

# State of Georgia

## Teaching to Standards: SCIENCE

### Alignment to Georgia Science Standards – Grades 3-12

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Note: Alignment is indicated in yellow highlighted text. The units and lessons are aligned to the GA standards elements.

LEGEND: C=Chemistry unit; B=Biology unit; W=Earth's Waters unit; E=Earth's history unit; and the number represents the lesson number [there are five lessons per unit].

Grade: 3

Description: S3CS1

Students will be aware of the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works.

Elements:

- a. Keep records of investigations and observations and do not alter the records later. E1, E2, E4, C5, B5
- b. Offer reasons for findings and consider reasons suggested by others. All lesson, all units
- c. Take responsibility for understanding the importance of being safety conscious. All lesson, all units

S3CS2

Grade: 3

Description: S3CS2

Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations.

Elements:

- a. Add, subtract, multiply, and divide whole numbers mentally, on paper, and with a calculator.
- b. Use commonly encountered fractions – halves, thirds, and fourths (but not sixths, sevenths, and so on) – in scientific calculations.
- c. Judge whether measurements and computations of quantities, such as length, weight, or time, are reasonable answers to scientific problems by comparing them to typical values.

S3CS3

Grade: 3

Description: S3CS3 Students will use tools and instruments for observing, measuring, and manipulating objects in scientific activities utilizing safe laboratory procedures.

Elements:

- a. Choose appropriate common materials for making simple mechanical constructions and repairing things.
- b. Use computers, cameras and recording devices for capturing information. B1, B2, B3, B4
- c. Identify and practice accepted safety procedures in manipulating science materials and equipment.  
All lessons, step 7

#### S3CS4

Grade: 3

Description: S3CS4 Students will use ideas of system, model, change, and scale in exploring scientific and technological matters.

Elements:

- a. Observe and describe how parts influence one another in things with many parts. B2
- b. Use geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories to represent corresponding features of objects, events, and processes in the real world. E1, E2, E3, E4, E5; B5; C5; all lessons in the ScienceWork student book
- c. Identify ways in which the representations do not match their original counterparts. E1, E2, E3, E4, E5

#### S3CS5

Grade: 3

Description: S3CS5 Students will communicate scientific ideas and activities clearly.  
All lessons in Earth, Biology, Waters, & Chemistry Units

Elements:

- a. Write instructions that others can follow in carrying out a scientific procedure.
- b. Make sketches to aid in explaining scientific procedures or ideas.  
All lessons require some form of explaining procedure or ideas, not necessarily sketches
- c. Use numerical data in describing and comparing objects and events. All lessons, all units
- d. Locate scientific information in reference books, back issues of newspapers and magazines, CD-ROMs, and computer databases.

#### S3CS6

Grade: 3

Description: S3CS6 Students will question scientific claims and arguments effectively.

Elements:

- a. Support statements with facts found in books, articles, and databases, and identify the sources used.

#### S3CS7

Grade: 3

Description: S3CS7 Students will be familiar with the character of scientific knowledge and how it is

achieved. Students will recognize that:

Elements:

- a. Similar scientific investigations seldom produce exactly the same results, which may differ due to unexpected differences in whatever is being investigated, unrecognized differences in the methods or circumstances of the investigation, or observational uncertainties. **All lessons, all units**
- b. Some scientific knowledge is very old and yet is still applicable today. **All lessons, all units**

S3CS8

Grade: 3 All Lessons in Earth, Biology, Waters, & Chemistry Units

Description: S3CS8 Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices:

Elements:

- a. Scientific investigations may take many different forms, including observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments. **All lessons use inquiry approach**
- b. Clear and active communication is an essential part of doing science. It enables scientists to inform others about their work, expose their ideas to criticism by other scientists, and stay informed about scientific discoveries around the world. **All lessons use inquiry approach**
- c. Scientists use technology to increase their power to observe things and to measure and compare things accurately. **B1, B2, B3, B4, B5**
- d. Science involves many different kinds of work and engages men and women of all ages and backgrounds. **All lessons, all units**

S3E1 Grade: 3

Description: Students will investigate the physical attributes of rocks and soils.

Elements:

- a. Explain the difference between a rock and a mineral.
- b. Recognize the physical attributes of rocks and minerals using observation (shape, color, texture), measurement, and simple tests (hardness). **E1, E2, E3, E4**
- c. Use observation to compare the similarities and differences of texture, particle size, and color in top soils (such as clay, loam or potting soil, and sand). **E1**
- d. Determine how water and wind can change rocks and soil over time using observation and research. **E3**

S3L1

Grade: 3

Description: Students will investigate the habitats of different organisms and the dependence of organisms on their habitat.

Elements:

- a. Differentiate between habitats of Georgia (mountains, marsh/swamp, coast, Piedmont, Atlantic Ocean) and the organisms that live there.
- b. Identify features of green plants that allow them to live and thrive in different regions of Georgia.
- c. Identify features of animals that allow them to live and thrive in different regions of Georgia.
- d. Explain what will happen to an organism if the habitat is changed.

S3L2

Grade: 3

Description: S3L2 Students will recognize the effects of pollution and humans on the environment.

Elements:

- a. Explain the effects of pollution (such as littering) to the habitats of plants and animals. E5, W4
- b. Identify ways to protect the environment. E5, W4, W5
  1. Conservation of resources W4, W5
  2. Recycling of materials E5

S3P1

Grade: 3

Description: Students will investigate how heat is produced and the effects of heating and cooling, and will understand a change in temperature indicates a change in heat.

Elements:

- a. Categorize ways to produce heat energy such as burning, rubbing (friction), and mixing one thing with another. C2
- b. Investigate how insulation affects heating and cooling.
- c. Investigate the transfer of heat energy from the sun to various materials.
- d. Use thermometers to measure the changes in temperatures of water samples (hot, warm, cold) over time. C4

S3P2

Grade: 3

Description: S3P2 Students will investigate magnets and how they affect other magnets and common objects.

Elements:

- a. Investigate to find common objects that are attracted to magnets.
- b. Investigate how magnets attract and repel each other.

S4CS1

Grade: 4

Description: S4CS1 Students will be aware of the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works.

Elements:

- a. Keep records of investigations and observations and do not alter the records later. E4, C5
- b. Carefully distinguish observations from ideas and speculation about those observations.
- c. Offer reasons for findings and consider reasons suggested by others. All lessons, all units
- d. Take responsibility for understanding the importance of being safety conscious.  
All lessons, all units

S4CS2

Grade: 4

Description: S4CS2 Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations.

Elements:

- a. Add, subtract, multiply, and divide whole numbers mentally, on paper, and with a calculator.
- b. Use fractions and decimals, and translate between decimals and commonly encountered fractions – halves, thirds, fourths, fifths, tenths, and hundredths (but not sixths, sevenths, and so on) – in scientific calculations.
- c. Judge whether measurements and computations of quantities, such as length, area, volume, weight, or time, are reasonable answers to scientific problems by comparing them to typical values.

S4CS3

Grade: 4

Description: S4CS3 Students will use tools and instruments for observing, measuring, and manipulating objects in scientific activities utilizing safe laboratory procedures.

Elements:

- a. Choose appropriate common materials for making simple mechanical constructions and repairing things.
- b. Measure and mix dry and liquid materials in prescribed amounts, exercising reasonable safety. E1, C1, C2, C3, C4, C5
- c. Use computers, cameras and recording devices for capturing information. B1, B2, B3, B4
- d. Identify and practice accepted safety procedures in manipulating science materials and equipment.  
All lessons, all units

S4CS4

Grade: 4

Description: Students will use ideas of system, model, change, and scale in exploring scientific and technological matters.

Elements:

- a. Observe and describe how parts influence one another in things with many parts. **B2**
- b. Use geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories to represent corresponding features of objects, events, and processes in the real world.  
**E1, E2, E3, E4, E5; B5; C5; All lessons in the ScienceWork student book**

Grade: 4

Description: S4CS7 Students will be familiar with the character of scientific knowledge and how it is achieved. Students will recognize that:

Elements:

- a. Similar scientific investigations seldom produce exactly the same results, which may differ due to unexpected differences in whatever is being investigated, unrecognized differences in the methods or circumstances of the investigation, or observational uncertainties. **All lessons, all units**
- b. Some scientific knowledge is very old and yet is still applicable today. **All lessons, all units**

S4CS8

Grade: 4

Description: S4CS8 Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices:

Elements:

- a. Scientific investigations may take many different forms, including observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments. **All lessons, all units**
- b. Clear and active communication is an essential part of doing science. It enables scientists to inform others about their work, expose their ideas to criticism by other scientists, and stay informed about scientific discoveries around the world. **All lessons, all units**
- c. Scientists use technology to increase their power to observe things and to measure and compare things accurately. **B1, B2, B3, B4, B5**
- d. Science involves many different kinds of work and engages men and women of all ages and backgrounds. **All lessons, all units**

S4E1

Grade: 4

Description: S4E1 Students will compare and contrast the physical attributes of stars, star patterns, and planets.

Elements:

- a. Recognize the physical attributes of stars in the night sky such as number, size, color and patterns.

- b. Compare the similarities and differences of planets to the stars in appearance, position, and number in the night sky.
- c. Explain why the pattern of stars in a constellation stays the same, but a planet can be seen in different locations at different times.
- d. Identify how technology is used to observe distant objects in the sky.

S4E2

Grade: 4

Description: S4E2 Students will model the position and motion of the earth in the solar system and will explain the role of relative position and motion in determining sequence of the phases of the moon.

Elements:

- a. Explain the day/night cycle of the earth using a model.
- b. Explain the sequence of the phases of the moon.
- c. Demonstrate the revolution of the earth around the sun and the earth's tilt to explain the seasonal changes.
- d. Demonstrate the relative size and order from the sun of the planets in the solar system.

S4E3

Grade: 4

Description: S4E3 Students will differentiate between the states of water and how they relate to the water cycle and weather.

Elements:

- a. Demonstrate how water changes states from solid (ice) to liquid (water) to gas (water vapor/steam) and changes from gas to liquid to solid. W1, W2, W3
- b. Identify the temperatures at which water becomes a solid and at which water becomes a gas. . W1, W2, W3
- c. Investigate how clouds are formed. W1, W2, W3
- d. Explain the water cycle (evaporation, condensation, and precipitation). W1, W2, W3
- e. Investigate different forms of precipitation and sky conditions (rain, snow, sleet, hail, clouds, and fog). W1, W2, W3

S4E4

Grade: 4

Description: S4E4 Students will analyze weather charts/maps and collect weather data to predict weather events and infer patterns and seasonal changes.

