how volume affects pressure, when temperature is constant (Boyle's Law).
- Observe and explain how temperature affects volume, when the pressure is constant (Charles's Law).
- Observe and explain how temperature affects pressure, when the volume is constant (Gay-Lussac's Law).
- Determine pressure, volume, or temperature, when only the amount of gas is constant using the combined gas law.

11. Describe the relationships among the temperature, pressure, and volume of a gas, as described in the gas laws, using the kinetic molecular theory. (6.1, 6.6)

- Explain what a solvent is.
- Explain what a solute is.
- In a solution, determine which substance is the solvent, and which one is the solute.
- Describe a solution as unsaturated, saturated, or supersaturated.
- Interpret a solubility graph.
- Explain the relationship between stirring and solution formation.
- Explain the relationship between temperature and solution formation.
- Explain the relationship between particle size and solution formation.
- Observe and explain how temperature affects solubility.
- Observe and explain how pressure affects solubility.

12. Identify the factors that affect the rate at which a solute dissolves. (7.1, 7.2, 7.5)

- Describe how to express the rate of a chemical reaction.
- Describe activation energy.
- Explain the relationship between temperature and reaction rates.
- Explain the relationship between concentration and reaction rates.
- Explain the relationship between particle size and reaction rates.
- Explain the relationship between catalysts and reaction rates.

Chemistry (Continued)

- Describe how the amounts of reactants and products change in a chemical system at equilibrium.
- Explain how concentration affects equilibrium.
- Explain how temperature affects equilibrium.
- Explain how pressure affects equilibrium.
- Explain what the value of K_{eq} indicates about the position of equilibrium.
- Determine the equilibrium constant, K_{eq} , for a given reaction.

13. Identify the factors that affect the rate of a chemical reaction and the factors that can cause a shift in equilibrium. (9.3, 9.5)

- Describe properties of acids and bases.
- Describe Arrhenius' definition of acids and bases.
- Describe Bronsted-Lowry's definition of acids and bases.
- Describe Lewis' theory of acids and bases.
- Describe how H^+ and OH^- are related in an aqueous solution.
- Classify a solution as neutral, acidic, or basic given the hydrogen-ion or hydroxide-ion concentration.
- Interpret the conversion of hydrogen-ion concentrations into pH values and hydroxide-ion concentrations into pH values.
- Describe the purpose of an acid-base pH indicator.

14. Compare and contrast acids and bases as defined by the theories of Arrhenius, Brønsted-Lowry, and Lewis and relate their concentration to the pH scale. (8.1, 8.2, 8.6)

Physics

Students will be able to:

- Collect, analyze, and draw conclusions from data.
- Communicate scientific ideas through writing and discussion.
- Support conclusions with reasons that are based on observation and experience.

- Recognize that an object moving at constant speed travels the same distance during the same interval of time.
- Communicate the motion of objects using graphical methods.
- Recognize vector quantities and the difference between speed and velocity.
- Recognize that changing the velocity of an object during certain interval of time results in acceleration.

1. Demonstrate the model the motion of objects by analytical and graphical methods. (1.4)

- Construct a model to explain **Newton's First Law** and the relationship of movement at constant velocity.
- Construct a model to explain **Newton's Second Law** and what does it tell us about why objects change velocity as a function of time.
- Analyze using the free-body diagram method the forces acting on moving and non-moving objects.
- Recognize the effect of friction on moving and non-moving objects.

2. Recognize the relation between the force that acts on a massive body and the resulting change in the body's velocity. (1.6, 1.7, 1.8)

- Identify situations in which mechanical energy is or is not conserved.
- Analyze situations in which a body's mechanical energy is changed by friction or by a specified externally applied force.
- State, prove and apply the relation between the work performed on a body by non-conservative forces and the change in a body's mechanical energy.

3. Recognize that the total energy of a system is conserved. (2.1)

- Identify situations in which mechanical energy is or is not conserved.
- Analyze situations in which a body's mechanical energy is changed by friction or by a specified externally applied force.
- State, prove and apply the relation between the work performed on a body by non-conservative forces and the change in a body's mechanical energy.

4. Recognize situations in which momentum is or is not conserved. (2.4)

Physics (Continued)

- State Kepler's three laws of planetary motion and use them to describe in qualitative terms the motion of a body in an elliptic orbit.
- Recognize those satellites, planets, and other space objects' motion is described by the Universal Gravitation law.

5. *Predict and describe the motion in space of an object based on Newton's Law of Gravitation and Kepler's Laws. (1.11)*

- Describe factors that affect the speed of waves.
- Describe the relationship among frequency, wavelength, and velocity of a wave.
- Distinguish between transverse and longitudinal waves.
- Distinguish between constructive and destructive interference.
- Describe the Doppler Effect for sound and relate it to the blue and red shifts for light.

6. *Recognize the characteristics and properties of waves. (4.2, 4.3, 4.6, 4.7)*

- Relate the pitch of a sound to its frequency.
- Compare the transmission of sound through air with that through solids, liquids, and a vacuum.
- Describe factors that affect the speed of sound.
- Identify the mathematical relationship of musical notes.

7. *Recognize the characteristics and properties of sound. (4.1, 4.8)*

- Describe electrical forces between objects.
- Distinguish between a conductor and an insulator.
- Describe how to measure the strength of an electric field at different points.
- Explain why a charged object in an electric field is considered to have electrical potential energy and electric potential.

8. *Recognize that charged objects are affected by electromagnetic forces. (5.3, 5.4, 5.5)*

- Describe the flow of electric charge.
- Describe the factors that affect the resistance of a wire.
- Use Ohm's law to describe the relation between voltage, current, and resistance.

9. *Recognize that charges are conserved in an electric circuit. (5.6)*

Physics (Continued)

- Relate the motion of electrons within a material to the ability of the material to become a magnet.
- Describe the magnetic field produced by a current-carrying wire.
- Describe how a magnetic field exerts a force on a moving charged particle in the field.

10. Recognize that the motion of charged particles is affected by the presence of a magnet. (5.6)

- Describe how voltage is induced in a coil of wire.
- Describe how a generator works.
- Explain why transformers are used for transmission of electric power.
- Describe electromagnetic waves.

11. Recognize that magnetism can produce electric current in a wire. (4.3)

- Describe the evidence that suggests light waves are transverse.
- Describe the relationship among light, radio waves, microwaves, and X-Rays.
- Explain how the frequency of light affects what happens when it enters a substance.
- Explain why certain materials are opaque.

12. Recognize the dual nature of light to explain its behavior as a particle and a wave. (6.2)

- Describe what happens to light when it strikes different materials.
- Explain the change in direction of light when it crosses a boundary between media.
- Describe the effects of refraction of light.
- Explain how a prism separates white light into colors.
- Describe total internal reflection, its effects, and its applications.

13. Recognize that light can be reflected and refracted. (4.5)

- Distinguish between converging and diverging lenses.
- Distinguish between real images and virtual images formed by lenses.
- Construct ray diagrams that show the positions of images formed by Lenses.
- Describe the effects of aberration in lenses.

14. Examine the application of refraction to lenses and the use of geometrical optics. (4.7, 6.4)

Physics (Continued)

- Describe the causes of visible diffraction of waves.
- Describe the causes of visible bright and dark interference fringes of Light.
- Describe Young's interference experiment.
- Explain the Michelson-Morley Experiment.

15. Light diffracting through a single-slit or double-slit opening will interfere constructively and destructively, producing bright fringes, or antinodes, and dark fringes, or nodes, respectively. (6.1, 6.2, 6.3, 6.4)