Elements:

- a. Identify weather instruments and explain how each is used in gathering weather data and making forecasts (thermometer, rain gauge, barometer, wind vane, anemometer).
- b. Using a weather map, identify the fronts, temperature, and precipitation and use the information to interpret the weather conditions.
- c. Use observations and records of weather conditions to predict weather patterns throughout the year.
- d. Differentiate between weather and climate.

S4L1

Grade: 4

Description: S4L1 Students will describe the roles of organisms and the flow of energy within an ecosystem.

Elements:

- a. Identify the roles of producers, consumers, and decomposers in a community.
- b. Demonstrate the flow of energy through a food web/food chain beginning with sunlight and including producers, consumers, and decomposers.
- c. Predict how changes in the environment would affect a community (ecosystem) of organisms.
- d. Predict effects on a population if some of the plants or animals in the community are scarce or if there are too many.

S4L2

Grade: 4

Description: S4L2 Students will identify factors that affect the survival or extinction of organisms such as adaptation, variation of behaviors (hibernation), and external features (camouflage and protection).

Elements:

- a. Identify external features of organisms that allow them to survive or reproduce better than organisms that do not have these features (for example: camouflage, use of hibernation, protection, etc.).
- b. Identify factors that may have led to the extinction of some organisms.

S4P1

Grade: 4

Description: S4P1 Students will investigate the nature of light using tools such as mirrors, lenses, and prisms.

Elements:

- a. Identify materials that are transparent, opaque, and translucent.
- b. Investigate the reflection of light using a mirror and a light source.
- c. Identify the physical attributes of a convex lens, a concave lens, and a prism and where each is used.

## S4P2

Grade: 4

Description: S4P2 Students will demonstrate how sound is produced by vibrating objects and how sound can be varied by changing the rate of vibration.

Elements:

- a. Investigate how sound is produced.
- b. Recognize the conditions that cause pitch to vary in the real world. Identify ways in which the representations do not match their original counterparts.
- c. Identify patterns of change in things—such as steady, repetitive, or irregular change—using records, tables, or graphs of measurements where appropriate.

## S4CS5

Grade: 4

Description: S4CS5 Students will communicate scientific ideas and activities clearly. All lessons, all units

Elements:

- a. Write instructions that others can follow in carrying out a scientific procedure.
- b. Make sketches to aid in explaining scientific procedures or ideas. All lessons require some form of explanation of procedure or ideas, not necessarily sketches.
- c. Use numerical data in describing and comparing objects and events. All lessons, all units
- d. Locate scientific information in reference books, back issues of newspapers and magazines, CD-ROMs, and computer databases.

## S4CS6

Grade: 4

Description: S4CS6 Students will question scientific claims and arguments effectively.

Elements:

- a. Support statements with facts found in books, articles, and databases, and identify the sources used.

## S3E2

Description: S3E2 Students will investigate fossils as evidence of organisms that lived long ago.

Elements:

- a. Investigate fossils by observing authentic fossils or models of fossils or view information resources about fossils as evidence of organisms that lived long ago. E2, E4
- b. Describe how a fossil is formed. E2, E4

## S4P3

Grade: 4

Description: S4P3 Students will demonstrate the relationship between the application of a force and the resulting change in position and motion on an object.

Elements:

- a. Identify simple machines and explain their uses (lever, pulley, wedge, inclined plane, screw, wheel and axle).
- b. Using different size objects, observe how force affects speed and motion.
- c. Explain what happens to the speed or direction of an object when a greater force than the initial one is applied.
- d. Demonstrate the effect of gravitational force on the motion of an object.

Teacher note: The use of mathematical formulas is not recommended in S4P3. Fourth grade students should carry out investigations to provide a foundation of concrete experience for the abstract understandings of physical science in upper grades.

S5CS1

Grade: 5

Description: S5CS1 Students will be aware of the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works.

Elements:

- a. Keep records of investigations and observations and do not alter the records later. E1, E2, E4, C5, B5.
- b. Carefully distinguish observations from ideas and speculation about those observations.
- c. Offer reasons for findings and consider reasons suggested by others. All lessons, all units
- d. Take responsibility for understanding the importance of being safety conscious. All lessons, all units

S5CS2

Grade: 5

Description: S5CS2 Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations.

Elements:

- a. Add, subtract, multiply, and divide whole numbers mentally, on paper, and with a calculator.
- b. Use fractions and decimals, and translate between decimals and commonly encountered fractions – halves, thirds, fourths, fifths, tenths, and hundredths (but not sixths, sevenths, and so on) – in scientific calculations.
- c. Judge whether measurements and computations of quantities, such as length, area, volume, weight, or time, are reasonable answers to scientific problems by comparing them to typical values.

S5CS3

Grade: 5

Description: S5CS3 Students will use tools and instruments for observing, measuring, and manipulating objects in scientific activities.

Elements:

- a. Choose appropriate common materials for making simple mechanical constructions and repairing things.
- b. Measure and mix dry and liquid materials in prescribed amounts, exercising reasonable safety.  
E1, C1, C2, C3, C4, C5
- c. Use computers, cameras and recording devices for capturing information. B1, B2, B3, B4
- d. Identify and practice accepted safety procedures in manipulating science materials and equipment.  
All lessons, all units

S5CS4 Grade: 5

Description: S5CS4 Students will use ideas of system, model, change, and scale in exploring scientific and technological matters.

Elements:

- a. Observe and describe how parts influence one another in things with many parts. B2
- b. Use geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories to represent corresponding features of objects, events, and processes in the real world. Identify ways in which the representations do not match their original counterparts.  
E1, E2, E3, E4, E5; C5; All lessons in the student book ScienceWorks
- c. Identify patterns of change in things—such as steady, repetitive, or irregular change—using records, tables, or graphs of measurements where appropriate.
- d. Identify the biggest and the smallest possible values of something.

S5CS5

Grade: 5

Description: S5CS5 Students will communicate scientific ideas and activities clearly. All lessons, all units

Elements:

- a. Write instructions that others can follow in carrying out a scientific procedure.
- b. Make sketches to aid in explaining scientific procedures or ideas. All lessons, all units though not in the form of sketches
- c. Use numerical data in describing and comparing objects and events. All lessons, all units
- d. Locate scientific information in reference books, back issues of newspapers and magazines, CD-ROMs, and computer databases.

S5CS6

Grade: 5

Description: S5CS6 Students will question scientific claims and arguments effectively.

Elements:

- a. Support statements with facts found in books, articles, and databases, and identify the sources used.
- b. Identify when comparisons might not be fair because some conditions are different.

S5CS7

Grade: 5

Description: S5CS7 Students will be familiar with the character of scientific knowledge and how it is achieved. Students will recognize that:

Elements:

- a. Similar scientific investigations seldom produce exactly the same results, which may differ due to unexpected differences in whatever is being investigated, unrecognized differences in the methods or circumstances of the investigation, or observational uncertainties. All lessons, all units
- b. Some scientific knowledge is very old and yet is still applicable today.

S5CS8

Grade: 5

Description: S5CS8 Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices:

Elements:

- a. Scientific investigations may take many different forms, including observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments. All lessons, all units
- b. Clear and active communication is an essential part of doing science. It enables scientists to inform others about their work, expose their ideas to criticism by other scientists, and stay informed about scientific discoveries around the world. All lessons, all units
- c. Scientists use technology to increase their power to observe things and to measure and compare things accurately. B1, B2, B3, B4, B5
- d. Science involves many different kinds of work and engages men and women of all ages and backgrounds. All lessons, all units

S5E1 Grade: 5

Description: S5E1 Students will identify surface features of the Earth caused by constructive and destructive processes.

Elements:

- a. Identify surface features caused by constructive processes. E1, E3
  - \* Deposition (deltas, sand dunes, etc.)
  - \* Earthquakes

\* Volcanoes

\* Faults

b. Identify and find examples of surface features caused by destructive processes. **E3**

\* Erosion (water—rivers and oceans, wind)

\* Weathering

\* Impact of organisms

\* Earthquake

\* Volcano

c. Relate the role of technology and human intervention in the control of constructive and destructive processes.

Examples include, but are not limited to

\* Seismological studies

\* Flood control (dams, levees, storm drain management, etc.)

\* Beach reclamation (Georgia coastal islands)

Grade: 5

Description: S5L1 Students will classify organisms into groups and relate how they determined the groups with how and why scientists use classification.

Elements:

a. Demonstrate how animals are sorted into groups (vertebrate and invertebrate) and how vertebrates are sorted into groups (fish, amphibian, reptile, bird, and mammal).

b. Demonstrate how plants are sorted into groups.

S5L2

Grade: 5

Description: S5L2 Students will recognize that offspring can resemble parents in inherited traits and learned behaviors.

Elements:

a. Compare and contrast the characteristics of learned behaviors and of inherited traits.

b. Discuss what a gene is and the role genes play in the transfer of traits.

Teacher note: Be sensitive to this topic since biological parents may be unavailable.

S5L3

Grade: 5

Description: S5L3 Students will diagram and label parts of various cells (plant, animal, single-celled, multi-celled).

Elements:

- a. Use magnifiers such as microscopes or hand lenses to observe cells and their structure. B1, B2, B3
- b. Identify parts of a plant cell (membrane, wall, cytoplasm, nucleus, chloroplasts) and of an animal cell (membrane, cytoplasm, and nucleus) and determine the function of the parts. B1, B2, B3
- c. Explain how cells in multi-celled organisms are similar and different in structure and function to single-celled organisms. B1, B2, B3

S5L4 Grade: 5

Description: S5L4 Students will relate how microorganisms benefit or harm larger organisms.

Elements:

- a. Identify beneficial microorganisms and explain why they are beneficial. B5
- b. Identify harmful microorganisms and explain why they are harmful. B4

S5P1

Grade: 5

Description: S5P1 Students will verify that an object is the sum of its parts.

Elements:

- a. Demonstrate that the mass of an object is equal to the sum of its parts by manipulating and measuring different objects made of various parts.
- b. Investigate how common items have parts that are too small to be seen without magnification. B1, B2, B3

S5P2

Grade: 5

Description: S5P2 Students will explain the difference between a physical change and a chemical change.

Elements:

- a. Investigate physical changes by separating mixtures and manipulating (cutting, tearing, folding) paper to demonstrate examples of physical change. C1, C2, C3, C4
- b. Recognize that the changes in state of water (water vapor/steam, liquid, ice) are due to temperature differences and are examples of physical change. W1, W2, W3
- c. Investigate the properties of a substance before, during, and after a chemical reaction to find evidence of change. C2, C3

S5P3

Grade: 5

Description: S5P3 Students will investigate the electricity, magnetism and their relationship.

Elements:

- a. Investigate static electricity.
- b. Determine the necessary components for completing an electric circuit.
- c. Investigate common materials to determine if they are insulators or conductors of electricity.
- d. Compare a bar magnet to an electromagnet.

S6CS1

Grade: 6

Description: S6CS1 Students will explore the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works.

Elements:

- a. Understand the importance of—and keep—honest, clear, and accurate records in science. E4, C5
- b. Understand that hypotheses are valuable if they lead to fruitful investigations, even if the hypotheses turn out not to be completely accurate descriptions. All units, all lessons

S6CS10

Grade: 6

Description: S6CS10. Students will enhance reading in all curriculum areas by:

Elements:

a. Reading in All Curriculum Areas

- \* Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas.
- \* Read both informational and fictional texts in a variety of genres and modes of discourse.
  - \* Read technical texts related to various subject areas.

b. Discussing books

- \* Discuss messages and themes from books in all subject areas.
- \* Respond to a variety of texts in multiple modes of discourse.
- \* Relate messages and themes from one subject area to messages and themes in another area.
- \* Evaluate the merit of texts in every subject discipline.
- \* Examine author's purpose in writing.
- \* Recognize the features of disciplinary texts.

c. Building vocabulary knowledge

- \* Demonstrate an understanding of contextual vocabulary in various subjects. All lessons, all units
- \* Use content vocabulary in writing and speaking. All lessons, all units
- \* Explore understanding of new words found in subject area texts.

d. Establishing context

- \* Explore life experiences related to subject area content.  
In ScienceWork student book, All lessons, all units
- \* Discuss in both writing and speaking how certain words are subject area related.
- \* Determine strategies for finding content and contextual meaning for unknown words.

S6CS2 Grade: 6

Description: S6CS2 Students will use standard safety practices for all classroom laboratory and field investigations.

Elements:

- a. Follow correct procedures for use of scientific apparatus. All lessons, all units
- b. Demonstrate appropriate techniques in all laboratory situations. All lessons, all units
- c. Follow correct protocol for identifying and reporting safety problems and violations. All lessons, all units

S6CS3

Grade: 6

Description: S6CS3 Students will use computation and estimation skills necessary for analyzing data and following scientific explanations.

Elements:

- a. Analyze scientific data by using, interpreting, and comparing numbers in several equivalent forms, such as integers and decimals.
- b. Use metric input units (such as seconds, meters, or grams per milliliter) of scientific calculations to determine the proper unit for expressing the answer
- c. Address the relationship between accuracy and precision and the importance of each.
- d. Draw conclusions based on analyzed data. All lessons, all units

S6CS4

Grade: 6

Description: S6CS4 Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities.

Elements:

- a. Use appropriate technology to store and retrieve scientific information in topical, alphabetical, numerical, and keyword files, and create simple files. Simple files, E4, C5

- b. Estimate the effect of making a change in one part of a system on the system as a whole.
- c. Read analog and digital meters on instruments used to make direct measurements of length, volume, weight, elapsed time, rates, and temperature, and choose appropriate units for reporting various quantities. C2, C3, C4

#### S6CS5

Grade: 6

Description: S6CS5 Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.

Elements:

- a. Observe and explain how parts are related to other parts in systems such as weather systems, solar systems, and ocean systems including how output from one part of a system (in the form of material, energy, or information) can become the input to other parts (e.g., El Nino's effect on weather). W1, W2, W3, W4; B4, B5
- b. Identify several different models (such as physical replicas, pictures, and analogies) that could be used to represent the same thing, and evaluate their usefulness, taking into account such things as the model's purpose and complexity. E1, E2, E3, E4

#### S6CS6

Grade: 6

Description: S6CS6 Students will communicate scientific ideas and activities clearly. All lessons, all units

Elements:

- a. Write clear, step-by-step instructions for conducting scientific investigations, operating a piece of equipment, or following a procedure.
- b. Understand and describe how writing for scientific purposes is different from writing for literary purposes.
- c. Organize scientific information using appropriate tables, charts, and graphs, and identify relationships they reveal. C5

#### S6CS7

Grade: 6

Description: S6CS7 Students will question scientific claims and arguments effectively.

Elements:

- a. Question claims based on vague attributions (such as "Leading doctors say...") or on statements made by people outside the area of their particular expertise.
- b. Recognize that there may be more than one way to interpret a given set of findings.

#### S6CS8

Grade: 6

Description: S6CS8 Students will investigate the characteristics of scientific knowledge and how it is achieved.

Elements:

- a. When similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, which often requires further study. Even with similar results, scientists may wait until an investigation has been repeated many times before accepting the results as meaningful.
- b. When new experimental results are inconsistent with an existing, well-established theory, scientists may require further experimentation to decide whether the results are flawed or the theory requires modification.
- c. As prevailing theories are challenged by new information, scientific knowledge may change and grow.

Grade: 6

Description: S6E1 Students will explore current scientific views of the universe and how those views evolved.

Elements:

- a. Relate the Nature of Science to the progression of basic historical scientific theories (geocentric and heliocentric) as they describe our solar system, and the Big Bang as it describes the formation
- b. Describe the position of the solar system in the Milky Way galaxy and the universe.
- c. Compare and contrast the planets in terms of
  - \* Size relative to the earth
  - \* Surface and atmospheric features
  - \* Relative distance from the sun
  - \* Ability to support life
- d. Explain the motion of objects in the day/night sky in terms of relative position.
- e. Explain that gravity is the force that governs the motion in the solar system.
- f. Describe the characteristics of comets, asteroids, and meteors.

S6E2

Grade: 6

Description: S6E2 Students will understand the effects of the relative positions of the earth, moon and sun.

Elements:

- a. Demonstrate the phases of the moon by showing the alignment of the earth, moon, and sun.
- b. Explain the alignment of the earth, moon, and sun during solar and lunar eclipses.
- c. Relate the tilt of the earth to the distribution of sunlight throughout the year and its effect on climate.

### S6E3

Grade: 6

Description: S6E3 Students will recognize the significant role of water in earth processes.

Elements:

- a. Explain that a large portion of the Earth's surface is water, consisting of oceans, rivers, lakes, underground water, and ice. W1, W2, W3, W4, W5
- b. Relate various atmospheric conditions to stages of the water cycle.
- c. Describe the composition, location, and subsurface topography of the world's oceans.
- d. Explain the causes of waves, currents, and tides.

### S6E4

Grade: 6

Description: S6E4 Students will understand how the distribution of land and oceans affects climate and weather.

Elements:

- a. Demonstrate that land and water absorb and lose heat at different rates and explain the resulting effects on weather patterns.
- b. Relate unequal heating of land and water surfaces to form large global wind systems and weather events such as tornados and thunderstorms.
- c. Relate how moisture evaporating from the oceans affects the weather patterns and the weather events such as hurricanes.

### S6E5

Grade: 6

Description: S6E5 Students will investigate the scientific view of how the earth's surface is formed.

Elements:

- a. Compare and contrast the Earth's crust, mantle, and core including temperature, density, and composition. E1
- b. Investigate the composition of rocks in terms of minerals.
- c. Classify rocks by their process of formation. E1
- d. Describe processes that change rocks and the surface of the earth. E3
- e. Recognize that lithospheric plates constantly move and cause major geological events on the earth's surface. E3
- f. Explain the effects of physical processes (plate tectonics, erosion, deposition, volcanic eruption, gravity) on geological features including oceans (composition, currents, and tides). E3

- g. Describe how fossils show evidence of the changing surface and climate of the Earth. E2, E4
- h. Describe soil as consisting of weathered rocks and decomposed organic material.
- i. Explain the effects of human activity on the erosion of the earth's surface.
- j. Describe methods for conserving natural resources such as water, soil, and air. W5

S6E6

Grade: 6

Description: S6E6 Students will describe various sources of energy, and with their uses, and conservation.

Elements:

- a. Explain the role of the sun as the major source of energy and the sun's relationship to wind and water energy.
- b. Identify renewable and nonrenewable resources. E5

S7CS1

Grade: 7

Description: S7CS1 Students will explore the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works.

Elements:

- a. Understand the importance of—and keep—honest, clear, and accurate records in science. E4, B5, C5
- b. Understand that hypotheses can be valuable, even if they turn out not to be completely accurate.  
All units, all lessons

S7CS10

Grade: 7

Description: S7CS10 Students will enhance reading in all curriculum areas by:

Elements:

a. Reading in All Curriculum Areas

- \* Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas.
  - \* Read both informational and fictional texts in a variety of genres and modes of discourse.
  - \* Read technical texts related to various subject areas.

b. Discussing books

- \* Discuss messages and themes from books in all subject areas.
- \* Respond to a variety of texts in multiple modes of discourse.

- \* Relate messages and themes from one subject area to messages and themes in another area.
- \* Evaluate the merit of texts in every subject discipline.
- \* Examine author's purpose in writing.
- \* Recognize the features of disciplinary texts.

c. Building vocabulary knowledge. **All units, all lessons**

- \* Demonstrate an understanding of contextual vocabulary in various subjects.
- \* Use content vocabulary in writing and speaking. **All units, all lessons**
- \* Explore understanding of new words found in subject area texts.

d. Establishing context

- \* Explore life experiences related to subject area content. **All units, all lessons in ScienceWork**
- \* Discuss in both writing and speaking how certain words are subject area related.
- \* Determine strategies for finding content and contextual meaning for unknown word

S7CS2

Grade: 7

Description: S7CS2 Students will use standard safety practices for all classroom laboratory and field investigations. **All units, all lessons**

Elements:

- a. Follow correct procedures for use of scientific apparatus. **All units, all lessons**
- b. Demonstrate appropriate techniques in all laboratory situations. **All units, all lessons**
- c. Follow correct protocol for identifying and reporting safety problems and violations. **All units, all lessons**

S7CS3

Grade: 7

Description: S7CS3 Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations.

Elements:

- a. Analyze scientific data by using, interpreting, and comparing numbers in several equivalent forms, such as integers, fractions, decimals, and percents.
- b. Use the mean, median, and mode to analyze a set of scientific data.
- c. Apply the metric system to a scientific investigation that includes metric to metric conversion. (i.e. centimeters to meters).
- d. Draw conclusions based on analyzed data. **All units, all lessons.**

- e. Decide what degree of precision is adequate, and round off appropriately.
- f. Address the relationship between accuracy and precision and the importance of each.

#### S6CS9

Grade: 6

Description: S6CS9 Students will investigate the features of the process of scientific inquiry.

Elements:

- a. Scientific investigations are conducted for different reasons. They usually involve collecting evidence, reasoning, devising hypotheses, and formulating explanations. **All units, all lessons.**
- b. Scientists often collaborate to design research. To prevent bias, scientists conduct independent studies of the same questions.
- c. Accurate record keeping, data sharing, and replication of results are essential for maintaining an investigator's credibility with other scientists and society. **E1, C5**
- d. Scientists use technology and mathematics to enhance the process of scientific inquiry. **B1, B2, B3, B4**
- e. The ethics of science require that special care must be taken and used for human subjects and animals in scientific research. Scientists must adhere to the appropriate rules and guidelines when conducting research.

Grade: 7

Description: S7CS4 Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities.

Elements:

- a. Use appropriate technology to store and retrieve scientific information in topical, alphabetical, numerical, and keyword files, and create simple files. Simple files, **E4, C5**
- b. Use appropriate tools for measuring objects and/or substances.
- c. Learn and use on a regular basis standard safety practices for scientific investigations. **All units, All lessons**

#### S7CS5

Grade: 7

Description: S7CS5 Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters. **E1, E2, E3, E4**

Elements:

- a. Observe and explain how parts can be related to other parts in a system such as predator/prey relationships in a community/ecosystem.
- b. Understand that different models (such as physical replicas, pictures, and analogies) can be used to represent the same thing. **E1, E2, E3, E4**

#### S7CS6

Grade: 7

Description: S7CS6 Students will communicate scientific ideas and activities clearly.

Elements:

- a. Write clear, step-by-step instructions for conducting particular scientific investigations, operating a piece of equipment, or following a procedure.
- b. Write for scientific purposes incorporating data from circle, bar, and line graphs, two-way data tables, diagrams, and symbols.
- c. Organize scientific information using appropriate simple tables, charts, and graphs, and identify relationships they reveal. C5, B5

S7CS7

Grade: 7

Description: S7CS7 Students will question scientific claims and arguments effectively.

Elements:

- a. Question claims based on vague attributions (such as “Leading doctors say...”) or on statements made by people outside the area of their particular expertise.
- b. Identify the flaws of reasoning that are based on poorly designed research (i.e., facts intermingled with opinion, conclusions based on insufficient evidence).
- c. Question the value of arguments based on small samples of data, biased samples, or samples for which there was no control.
- d. Recognize that there may be more than one way to interpret a given set of findings.

S7CS8

Grade: 7

Description: S7CS8 Students will investigate the characteristics of scientific knowledge and how that knowledge is achieved.

Elements:

- a. When similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, which often requires further study. Even with similar results, scientists may wait until an investigation has been repeated many times before accepting the results as meaningful.
- b. When new experimental results are inconsistent with an existing, well-established theory, scientists may pursue further experimentation to determine whether the results are flawed or the theory requires modification.
- c. As prevailing theories are challenged by new information, scientific knowledge may change.

S7CS9

Grade: 7

Description: S7CS9 Students will investigate the features of the process of scientific inquiry.

Elements:

- a. Investigations are conducted for different reasons, which include exploring new phenomena, confirming previous results, testing how well a theory predicts, and comparing competing theories.
- b. Scientific investigations usually involve collecting evidence, reasoning, devising hypotheses, and formulating explanations to make sense of collected evidence. All lessons, all units
- c. Scientific experiments investigate the effect of one variable on another. All other variables are kept constant.
- d. Scientists often collaborate to design research. To prevent bias, scientists conduct independent studies of the same questions.
- e. Accurate record keeping, data sharing, and replication of results are essential for maintaining an investigator's credibility with other scientists and society. All lessons, all units
- f. Scientists use technology and mathematics to enhance the process of scientific inquiry. B1, B2, B3
- g. The ethics of science require that special care must be taken and used for human subjects and animals in scientific research. Scientists must adhere to the appropriate rules and guidelines when conducting research.

S7L1

Grade: 7

Description: S7L1 Students will investigate the diversity of living organisms and how they can be compared scientifically.

Elements:

- a. Demonstrate the process for the development of a dichotomous key.
- b. Classify organisms based on physical characteristics using a dichotomous key of the six kingdom system (archaebacteria, eubacteria, protists, fungi, plants, and animals).

S7L2

Grade: 7

Description: S7L2 Students will describe the structure and function of cells, tissues, organs, and organ systems.

Elements:

- a. Explain that cells take in nutrients in order to grow and divide and to make needed materials. B3, B4, B5
- b. Relate cell structures (cell membrane, nucleus, cytoplasm, chloroplasts, mitochondria) to basic cell functions. B3, B4, B5
- c. Explain that cells are organized into tissues, tissues into organs, organs into systems, and systems into organisms.
- d. Explain that tissues, organs, and organ systems serve the needs cells have for oxygen, food, and waste

removal.

- e. Explain the purpose of the major organ systems in the human body (i.e., digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease).

### S7L3

Grade: 7

Description: S7L3 Students will recognize how biological traits are passed on to successive generations.

Elements:

- a. Explain the role of genes and chromosomes in the process of inheriting a specific trait.
- b. Compare and contrast sexual and asexual reproduction in organisms (bacteria, protists, fungi, plants & animals).
- c. Recognize that selective breeding can produce plants or animals with desired traits.

### S7L4

Grade: 7

Description: S7L4 Students will examine the dependence of organisms on one another and their environments.

Elements:

- a. Demonstrate in a food web that matter is transferred from one organism to another and can recycle between organisms and their environments.
- b. Explain in a food web that sunlight is the source of energy and that this energy moves from organism to organism.
- c. Recognize that changes in environmental conditions can affect the survival of both individuals and entire species. **W5**
- d. Categorize relationships between organisms that are competitive or mutually beneficial.
- e. Describe the characteristics of Earth's major terrestrial biomes (i.e. tropical rain forest, savannah, temperate, desert, taiga, tundra, and mountain) and aquatic communities (i.e. freshwater, estuaries, and marine).

Grade: 7

Description: S7CS4 Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities.

Elements:

- a. Use appropriate technology to store and retrieve scientific information in topical, alphabetical, numerical, and keyword files, and create simple files. Simple files **E4, C5**
- b. Use appropriate tools for measuring objects and/or substances. C1, C2, C3, C4, C5

c. Learn and use on a regular basis standard safety practices for scientific investigations. All units, all lessons.

### S7CS5

Grade: 7

Description: S7CS5 Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.

Elements:

- a. Observe and explain how parts can be related to other parts in a system such as predator/prey relationships in a community/ecosystem.
- b. Understand that different models (such as physical replicas, pictures, and analogies) can be used to represent the same thing. E1, E2, E3, E4

### S7CS6

Grade: 7

Description: S7CS6 Students will communicate scientific ideas and activities clearly.

Elements:

- a. Write clear, step-by-step instructions for conducting particular scientific investigations, operating a piece of equipment, or following a procedure.
- b. Write for scientific purposes incorporating data from circle, bar, and line graphs, two-way data tables, diagrams, and symbols.
- c. Organize scientific information using appropriate simple tables, charts, and graphs, and identify relationships they reveal. C5, E4

### S7CS7

Grade: 7

Description: S7CS7 Students will question scientific claims and arguments effectively.

Elements:

- a. Question claims based on vague attributions (such as “Leading doctors say...”) or on statements made by people outside the area of their particular expertise.
- b. Identify the flaws of reasoning that are based on poorly designed research (i.e., facts intermingled with opinion, conclusions based on insufficient evidence).
- c. Question the value of arguments based on small samples of data, biased samples, or samples for which there was no control.
- d. Recognize that there may be more than one way to interpret a given set of findings.

### S7CS8

Grade: 7

Description: S7CS8 Students will investigate the characteristics of scientific knowledge and how that knowledge is achieved.

Elements:

- a. When similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, which often requires further study. Even with similar results, scientists may wait until an investigation has been repeated many times before accepting the results as meaningful.
- b. When new experimental results are inconsistent with an existing, well-established theory, scientists may pursue further experimentation to determine whether the results are flawed or the theory requires modification.
- c. As prevailing theories are challenged by new information, scientific knowledge may change.

S7CS9

Grade: 7

Description: S7CS9 Students will investigate the features of the process of scientific inquiry.

Elements:

- a. Investigations are conducted for different reasons, which include exploring new phenomena, confirming previous results, testing how well a theory predicts, and comparing competing theories.
- b. Scientific investigations usually involve collecting evidence, reasoning, devising hypotheses, and formulating explanations to make sense of collected evidence. All lessons, all units
- c. Scientific experiments investigate the effect of one variable on another. All other variables are kept constant. All lessons, all units
- d. Scientists often collaborate to design research. To prevent bias, scientists conduct independent studies of the same questions.
- e. Accurate record keeping, data sharing, and replication of results are essential for maintaining an investigator's credibility with other scientists and society. E4, C5
- f. Scientists use technology and mathematics to enhance the process of scientific inquiry.
- g. The ethics of science require that special care must be taken and used for human subjects and animals in scientific research. Scientists must adhere to the appropriate rules and guidelines when conducting research.

S7L1

Grade: 7

Description: S7L1 Students will investigate the diversity of living organisms and how they can be compared scientifically.

Elements:

- a. Demonstrate the process for the development of a dichotomous key.
- b. Classify organisms based on physical characteristics using a dichotomous key of the six kingdom system

(archaeobacteria, eubacteria, protists, fungi, plants, and animals).

### S7L2

Grade: 7

Description: S7L2 Students will describe the structure and function of cells, tissues, organs, and organ systems.

Elements:

- a. Explain that cells take in nutrients in order to grow and divide and to make needed materials. **B1, B5**
- b. Relate cell structures (cell membrane, nucleus, cytoplasm, chloroplasts, mitochondria) to basic cell functions. **B2**
- c. Explain that cells are organized into tissues, tissues into organs, organs into systems, and systems into organisms.
- d. Explain that tissues, organs, and organ systems serve the needs cells have for oxygen, food, and waste removal.
- e. Explain the purpose of the major organ systems in the human body (i.e., digestion, respiration, reproduction, circulation, excretion, movement, control, and coordination, and for protection from disease).

### S7L3

Grade: 7

Description: S7L3 Students will recognize how biological traits are passed on to successive generations.

Elements:

- a. Explain the role of genes and chromosomes in the process of inheriting a specific trait.
- b. Compare and contrast sexual and asexual reproduction in organisms (bacteria, protists, fungi, plants & animals).
- c. Recognize that selective breeding can produce plants or animals with desired traits.

### S7L4

Grade: 7

Description: S7L4 Students will examine the dependence of organisms on one another and their environments.

Elements:

- a. Demonstrate in a food web that matter is transferred from one organism to another and can recycle between organisms and their environments.
- b. Explain in a food web that sunlight is the source of energy and that this energy moves from organism to organism.
- c. Recognize that changes in environmental conditions can affect the survival of both individuals and entire

species. W4, W5

- d. Categorize relationships between organisms that are competitive or mutually beneficial.
- e. Describe the characteristics of Earth's major terrestrial biomes (i.e. tropical rain forest, savannah, temperate, desert, taiga, tundra, and mountain) and aquatic communities (i.e. freshwater, estuaries, and marine).

S7L5

Grade: 7

Description: S7L5 Students will examine the evolution of living organisms through inherited characteristics that promote survival of organisms and the survival of successive generations of their offspring.

Elements:

- a. Explain that physical characteristics of organisms have changed over successive generations (e.g. Darwin's finches and peppered moths of Manchester).
- b. Describe ways in which species on earth have evolved due to natural selection.
- c. Explain how the fossil record found in sedimentary rock provides evidence for the long history of changing life forms. E4

S8CS1

Grade: 8

Description: S8CS1 Students will explore the importance of curiosity, honesty, openness, and skepticism in science and will exhibit these traits in their own efforts to understand how the world works.

Elements:

- a. Understand the importance of—and keep—honest, clear, and accurate records in science. E4, C5
- b. Understand that hypotheses can be valuable even if they turn out not to be completely accurate. All lessons, all units

S8CS10

Grade: 8

Description: S8CS10 Students will enhance reading in all curriculum areas by:

Elements:

- a. Reading in All Curriculum Areas

- \* Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas.
- \* Read both informational and fictional texts in a variety of genres and modes of discourse.
- \* Read technical texts related to various subject areas.

b. Discussing books

- \* Discuss messages and themes from books in all subject areas.
- \* Respond to a variety of texts in multiple modes of discourse.
- \* Relate messages and themes from one subject area to messages and themes in another area.
- \* Evaluate the merit of texts in every subject discipline.
- \* Examine author's purpose in writing.
- \* Recognize the features of disciplinary texts.

c. Building vocabulary knowledge

- \* Demonstrate an understanding of contextual vocabulary in various subjects. All lessons, all units
- \* Use content vocabulary in writing and speaking.
- \* Explore understanding of new words found in subject area texts.

d. Establishing context

- \* Explore life experiences related to subject area content.
  - \* Discuss in both writing and speaking how certain words are subject area related.
  - \* Determine strategies for finding content and contextual meaning for unknown words.

S8CS2

Grade: 8

Description: S8CS2 Students will use standard safety practices for all classroom laboratory and field investigations.

Elements:

- a. Follow correct procedures for use of scientific apparatus. All lessons, all units
- b. Demonstrate appropriate techniques in all laboratory situations. All lessons, all units
- c. Follow correct protocol for identifying and reporting safety problems and violations. All lessons, all units

S8CS3

Grade: 8

Description: S8CS3 Students will have the computation and estimation skills necessary for analyzing data and following scientific explanations.

Elements:

- a. Analyze scientific data by using, interpreting, and comparing numbers in several equivalent forms, such as integers, fractions, decimals, and percents.
- b. Find the mean, median, and mode and use them to analyze a set of scientific data.

- c. Apply the metric system to scientific investigations that include metric to metric conversions (i.e., centimeters to meters).
- d. Decide what degree of precision is adequate, and round off appropriately.
- e. Address the relationship between accuracy and precision.
- f. Use ratios and proportions, including constant rates, in appropriate problems.

#### S8CS4

Grade: 8

Description: S8CS4 Students will use tools and instruments for observing, measuring, and manipulating equipment and materials in scientific activities utilizing safe laboratory procedures.

Elements:

- a. Use appropriate technology to store and retrieve scientific information in topical, alphabetical, numerical, and keyword files, and create simple files. **Simple files, E4, C5**
- b. Use appropriate tools and units for measuring objects and/or substances. **C1, C2, C3, C4**
- c. Learn and use standard safety practices when conducting scientific investigations. **All lessons, all units**

#### S8CS5

Grade: 8

Description: S8CS5 Students will use the ideas of system, model, change, and scale in exploring scientific and technological matters.

Elements:

- a. Observe and explain how parts can be related to other parts in a system such as the role of simple machines in complex machines.
- b. Understand that different models (such as physical replicas, pictures, and analogies) can be used to represent the same thing. **E1, E2, E3, E4**

#### S8CS6

Grade: 8

Description: S8CS6 Students will communicate scientific ideas and activities clearly.

Elements:

- a. Write clear, step-by-step instructions for conducting scientific investigations, operating a piece of equipment, or following a procedure.
- b. Write for scientific purposes incorporating information from a circle, bar, or line graph, data tables, diagrams, and symbols.
- c. Organize scientific information in appropriate tables, charts, and graphs, and identify relationships they reveal. **C5, B5**

## S8CS7

Grade: 8

Description: S8CS7 Students will question scientific claims and arguments effectively.

Elements:

- a. Question claims based on vague attributions (such as “Leading doctors say...”) or on statements made by people outside the area of their particular expertise.
- b. Identify the flaws of reasoning in arguments that are based on poorly designed research (e.g., facts intermingled with opinion, conclusions based on insufficient evidence).
- c. Question the value of arguments based on small samples of data, biased samples, or samples for which there was no control.
- d. Recognize that there may be more than one way to interpret a given set of findings. All units, all lessons

## S8CS8

Grade: 8

Description: S8CS8 Students will be familiar with the characteristics of scientific knowledge and how it is achieved.

Elements:

- a. When similar investigations give different results, the scientific challenge is to judge whether the differences are trivial or significant, which often requires further study. Even with similar results, scientists may wait until an investigation has been repeated many times before accepting the results as meaningful.
- b. When new experimental results are inconsistent with an existing, well-established theory, scientists may pursue further experimentation to determine whether the results are flawed or the theory requires modification.
- c. As prevailing theories are challenged by new information, scientific knowledge may change.

## S8CS9

Grade: 8

Description: S8CS9 Students will understand the features of the process of scientific inquiry.

Elements:

- a. Investigations are conducted for different reasons, which include exploring new phenomena, confirming previous results, testing how well a theory predicts, and comparing different theories.
- b. Scientific investigations usually involve collecting evidence, reasoning, devising hypotheses, and formulating explanations to make sense of collected evidence. All units, all lessons.
- c. Scientific experiments investigate the effect of one variable on another. All other variables are kept constant. All units, all lessons.
- d. Scientists often collaborate to design research. To prevent this bias, scientists conduct independent studies of the same questions.

- e. Accurate record keeping, data sharing, and replication of results are essential for maintaining an investigator's credibility with other scientists and society. E4, C5
- f. Scientists use technology and mathematics to enhance the process of scientific inquiry.
- g. The ethics of science require that special care must be taken and used for human subjects and animals in scientific research. Scientists must adhere to the appropriate rules and guidelines when conducting research.

### S8P1

Grade: 8

Description: S8P1 Students will examine the scientific view of the nature of matter.

Elements:

- a. Distinguish between atoms and molecules.
- b. Describe the difference between pure substances (elements and compounds) and mixtures.
- c. Describe the movement of particles in solids, liquids, gases, and plasma states.
- d. Distinguish between physical and chemical properties of matter as physical (i.e., density, melting point, boiling point) or chemical (i.e., reactivity, combustibility).
- e. Distinguish between changes in matter as physical (i.e., physical change) or chemical (development of a gas, formation of precipitate, and change in color).
- f. Recognize that there are more than 100 elements and some have similar properties as shown on the Periodic Table of Elements.
- g. Identify and demonstrate the Law of Conservation of Matter.

### S8P2

Grade: 8

Description: S8P2 Students will be familiar with the forms and transformations of energy.

Elements:

- a. Explain energy transformation in terms of the Law of Conservation of Energy.
- b. Explain the relationship between potential and kinetic energy.
- c. Compare and contrast the different forms of energy (heat, light, electricity, mechanical motion, sound) and their characteristics.
- d. Describe how heat can be transferred through matter by the collisions of atoms (conduction) or through space (radiation). In a liquid or gas, currents will facilitate the transfer of heat (convection).

### S8P3

Grade: 8

Description: S8P3 Students will investigate relationship between force, mass, and the motion of objects.

Elements:

- a. Determine the relationship between velocity and acceleration.
- b. Demonstrate the effect of balanced and unbalanced forces on an object in terms of gravity, inertia, and friction.
- c. Demonstrate the effect of simple machines (lever, inclined plane, pulley, wedge, screw, and wheel and axle) on work.

S8P4

Grade: 8

Description: S8P4 Students will explore the wave nature of sound and electromagnetic radiation.

Elements:

- a. Identify the characteristics of electromagnetic and mechanical waves.
- b. Describe how the behavior of light waves is manipulated causing reflection, refraction diffraction, and absorption.
- c. Explain how the human eye sees objects and colors in terms of wavelengths.
- d. Describe how the behavior of waves is affected by medium (such as air, water, solids).
- e. Relate the properties of sound to everyday experiences.
- f. Diagram the parts of the wave and explain how the parts are affected by changes in amplitude and pitch.

S8P5

Grade: 8

Description: S8P5 Students will recognize characteristics of gravity, electricity, and magnetism as major kinds of forces acting in nature.

Elements:

- a. Recognize that every object exerts gravitational force on every other object and that the force exerted depends on how much mass the objects have and how far apart they are.
- b. Demonstrate the advantages and disadvantages of series and parallel circuits and how they transfer energy.
- c. Investigate and explain that electric currents and magnets can exert force on each other.

Grade: 9,10,11,12

Description: SAP1 Students will analyze anatomical structures in relationship to their physiological functions.

Elements:

- a. Apply correct terminology when explaining the orientation of body parts and regions.
- b. Investigate the interdependence of the various body systems to each other and to the body as a whole.

- c. Explain the role of homeostasis and its mechanisms as these relate to the body as a whole and predict the consequences of the failure to maintain homeostasis.
- d. Relate cellular metabolism and transport to homeostasis and cellular reproduction.
- e. Describe how structure and function are related in terms of cell and tissue types.

#### SAP2

Grade: 9,10,11,12

Description: SAP2 Students will analyze the interdependence of the integumentary, skeletal, and muscular systems as these relate to the protection, support and movement of the human body.

Elements:

- a. Relate the structure of the integumentary system to its functional role in protecting the body and maintaining homeostasis.
- b. Explain how the skeletal structures provide support and protection for tissues, and function together with the muscular system to make movements possible.

#### SAP3

Grade: 9,10,11,12

Description: SAP3 Students will assess the integration and coordination of body functions and their dependence on the endocrine and nervous systems to regulate physiological activities.

Elements:

- a. Interpret interactions among hormones, senses, and nerves which make possible the coordination of functions of the body.
- b. Investigate the physiology of electrochemical impulses and neural integration and trace the pathway of an impulse, relating biochemical changes involved in the conduction of the impulse.
- c. Describe how the body perceives internal and external stimuli and responds to maintain a stable internal environment, as it relates to biofeedback.

#### SAP4

Grade: 9,10,11,12

Description: SAP4 Students will analyze the physical, chemical, and biological properties of process systems as these relate to transportation, absorption and excretion, including the cardiovascular, respiratory, digestive, excretory and immune systems.

Elements:

- a. Describe the chemical and physical mechanisms of digestion, elimination, transportation, and absorption within the body to change food and derive energy.
- b. Analyze, and explain the relationships between the respiratory and cardiovascular systems as they obtain oxygen needed for the oxidation of nutrients and removal of carbon dioxide.
- c. Relate the role of the urinary system to regulation of body wastes (i.e. water-electrolyte balance, volume of

body fluids).

- d. Examine various conditions that change normal body functions (e.g. tissue rejection, allergies, injury, diseases and disorders) and how the body responds.
- e. Describe the effects of aging on body systems.

SAP5

Grade: 9,10,11,12

Description: SAP5 Students will analyze the role of the reproductive system as it pertains to the growth and development of humans.

Elements:

- a. Explain how the functions of the reproductive organs are regulated by hormonal interactions.
- b. Describe the stages of human embryology and gestation including investigation of gestational and congenital disorders (e.g. ectopic pregnancy, miscarriage, cleft palate, hydrocephaly, fetal alcohol syndrome).
- c. Describe the stages of development from birth to adulthood (i.e. neonatal period, infancy, childhood, adolescence and puberty, and maturity).

SB1

Grade: 9,10,11,12

Description: SB1 Students will analyze the nature of the relationships between structures and functions in living cells.

Elements:

- a. Explain the role of cell organelles for both prokaryotic and eukaryotic cells, including the cell membrane, in maintaining homeostasis and cell reproduction.
- b. Explain how enzymes function as catalysts.
- c. Identify the function of the four major macromolecules (i.e., carbohydrates, proteins, lipids, nucleic acids).
- d. Explain the impact of water on life processes (i.e., osmosis, diffusion).

SB2

Grade: 9,10,11,12

Description: SB2 Students will analyze how biological traits are passed on to successive generations.

Elements:

- a. Distinguish between DNA and RNA.
- b. Explain the role of DNA in storing and transmitting cellular information.
- c. Using Mendel's laws, explain the role of meiosis in reproductive variability.

d. Describe the relationships between changes in DNA and potential appearance of new traits including

\* Alterations during replication.

- o Insertions
- o Deletions
- o Substitutions

\* Mutagenic factors that can alter DNA.

- o High energy radiation (x-rays and ultraviolet)
- o Chemical

e. Compare the advantages of sexual reproduction and asexual reproduction in different situations.

f. Examine the use of DNA technology in forensics, medicine, and agriculture.

SB3

Grade: 9,10,11,12

Description: SB3 Students will derive the relationship between single-celled and multi-celled organisms and the increasing complexity of systems.

Elements:

- a. Explain the cycling of energy through the processes of photosynthesis and respiration.
- b. Compare how structures and function vary between the six kingdoms
- c. Examine the evolutionary basis of modern classification systems (archaebacteria, eubacteria, protists, fungi, plants, and animals).
- d. Compare and contrast viruses with living organisms.

SB4

Grade: 9,10,11,12

Description: SB4 Students will assess the dependence of all organisms on one another and the flow of energy and matter within their ecosystems.

Elements:

- a. Investigate the relationships among organisms, populations, communities, ecosystems, and biomes.
- b. Explain the flow of matter and energy through ecosystems by
  - \* Arranging components of a food chain according to energy flow.
  - \* Comparing the quantity of energy in the steps of an energy pyramid
  - \* Explaining the need for cycling of major nutrients (C, O, H, N, P).
- c. Relate environmental conditions to successional changes in ecosystems. W4, W5

- d. Assess and explain human activities that influence and modify the environment such as global warming, population growth, pesticide use, and water and power consumption.
- e. Relate plant adaptations, including tropisms, to the ability to survive stressful environmental conditions.
- f. Relate animal adaptations, including behaviors, to the ability to survive stressful environmental conditions.

#### SB5

Grade: 9,10,11,12

Description: SB5 Students will evaluate the role of natural selection in the development of the theory of evolution.

Elements:

- a. Trace the history of the theory.
- b. Explain the history of life in terms of biodiversity, ancestry, and the rates of evolution.
- c. Explain how fossil and biochemical evidence support the theory.
- d. Relate natural selection to changes in organisms.
- e. Recognize the role of evolution to biological resistance (pesticide and antibiotic resistance).

Grade: 9,10,11,12

Description: SC1 Students will analyze the nature of matter and its classifications.

Elements:

- a. Relate the role of nuclear fusion in producing essentially all elements heavier than hydrogen.
- b. Identify substances based on chemical and physical properties.
- c. Predict formulas for stable ionic compounds (binary and tertiary) based on balance of charges.
- d. Use IUPAC nomenclature for both chemical names and formulas:
  - \* Ionic compounds (Binary and tertiary)
  - \* Covalent compounds (Binary and tertiary)
  - \* Acidic compounds ( Binary and tertiary)

#### SC2

Grade: 9,10,11,12

Description: SC2 Students will relate how the Law of Conservation of Matter is used to determine chemical composition in compounds and chemical reactions.

Elements:

- a. Identify and balance the following types of chemical equations:

- \* Synthesis
- \* Decomposition
- \* Single Replacement
- \* Double Replacement
- \* Combustion

- b. Experimentally determine indicators of a chemical reaction specifically precipitation, gas evolution, water production, and changes in energy to the system.
- c. Apply concepts of the mole and Avogadro's number to conceptualize and calculate
  - \* Empirical/molecular formulas,
  - \* Mass, moles and molecules relationships,
  - \* Molar volumes of gases.
- d. Identify and solve different types of stoichiometry problems, specifically relating mass to moles and mass to mass.
- e. Demonstrate the conceptual principle of limiting reactants.
- f. Explain the role of equilibrium in chemical reactions.

### SC3

Grade: 9,10,11,12

Description: SC3 Students will use the modern atomic theory to explain the characteristics of atoms.

Elements:

- a. Discriminate between the relative size, charge, and position of protons, neutrons, and electrons in the atom.
- b. Use the orbital configuration of neutral atoms to explain its effect on the atom's chemical properties.
- c. Explain the relationship of the proton number to the element's identity.
- d. Explain the relationship of isotopes to the relative abundance of atoms of a particular element.
- e. Compare and contrast types of chemical bonds (i.e. ionic, covalent).
- f. Relate light emission and the movement of electrons to element identification.

### SC4

Grade: 9,10,11,12

Description: SC4 Students will use the organization of the Periodic Table to predict properties of elements.

Elements:

- a. Use the Periodic Table to predict periodic trends including atomic radii, ionic radii, ionization energy, and electronegativity of various elements.
- b. Compare and contrast trends in the chemical and physical properties of elements and their placement on the Periodic Table.

#### SC5

Grade: 9,10,11,12

Description: SC5 Students will understand that the rate at which a chemical reaction occurs can be affected by changing concentration, temperature, or pressure and the addition of a catalyst.

Elements:

- a. Demonstrate the effects of changing concentration, temperature, and pressure on chemical reactions. C4
- b. Investigate the effects of a catalyst on chemical reactions and apply it to everyday examples.
- c. Explain the role of activation energy and degree of randomness in chemical reactions.

#### SC6

Grade: 9,10,11,12

Description: SC6 Students will understand the effects motion of atoms and molecules in chemical and physical processes.

Elements:

- a. Compare and contrast atomic/molecular motion in solids, liquids, gases, and plasmas.
- b. Collect data and calculate the amount of heat given off or taken in by chemical or physical processes.
- c. Analyzing (both conceptually and quantitatively) flow of energy during change of state (phase).

Teacher Note: The use of Gas Laws to achieve this standard is permissible, but not mandated.

SC7 Grade: 9,10,11,12

Description: SC7 Students will characterize the properties that describe solutions and the nature of acids and bases.

Elements:

- a. Explain the process of dissolving in terms of solute/solvent interactions: C1, C3, C4
  - \* Observe factors that effect the rate at which a solute dissolves in a specific solvent
  - \* Express concentrations as molarities,
  - \* Prepare and properly label solutions of specified molar concentration,
  - \* Relate molality to colligative properties.
- b. Compare, contrast, and evaluate the nature of acids and bases:

- \* Arrhenius, Bronsted-Lowry Acid/Bases
- \* Strong vs. weak acids/bases in terms of percent dissociation
- \* Hydronium ion concentration
- \* pH
- \* Acid-Base neutralization

### SCSh1

Grade: 9,10,11,12

Description: SCSh1 Students will evaluate the importance of curiosity, honesty, openness, and skepticism in science.

Elements:

- a. Exhibit the above traits in their own scientific activities. All units, all lessons.
- b. Recognize that different explanations often can be given for the same evidence.
- c. Explain that further understanding of scientific problems relies on the design and execution of new experiments which may reinforce or weaken opposing explanations.

SCSh2 Grade: 9,10,11,12

Description: SCSh2 Students will use standard safety practices for all classroom laboratory and field investigations.

Elements:

- a. Follow correct procedures for use of scientific apparatus. All units, all lessons.
- b. Demonstrate appropriate techniques in all laboratory situations. All units, all lessons.
- c. Follow correct protocol for identifying and reporting safety problems and violations. All units, all lessons.

### SCSh3

Grade: 9,10,11,12

Description: SCSh3 Students will identify and investigate problems scientifically.

Elements:

- a. Suggest reasonable hypotheses for identified problems. All units, all lessons.
- b. Develop procedures for solving scientific problems. All units, all lessons.
- c. Collect, organize and record appropriate data. All units, all lessons.
- d. Graphically compare and analyze data points and/or summary statistics. C5
- e. Develop reasonable conclusions based on data collected. All units, all lessons.

- f. Evaluate whether conclusions are reasonable by reviewing the process and checking against other available information.

#### SCSh4

Description: SCSh4 Students will use tools and instruments for observing, measuring, and manipulating scientific equipment and materials.

Elements:

- a. Develop and use systematic procedures for recording and organizing information. C5, E4
- b. Use technology to produce tables and graphs.
- c. Use technology to develop, test, and revise experimental or mathematical models.

#### SCSh5

Grade: 9,10,11,12

Description: SCSh5 Students will demonstrate the computation and estimation skills necessary for analyzing data and developing reasonable scientific explanations.

Elements:

- a. Trace the source on any large disparity between estimated and calculated answers to problems.
- b. Consider possible effects of measurement errors on calculations.
- c. Recognize the relationship between accuracy and precision.
- d. Express appropriate numbers of significant figures for calculated data, using scientific notation where appropriate.
- e. Solve scientific problems by substituting quantitative values, using dimensional analysis and/or simple algebraic formulas as appropriate.

#### SCSh6

Grade: 9,10,11,12

Description: SCSh6 Students will communicate scientific investigations and information clearly.

Elements:

- a. Write clear, coherent laboratory reports related to scientific investigations.
- b. Write clear, coherent accounts of current scientific issues, including possible alternative interpretations of the data.
- c. Use data as evidence to support scientific arguments and claims in written or oral presentations. All units, all lessons.
- d. Participate in group discussions of scientific investigation and current scientific issues. All units, all lessons.

#### SCSh7

Grade: 9,10,11,12

Description: SCSH7 Students will analyze how scientific knowledge is developed. Students will recognize that:

Elements:

- a. The universe is a vast single system in which the basic principles are the same everywhere.
- b. Universal principles are discovered through observation and experimental verification.
- c. From time to time, major shifts occur in the scientific view of how the world works. More often, however, the changes that take place in the body of scientific knowledge are small modifications of prior knowledge. Major shifts in scientific views typically occur after the observation of a new phenomenon or an insightful interpretation of existing data by an individual or research group.
- d. Hypotheses often cause scientists to develop new experiments that produce additional data.
- e. Testing, revising, and occasionally rejecting new and old theories never ends.

SCSh8

Grade: 9,10,11,12

Description: SCSH8 Students will understand important features of the process of scientific inquiry. Students will apply the following to inquiry learning practices:

Elements:

- a. Scientific investigators control the conditions of their experiments in order to produce valuable data.
- b. Scientific researchers are expected to critically assess the quality of data including possible sources of bias in their investigations' hypotheses, observations, data analyses, and interpretations.
- c. Scientists use practices such as peer review and publication to reinforce the integrity of scientific activity and reporting.
- d. The merit of a new theory is judged by how well scientific data are explained by the new theory.
- e. The ultimate goal of science is to develop an understanding of the natural universe which is free of biases.
- f. Science disciplines and traditions differ from one another in what is studied, techniques used, and outcomes sought.

SCSh9

Grade: 9,10,11,12

Description: SCSH9 Students will enhance reading in all curriculum areas by:

Elements:

- a. Reading in All Curriculum Areas

\* Read a minimum of 25 grade-level appropriate books per year from a variety of subject disciplines and participate in discussions related to curricular learning in all areas.

- \* Read both informational and fictional texts in a variety of genres and modes of discourse.
- \* Read technical texts related to various subject areas.

b. Discussing books

- \* Discuss messages and themes from books in all subject areas.
- \* Respond to a variety of texts in multiple modes of discourse.
- \* Relate messages and themes from one subject area to messages and themes in another area.
- \* Evaluate the merit of texts in every subject discipline.
- \* Examine author's purpose in writing.
- \* Recognize the features of disciplinary texts.

c. Building vocabulary knowledge

- \* Demonstrate an understanding of contextual vocabulary in various subjects.
- \* Use content vocabulary in writing and speaking.
- \* Explore understanding of new words found in subject area texts.

d. Establishing context

- \* Explore life experiences related to subject area content.
- \* Discuss in both writing and speaking how certain words are subject area related.
- \* Determine strategies for finding content and contextual meaning for unknown words.

SES1

Grade: 9,10,11,12

Description: SES1 Students will investigate the composition and formation of Earth systems, including the Earth's relationship to the solar system.

Elements:

- Describe the early evolution of the Earth and solar system, including the formation of Earth's solid layers (core, mantle, crust), the distribution of major elements, the origin of internal heat sources, and the mechanism by which heat transfer drives plate tectonics.
- Explain how the composition of the Earth's crust, mantle and core is determined and compare it to that of other solar system objects.
- Describe how the decay of radioactive isotopes is used to determine the age of rocks, Earth, and solar system.
- Describe how the Earth acquired its initial oceans and atmosphere.
- Identify the transformations and major reservoirs that make up the rock cycle, hydrologic cycle, carbon cycle, and other important geochemical cycles.

## SES2

Grade: 9,10,11,12

Description: SES2 Students will understand how plate tectonics creates certain geologic features, materials, and hazards.

Elements:

- a. Distinguish among types of plate tectonic settings produced by plates diverging, converging, and sliding past each other. **E3**
- b. Relate modern and ancient geologic features to each kind of plate tectonic setting. **E3**
- c. Relate certain geologic hazards to specific plate tectonic settings. **E3**
- d. Associate specific plate tectonic settings with the production of particular groups of igneous and metamorphic rocks and mineral resources.
- e. Explain how plate tectonics creates and destroys sedimentary basins through time.

SES3 Grade: 9,10,11,12

Description: SES3 Students will explore the actions of water, wind, ice, and gravity that create landforms and systems of landforms (landscapes). **E3**

Elements:

- a. Describe how surface water and groundwater act as the major agents of physical and chemical weathering.
- b. Explain how soil results from weathering and biological processes acting on parent rock.
- c. Describe the processes and hazards associated with both sudden and gradual mass wasting.
- d. Relate the past and present actions of ice, wind, and water to landform distribution and landscape evolution.
- e. Explain the processes that transport and deposit material in terrestrial and marine sedimentary basins, which result, over time, in sedimentary rock.

SES4 Grade: 9,10,11,12

Description: SES4 Students will understand how rock relationships and fossils are used to reconstruct the Earth's past.

Elements:

- a. Describe and apply principles of relative age (superposition, original horizontality, cross-cutting relations, and original lateral continuity) and describe how unconformities form. **E4**
- b. Interpret the geologic history of a succession of rocks and unconformities.
- c. Apply the principle of uniformitarianism to relate sedimentary rock associations and their fossils to the environments in which the rocks were deposited.
- d. Explain how sedimentary rock units are correlated within and across regions by a variety of methods (e.g., geologic map relationships, the principle of fossil succession, radiometric dating, and paleomagnetism).

- e. Use geologic maps and stratigraphic relationships to interpret major events in Earth history (e.g., mass extinction, major climatic change, tectonic events).

Grade: 9,10,11,12

Description: SES5 Students will investigate the interaction of insolation and Earth systems to produce weather and climate.

Elements:

- a. Explain how latitudinal variations in solar heating create atmospheric and ocean currents that redistribute heat globally.
- b. Explain the relationship between air masses and the surfaces over which they form.
- c. Relate weather patterns to interactions among ocean currents, air masses, and topography.
- d. Describe how temperature and precipitation produce the pattern of climate regions (classes) on Earth.
- e. Describe the hazards associated with extreme weather events and climate change (e.g., hurricanes, tornadoes, El Niño/La Niña, global warming).

SES6

Grade: 9,10,11,12

Description: SES6 Students will explain how life on Earth responds to and shapes Earth systems.

Elements:

- a. Relate the nature and distribution of life on Earth, including humans, to the chemistry and availability of water.
- b. Relate the distribution of biomes (terrestrial, freshwater, and marine) to climate regions through time.
- c. Explain how geological and ecological processes interact through time to cycle matter and energy, and how human activity alters the rates of these processes (e.g., fossil fuel formation and combustion).
- d. Describe how fossils provide a record of shared ancestry, evolution, and extinction that is best explained by the mechanism of natural selection.
- e. Identify the evolutionary innovations that most profoundly shaped Earth systems: photosynthetic prokaryotes and the atmosphere; multicellular animals and marine environments; land plants and terrestrial environments.

SEV1

Grade: 9,10,11,12

Description: Students will investigate the flow of energy and cycling of matter within an ecosystem and relate these phenomena to human society.

Elements:

- a. Interpret biogeochemical cycles including hydrologic, nitrogen, phosphorus, oxygen, and carbon cycles. Recognize that energy is not recycled in ecosystems.

- b. Relate energy changes to food chains, food webs, and to trophic levels in a generalized ecosystem, recognizing that entropy is a primary factor in the loss of usable food energy during movement up the trophic levels.
- c. Relate food production and quality of nutrition to population growth and the trophic levels.
- d. Relate the cycling of matter and the flow of energy to the Laws of Conservation of matter and energy. Identify the role and importance of decomposers in the recycling process.
- e. Distinguish between abiotic and biotic factors in an ecosystem and describe how matter and energy move between these.

## SEV2

Grade: 9,10,11,12

Description: SEV2 Students will demonstrate an understanding that the Earth is one interconnected system.

Elements:

- a. Describe how the abiotic components (water, air, and energy) affect the biosphere.
- b. Recognize and give examples of the hierarchy of the biological entities of the biosphere (organisms, populations, communities, ecosystems, and biosphere).
- c. Characterize the components that define a Biome. Abiotic Factors - to include precipitation, temperature and soils. Biotic Factors - plant and animal adaptations that create success in that biome.
- d. Characterize the components that define fresh-water and marine systems. Abiotic Factors - to include light, dissolved oxygen, phosphorus, nitrogen, pH and substrate. Biotic Factors - plant and animal adaptations characteristic to that system.

## SEV3

Grade: 9,10,11,12

Description: SEV3 Students will describe stability and change in ecosystems.

Elements:

- a. Describe interconnections between abiotic and biotic factors, including normal cyclic fluctuations and changes associated with climatic change (i.e. ice ages).
- b. Explain succession in terms of changes in communities through time to include changes in biomass, diversity, and complexity.
- c. Explain how succession may be altered by traumatic events.
- d. Explain how biotic and abiotic factors influence populations.
- e. Describe interactions between individuals (i.e. mutualism, commensalisms, parasitism, predation, and competition).

## SEV4

Grade: 9,10,11,12

Description: SEV4 Students will understand and describe availability, allocation and conservation of energy and other resources.

Elements:

- a. Differentiate between renewable and nonrenewable resources including how different resources are produced, rates of use, renewal rates, and limitations of sources. Distinguish between natural and produced resources. E5, W5
- b. Describe how technology is increasing the efficiency of utilization and accessibility of resources.
- c. Describe how energy and other resource utilization impact the environment and recognize that individuals as well as larger entities (businesses, governments, etc.) have impact on energy efficiency.
- d. Describe the relationship of energy consumption and the living standards of societies.
- e. Describe the commonly used fuels (e.g. fossil fuels, nuclear fuels, etc.) and some alternative fuels (e.g. wind, solar, ethanol, etc.) including the required technology, availability, pollution problems and implementation problems. Recognize the origin of fossil fuels and the problems associated with our dependence on this energy source.
- f. Describe the need for informed decision making of resource utilization. (i.e. energy and water usage allocation, conservation, food and land, and long-term depletion)

SEV5

Grade: 9,10,11,12

Description: SEV5 Students will recognize that human beings are part of the global ecosystem and will evaluate the effects of human activities and technology on ecosystems.

Elements:

- a. Describe factors affecting population growth of all organisms, including humans. Relate these to factors affecting growth rates and carrying capacity of the environment.
- b. Describe the effects of population growth, demographic transitions, cultural differences, emergent diseases, etc. on societal stability.
- c. Explain how human activities affect global and local sustainability.
- d. Describe the actual and potential effects of habitat destruction, erosion, and depletion of soil fertility associated with human activities.
- e. Describe the effects and potential implications of pollution and resource depletion on the environment at the local and global levels (e.g. air and water pollution, solid waste disposal, depletion of the stratospheric ozone, global warming, and land uses).
- f. Describe how political, legal, social, and economic decisions may affect global and local ecosystems.

SP1

Grade: 9,10,11,12

Description: SP1 Students will analyze the relationships between force, mass, gravity, and the motion of objects.

Elements:

- a. Calculate average velocity, instantaneous velocity, and acceleration in a given frame of reference.
- b. Compare and contrast scalar and vector quantities.
- c. Compare graphically and algebraically the relationships among position, velocity, acceleration, and time.
- d. Measure and calculate the magnitude of frictional forces and Newton's three Laws of Motion.
- e. Measure and calculate the magnitude of gravitational forces.
- f. Measure and calculate two-dimensional motion (projectile and circular) by using component vectors.
- g. Measure and calculate centripetal force.
- h. Determine the conditions required to maintain a body in a state of static equilibrium.

SP2

Grade: 9,10,11,12

Description: SP2 Students will evaluate the significance of energy in understanding the structure of matter and the universe.

Elements:

- a. Relate the energy produced through fission and fusion by stars as a driving force in the universe.
- b. Explain how the instability of radioactive isotopes results in spontaneous nuclear reactions.

SP3

Grade: 9,10,11,12

Description: SP3 Students will evaluate the forms and transformations of energy.

Elements:

- a. Analyze, evaluate, and apply the principle of conservation of energy and measure the components of work-energy theorem by
  - \* describing total energy in a closed system.
  - \* identifying different types of potential energy.
  - \* calculating kinetic energy given mass and velocity.
  - \* relating transformations between potential and kinetic energy.
- b. Explain the relationship between matter and energy.
- c. Measure and calculate the vector nature of momentum.
- d. Compare and contrast elastic and inelastic collisions.
- e. Demonstrate the factors required to produce a change in momentum.
- f. Analyze the relationship between temperature, internal energy, and work done in a physical system.

g. Analyze and measure power.

Grade: 9,10,11,12

Description: SP4 Students will analyze the properties and applications of waves.

Elements:

- a. Explain the processes that results in the production and energy transfer of electromagnetic waves.
- b. Experimentally determine the behavior of waves in various media in terms of reflection, refraction, and diffraction of waves.
- c. Explain the relationship between the phenomena of interference and the principle of superposition.
- d. Demonstrate the transfer of energy through different mediums by mechanical waves.
- e. Determine the location and nature of images formed by the reflection or refraction of light.

SP5

Grade: 9,10,11,12

Description: SP5 Students will evaluate relationships between electrical and magnetic forces.

Elements:

- a. Describe the transformation of mechanical energy into electrical energy and the transmission of electrical energy.
- b. Determine the relationship among potential difference, current, and resistance in a direct current circuit.
- c. Determine equivalent resistances in series and parallel circuits.
- d. Determine the relationship between moving electric charges and magnetic fields.

SP6

Grade: 9,10,11,12

Description: SP6 The student will describe the corrections to Newtonian physics given by quantum mechanics and relativity when matter is very small, moving fast compared to the speed of light, or very large.

Elements:

- a. Explain matter as a particle and as a wave.
- b. Describe the Uncertainty Principle.
- c. Explain the differences in time, space, and mass measurements by two observers when one is in a frame of reference moving at constant velocity parallel to one of the coordinate axes of the other observer's frame of reference if the constant velocity is greater than one tenth the speed of light.
- d. Describe the gravitational field surrounding a large mass and its effect on a ray of light.

SPS1

Grade: 9,10,11,12

Description: SPS1 Students will investigate our current understanding of the atom.

Elements:

a. Examine the structure of the atom in terms of

\* proton, electron, and neutron locations.

\* atomic mass and atomic number.

\* atoms with different numbers of neutrons (isotopes).

\* explain the relationship of the proton number to the element's identity.

b. Compare and contrast ionic and covalent bonds in terms of electron position.

SPS10

Grade: 9,10,11,12

Description: SPS10 Students will investigate the properties of electricity and magnetism.

Elements:

a. Investigate static electricity in terms of

\* friction

\* induction

\* conduction

b. Explain the flow of electrons in terms of

\* alternating and direct current.

\* the relationship among voltage, resistance and current.

\* simple series and parallel circuits.

c. Investigate applications of magnetism and/or its relationship to the movement of electrical charge as it relates to

\* electromagnets

\* simple motors

\* permanent magnets

SPS2

Grade: 9,10,11,12

Description: SPS2 Students will explore the nature of matter, its classifications, and the system for naming types of matter.

Elements:

- a. Calculate density when given a means to determine a substance's mass and volume.
- b. Predict formulas for stable binary ionic compounds based on balance of charges.
- c. Use IUPAC nomenclature for transition between chemical names and chemical formulas of
  - \* binary ionic compounds (containing representative elements).
  - \* binary covalent compounds (i.e. carbon dioxide, carbon tetrachloride).
- d. Demonstrate the Law of Conservation of Matter in a chemical reaction.
- e. Apply the Law of Conservation of Matter by balancing the following types of chemical equations:
  - \* Synthesis
  - \* Decomposition
  - \* Single Replacement
  - \* Double Replacement

### SPS3

Grade: 9,10,11,12

Description: SPS3 Students will distinguish the characteristics and components of radioactivity.

Elements:

- a. Differentiate between alpha and beta particles and gamma radiation.
- b. Differentiate between fission and fusion.
- c. Explain the process half-life as related to radioactive decay.
- d. Describe nuclear energy, its practical application as an alternative energy source, and its potential problems.

### SPS4

Grade: 9,10,11,12

Description: SPS4 Students will investigate the arrangement of the Periodic Table.

Elements:

- a. Determine the trends of the following:
  - \* Number of valence electrons
  - \* Types of ions formed by representative elements
  - \* Location of metals, nonmetals, and metalloids
  - \* Phases at room temperature
- b. Use the Periodic Table to predict the above properties for representative elements.

## SPS5

Grade: 9,10,11,12

Description: SPS5 Students will compare and contrast the phases of matter as they relate to atomic and molecular motion.

Elements:

- a. Compare and contrast the atomic/molecular motion of solids, liquids, gases and plasmas.
- b. Relate temperature, pressure, and volume of gases to the behavior of gases.

## SPS6

Grade: 9,10,11,12

Description: SPS6 Students will investigate the properties of solutions.

Elements:

- a. Describe solutions in terms of C1, C2, C3, C4

\* solute/solvent

\* conductivity

\* concentration

- b. Observe factors affecting the rate a solute dissolves in a specific solvent.
- c. Demonstrate that solubility is related to temperature by constructing a solubility curve.
- d. Compare and contrast the components and properties of acids and bases.
- e. Determine whether common household substances are acidic, basic, or neutral.

Grade: 9,10,11,12

Description: SPS7 Students will relate transformations and flow of energy within a system.

Elements:

- a. Identify energy transformations within a system (e.g. lighting of a match).
- b. Investigate molecular motion as it relates to thermal energy changes in terms of conduction, convection, and radiation.
- c. Determine the heat capacity of a substance using mass, specific heat, and temperature.
- d. Explain the flow of energy in phase changes through the use of a phase diagram.

## SPS8

Grade: 9,10,11,12

Description: SPS8 Students will determine relationships among force, mass, and motion.

Elements:

- a. Calculate velocity and acceleration.
- b. Apply Newton's three laws to everyday situations by explaining the following:
  - \* Inertia
    - \* Relationship between force, mass and acceleration
    - \* Equal and opposite forces
- c. Relate falling objects to gravitational force
- d. Explain the difference in mass and weight.
- e. Calculate amounts of work and mechanical advantage using simple machines.

SPS9

Grade: 9,10,11,12

Description: SPS9 Students will investigate the properties of waves.

Elements:

- a. Recognize that all waves transfer energy.
- b. Relate frequency and wavelength to the energy of different types of electromagnetic waves and mechanical waves.
- c. Compare and contrast the characteristics of electromagnetic and mechanical (sound) waves.
- d. Investigate the phenomena of reflection, refraction, interference, and diffraction.
- e. Relate the speed of sound to different mediums.
- f. Explain the Doppler Effect in terms of everyday interactions.